Book of Posters

Emerging scholars Program (ESP) – Spring 2023

THE EFFECT OF POLYETHYLENE (GLYCOL) DIACRYLATE POST-FABRICATION REST TIME ON COMPRESSIVE PROPERTIES

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INTRODUCTION

In recent years, tissue engineering has been utilized as an alternative approach for the organ transplantation. The success rate of tissue regeneration is influenced by the type of biomaterials, cell sources, growth factors and scaffold fabrication techniques used. The poly(ethylene glycol) diacrylate (PEGDA) is one of commonly used biomaterials because of its biocompatibility, ease of use, and porous microstructure. The mechanical properties of PEGDA have been studied to some extent by several research groups. However, the stability of the mechanical properties with time has not been investigated.

In this research, we studied how the mechanical properties of different concentrations of PEGDA change with the post fabrication ageing time. Cylindrical PEGDA samples were prepared 20%, 40%, 60%, 80%, and 100% concentrations and cured under the UV light. After the solidification process, weight of each sample was monitored in every 0, 2, 4, 6, and 24 hours post-fabrication ageing time until the mechanical testing. Compressive elastic modulus and strength were calculated and statistically analyzed. Our results indicated that the water content of each PEGDA group constantly decreased by time, however, this loss significantly affected the elastic modulus and strength only after 6 hours in some PEGDA concentration.

SIGNIFICANCE

Modeling, design and fabrication of tissue scaffolds to meet multiple biological and biophysical requirements is always a challenge in tissue engineering. Engineered scaffolds must have sufficient mechanical strengths to hold the pressure due to surrounding environment after the implantation process. Strength of PEGDA-based scaffolds can be changed and controlled with the various photoinitiator concentrations. Successful scaffold fabrication with the right mechanical properties enables to open the new doors for the tissue regenerations.

PROCESS FLOW

PEGDA Preparation

In this research, poly(ethylene glycol) diacrylate (PEGDA) which is a biocompatible and also biodegradable scaffold was used as a fabrication material. 2,2-dimethoxy-2-phenyl-acetophenone (DMPA) was used as a photoinitiator to initiate the polymerization process. 0.02% (w/v), 0.06% (w/v), and 0.1% (w/v) photoinitiator-solvent mixtures were prepared to alter the DMPA concentration to test the DMPA effect on mechanical characterization of engineered scaffolds.

PEGDA Fabrication- Photolithography and Compression Test

The silicon mold, was first designed in an engineering design and drafting software (Autodesk Inventor, New York, NY). The male component of the mold, composed of 12 posts with a diameter and height of 15 x 15 mm each, was fabricated with a 3D Printer (Makerbot Replicator 2, Brooklyn, NY) (Figure 1a). Ecoflex 0050 platinum cure silicone rubber A and Ecoflex 0050 platinum cure silicone rubber B were mixed in 1A:1B ratio by volume and poured onto the 3D printed cylindrical posts. The Ecoflex silicon mixture was solidified in the room temperature in 3 hours. 3D printed male component was removed and the custom-made Ecoflex silicon mold with 12 identical wells was obtained.

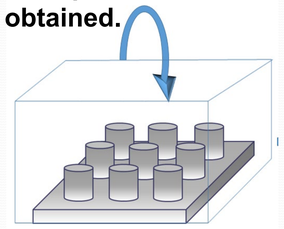


Figure 1. **Negative** well - 3D printed mold

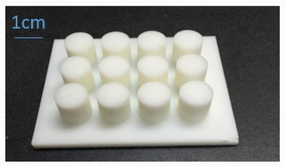


Figure 2. **Negative** mold

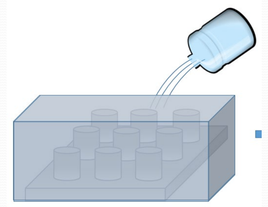


Figure 3. **Silicon on the negative mold**

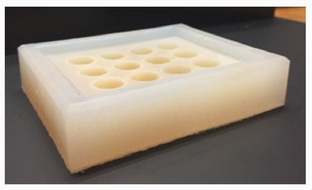


Figure 4. **Silicon** mold

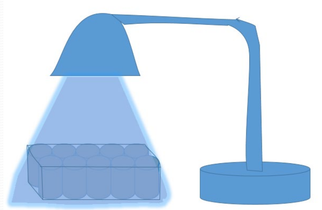


Figure 5. Polymerization Set-up

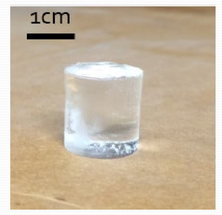
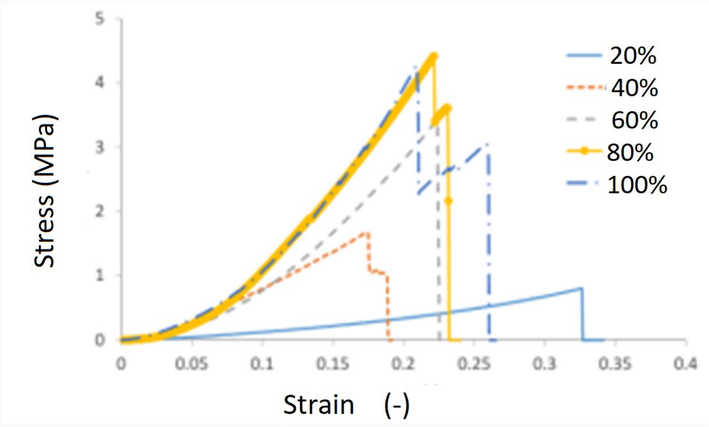


Figure 6. Polymerized Cylinder

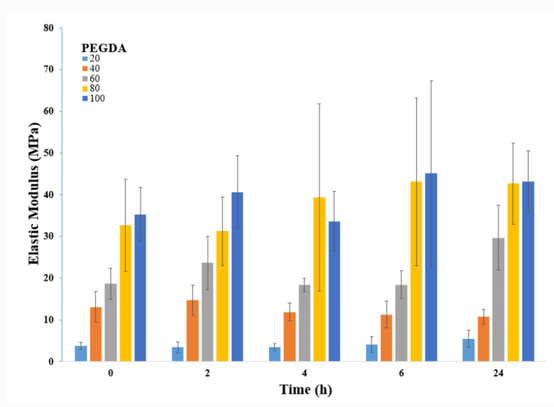
Simple compression tests were conducted 0, 2, 4, 6, and 24 hours after samples were removed from the mold. At the time of testing, the hydrogel specimen was placed between two parallel compression platens and loaded to failure at a rate of 5 mm/min.

RESULTS

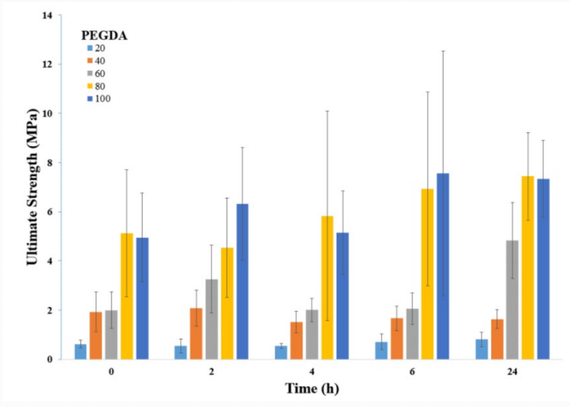
The failure mode of specimens was a brittle fracture with a sudden large crack formation followed by a complete failure short after, which was in an explosive fashion most of the time. Statistical analysis showed that PEGDA concentration ($P<0.0001$), post-fabrication ageing time ($P<0.0001$) as well as their interactions ($P=0.002$) had significant effects on elastic modulus and ultimate strength.



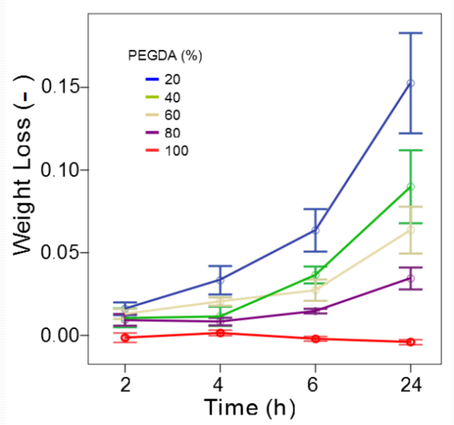
(a)



(b)



(c)



(d)

Figure 7. (a) Representative load-displacement curves for all PEGDA concentrations of weight loss by time b) Change in elastic modulus with PEGDA concentration and time c) Change in ultimate strength with PEGDA concentration and time d) Mean and standard deviation

Mechanical and physical properties of PEGDA based materials changed depending on the initial polymer concentration and the water content remaining in the material by time. This is an important pitfall, which highlights that storage conditions of these materials should be carefully considered. For applications where mechanical property requirements are not strict, PEGDA materials may be still safe to use despite the change in composition because they maintain considerable amount of elastic modulus and strength after 24 hours of production. For in-vivo applications, it is fortunate that the surrounding environment will be sufficiently moist and can prevent the loss of water content and thus any change in mechanical and physical properties.

FUTURE WORK

Explore the development of photolithography parameters

Tensile, flexure and indentation tests for drug delivered PEGDA

ACKNOWLEDGEMENT

The authors acknowledge the research support from the Dean's Office at New York City College of Technology and California State University, Chico.

3d Printing with Lunar Geopolymer's

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Team Member's : John Anthony , Maria Hashmi , Brian Rosendo , Charudatta Mhasde
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Department of Mechanical Engineering Technology (Composite and Biomaterial Lab)

Abstract

The way of using concrete to build structures is a thing of the past and the future is using geopolymer made with lunar material. Not just using lunar material but contrasting with state-of-the-art methods like 3d printing. To move a step in the right direction, our group's top priority is to create a lunar-based geopolymer that is not only strong but resilient. Our main task was creating a geopolymer sample with two lunar-based stimulants along with other chemicals that can endure several tests such as compression and tensile tests.

Important terms

3D Printing- a form of additive manufacturing used for constructing a three-dimensional object from a CAD model or a digital 3D model.

Geopolymer- Inorganic, typically ceramic, alumino-silicate forming long-range, covalently bonded, non-crystalline networks.

Lunar Geopolymer- A geopolymer made with lunar regolith or dust

Curing- Leaving the sample in the mold as it's being heat treated

Drying-Taking the sample out of the mold and laying it out as it is being heat treated

Objective

1) Creating a Geopolymer with LHS (Lunar Highland Stimulant) and LMS (Lunar Mere Stimulant) that is strong and thermally stable.
   A. Choosing the appropriate chemicals that will synergize with our Stimulants
   B. Calculate and measure the effective ratio of each chemical so that it doesn't overpower the chemical properties of the stimulants.
   C. Getting prepped for heating after being in the centrifuge
2) Testing samples made from the LHS geopolymer and LMS geopolymer with different tests: Compression and Tensile

Making our Geopolymer

Making our lunar-based geopolymer (with LMS or LHS)

A) When looking at past trials with different chemicals, 3 elements stood out as strong contenders: KSI, KOH, and SiO. Potassium Hydroxide (KOH) and Silyl potassium (KSI) were both excellent binders as they paired well with the natural aluminum silicone contents of LMS and LHS. Silicone Monoxide (Si0) acted as an alkali booster for our inorganic geopolymer. The final bowtie to our geopolymer was good ol' H20 or water which naturally bonded with all the chemicals.

Calculating our ratios of how much chemicals to mix

B) By using specific guideless and past experiments we ran calculations on how much of each chemical to the lunar-based sample in order to determine how much freedom we had on how much of it to add to the sample.

Sample A	Sample B
LHS : 20g	LMS : 25g
KSI : 18g	KSI :3.5g
KOH : 4g	KOH : 16g
Si0 : 0.1g	SiO : 0.1g
H20 : 4g	H20 : 7g

Figure 1: A breakdown of the two recent samples along with how much of each chemical measured in grams

After we make our sample takes a spin in the centrifuge its time for heat treating

C) Despite our geopolymer needing to be in a paste format when printing it needs to be solidified with heat in order to test its various mechanical properties

CD : Cure ; Dry	**C**ured for 10 hours at 90 °C and then **D**ried for 5 hours at 90 °C.
CDD: Cure; Dry; Dry	**C**ured for 10 hours at 90 °C, **D**ried for 5 hours at 90 °C, and then **D**ried again for 5 hours at 150 °C.

Figure 2: The pre-calculated heat process that we've done with past trails

Results

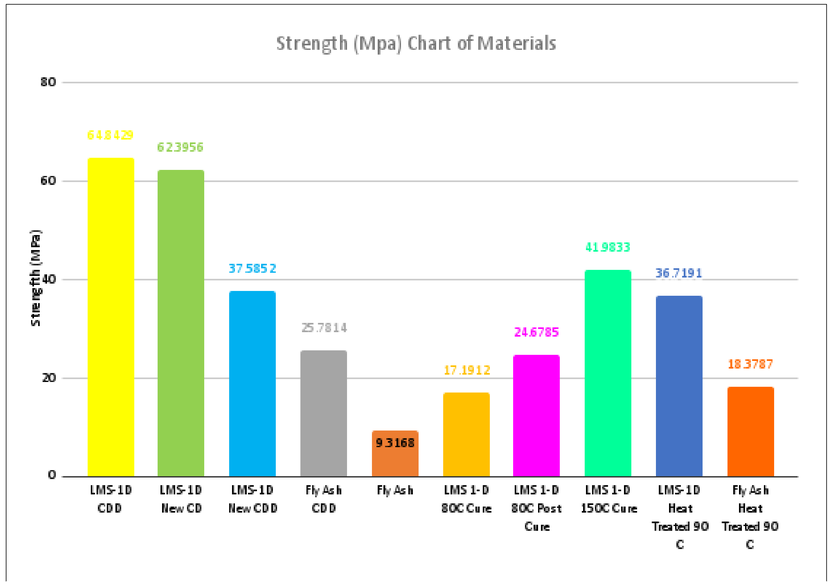

Figure 3: The compression test done on previous samples and our most current on LMS-1D had the highest mechanical strength

Conclusion

In summary, despite not reaching our goal of making the most effective and mechanically stable lunar-based geopolymer, we learned a lot while running these experiments. The most important one would be the result of Figure 3, our compression test results. We discovered that the more heat applied to the sample, the higher its mechanical strength. The next steps are to run tensile and other mechanical tests. Also, we can now improve our heat processing temperatures as I showed in Figure 2 to higher temperatures. While this is the walking stage of our research, I believe that it could open the gateways to lunar-based structures on the moon or even military applications.

Acknowledgment

I acknowledge the members of the CBML lab along with my Professor and team member's dedication to this research.

Artificial Intelligence’s relationship with UI/UX and its Implementations in Compliance Regulations/UI

Ahjahla Castello-Murphy, Mentor: Professor Patrick Slattery

Abstract

Artificial Intelligence (AI) is an evolving field that focuses on developing computer systems capable of performing tasks typically requiring human intelligence, such as language translation, decision-making, and speech recognition. AI technologies, including augmented reality, virtual assistants, and robots, have the potential to significantly improve creativity in user experience (UX) and user interface (UI) design. These design aspects play a critical role in the successful development and implementation of AI products and should be considered throughout the AI life cycle.

This research aims to explore the relationship between AI and UI/UX design and its implementations in compliance regulations. It will address the following questions: (1) How can AI be employed to enhance UI and UX design in various industries? (2) What role does AI play in algorithmic compliance regulations, particularly in financial institutions?

To answer these questions, the researcher will investigate existing AI technologies and their applications in UI and UX design. They will also analyze how AI systems can contribute to more efficient and effective compliance processes in industries such as finance. By reducing regulatory breaches and human errors, AI and automation can improve compliance management and risk mitigation.

Through this study, the researcher aims to provide valuable insights into the potential of AI in transforming UI/UX design and improving compliance regulations. The findings will contribute to a better understanding of AI's role in these domains and pave the way for future research and innovation

Method:

When conducting research on artificial intelligence (AI), data analysis plays a crucial role in gaining insights into the behavior and performance of AI systems. With the vast amounts of data generated by these systems, it is essential to use effective data analysis techniques to make sense of the information. This approach analyzes large datasets and identify trends, as well as to develop predictive models. Additionally, qualitative data analysis methods such as thematic analysis aided to identify patterns and themes in unstructured data such as user feedback or customer support interactions. By utilizing data analysis techniques in AI research, I gained a deeper understanding of the capabilities and limitations of these systems, as well as identified areas for improvement and development.

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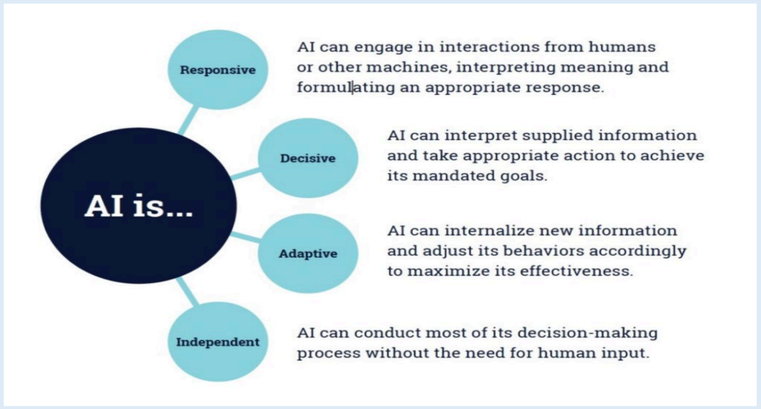
Introduction:

One critical and often overlooked feature of artificial intelligence is how much of a role UI and UX design play in its administration. In the industrial design field of human–computer interaction, a user interface (UI) is the space where interactions between humans and machines occur. Additionally, the user experience(UX) is how a user interacts with and experiences a product, system, or service. It includes a person's perceptions of utility, ease of use, and efficiency. Both UI and UX are related design disciplines but are very different in nature. The UI design is more concerned with the visual properties of design as well as the overall feel it conveys. But without great UX, even the most beautifully designed UI will cause a bad user experience. Both user experience (UX) and user interface (UI) design play crucial roles in successful AI product development and implementations and should be considered throughout the entirety of the AI life cycle. User interface (UI) and user experience (UX) are two essential components of product design. The quality of a product's UI/UX can have a significant impact on its success or failure. The use of artificial intelligence (AI) in UI/UX design can improve the design process and enhance user experience. AI algorithms can help designers analyze vast amounts of data and make design decisions based on that data.



Literature Review:

To understand why user experience(UX) and user interface(UI) play such a pivotal role in the design of artificial intelligence, it is imperative to look further at the existing body of research on the subject. There have been a variety of past studies regarding the relationship between UI/UX design and AI concerning how they benefit from one another. For example, past articles have provided evidence that every step of the design stage can be made a lot more efficient with these AI-enabled tools for UI/UX.

This has also been explored in a prior study by Kondor Shitji titled “Role of AI in UX Design-How Artificial Intelligence Impacts UX”[1]. In this article, Shitji covers the effects of AI on user experience and explains why it's crucial to consider these effects when creating intelligent machines. He goes on to explain that Due to the rapid development of new technology, user experience is rapidly evolving. Artificial intelligence is a technology whose development and effects on the user experience strategy are swiftly advancing. The role of UX designers and machine learning (ML) specialists are comparable in specific ways. Both collect information, evaluate user activity, and predict people's behavior. Thanks to Al and ML, designers can now create more satisfying mobile app interactions for users[2].

Results:

The effects of AI on UI/UX:

AI has several effects on UI/UX, including:

- Personalization: AI algorithms can help designers personalize user interfaces based on individual user preferences and behavior. For example, AI can analyze user data to determine which features are used most frequently and then prioritize those features.
- Automation: AI can automate repetitive design tasks, such as layout and typography, freeing up designers' time to focus on more complex design tasks.
- Predictive design: AI can analyze user behavior and predict what users will want next, allowing designers to anticipate user needs and design interfaces that meet those needs.
- Accessibility: AI can help designers create more accessible interfaces by identifying potential issues with color contrast, font size, and other design elements.

AI can also play a significant role in compliance regulations/UI. Compliance regulations, such as GDPR and CCPA, require companies to protect user data and privacy. AI algorithms can help companies comply with these regulations by:

- Identifying sensitive data: AI can analyze user data to identify sensitive information such as names, addresses, and credit card numbers.
- Encryption: AI can encrypt sensitive data to protect it from unauthorized access.
- Anonymization: AI can anonymize user data to protect user privacy.
- Monitoring: AI can monitor user activity to detect suspicious behavior and potential security breaches.

Conclusion:

In conclusion, UI/UX and AI are closely linked, and their relationship is mutually beneficial. A well-designed UI/UX can enhance the performance of AI, while AI can improve the user experience by providing better recommendations, personalized interactions, and more natural communication. As technology continues to advance, the importance of UI/UX and AI will only continue to grow, leading to even more innovative and user-friendly applications. AI is changing the landscape of UI/UX design and compliance regulations/UI. The use of AI algorithms can help designers create more personalized, accessible, and predictive user interfaces. AI can also help companies comply with regulations by identifying sensitive data, encrypting data, anonymizing data, and monitoring user activity. As AI continues to advance, we can expect it to play an even more significant role in the future of UI/UX design and compliance regulations/UI.

Beyond The Egyptian Pharaohs

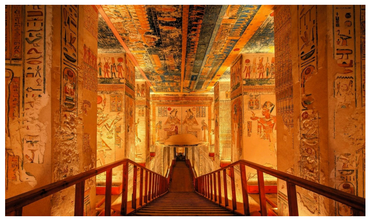
AIA MAHMOUD - JIEUM YANG

Department of Architectural Technology

Abstract

The project is designing a museum to showcase the history and culture of Egyptian Pharaohs. Ancient Egyptians showed creativity with their unique colors, patterns, language, makeup, fashion, architecture, and beliefs. Their language, Hieroglyphics, was a form of art that was inspired by nature. kings and queens are buried in their own sarcophagus, a coffin designed to resemble the person with the hands placed on the chest. The museum includes a main exhibit (“Pharaoh craft”, showcasing sculptures and architecture), two large exhibits (food and origins of Egypt), three small exhibits (hieroglyphics, religion, clothing), and an outdoor exhibit (natural world).

The architecture and design process are inspired by layered patterns and spaces of the ancient Egyptian temples. The architectural plans showcase the hierarchy of different exhibits and public spaces, and the angled geometry helps the reading of the layered spaces. The concrete exterior reflects the massiveness of the Egyptian temples, and glass gaps let light layer through interior spaces.



Curatorial Strategy

Main Exhibit- “Pharaoh Craft”

Large Exhibit- “Origins of Egypt”.

Large Exhibit- “Religion”.

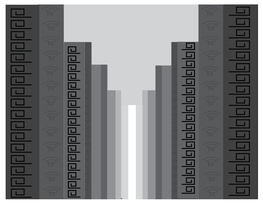
Small Exhibit- “Hieroglyphics”.

Small Exhibit- “Clothing”.

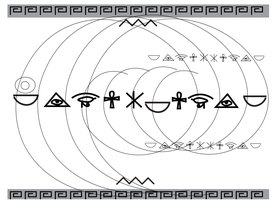
Small Exhibit- “Food & Religion”.

Outdoor Exhibit- “Green area”.

Concept Phrases

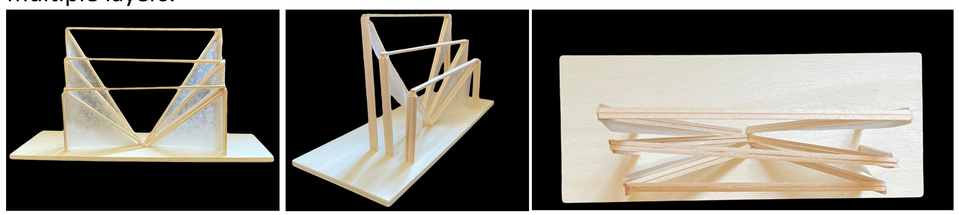


Patterns **layer through** temples that ancient Egyptian life had.



Art **embedded into** the ancient Egyptian life.

Concept Model:
Show the patterns of ancient Egypt through multiple layers.



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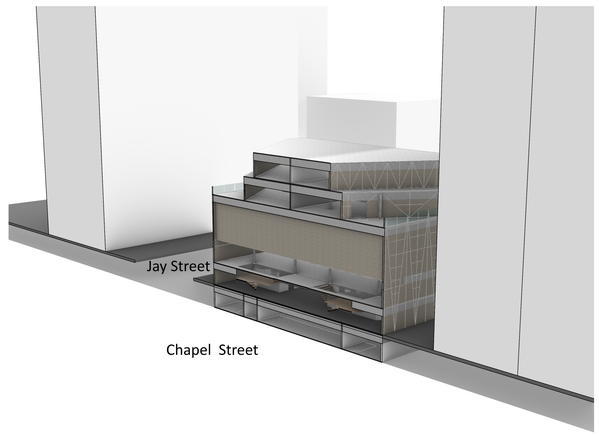
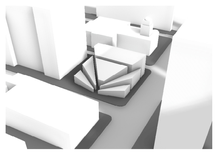
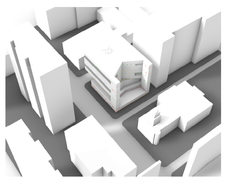


Site Analysis

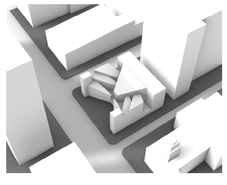
This is the surrounded interesting. This model is sloping down towards the park that on a cross the street to grab people attention.

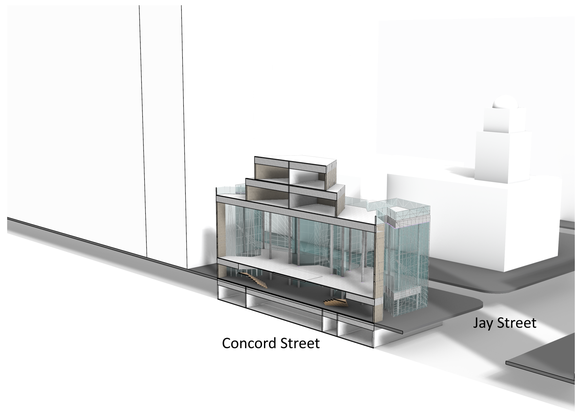


This is the sun diagram. The yellow is sun and gray is the shade. That conclude that half of the building will have sun and the other half will be shaded.

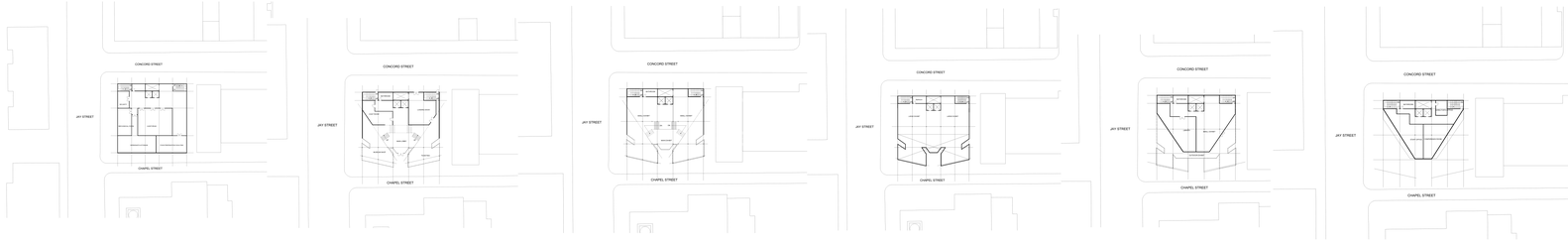


Hard and soft scape, there are barely tress and they are all located far away from each other and the surface is more of hard surface.





Plans



Basement | First Floor | Second Floor | Third Floor | Fourth Floor | Fifth Floor

MAPPING THE CAMPUS

Collaborators: Alyssa Duran and Wilna Michel
Mentors: Prof. Anne Leonhardt and Prof. Maria Hitchings

ABSTRACT

A campus map helps students attending classes reach the necessary classrooms and offices. For this project, we are going to use maps and data to create a campus map for the New York City College of Technology. We are going to create a map of the general overall campus and then one for the Voorhees building. The goal of this project is to provide a clear organized system so the upcoming and current students can easily navigate the many buildings and areas at City Tech and reach where they need to go.

INTRODUCTION

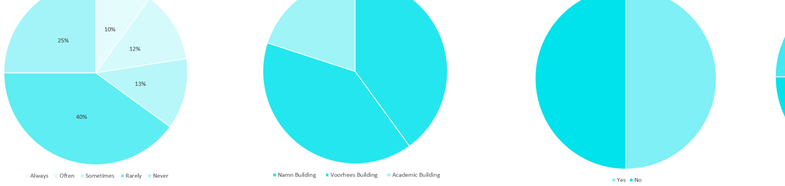
The making of maps has been with us since early on in human existence, showing their crucial importance to people's lives. Some of the oldest known artifacts involve maps that were etched into stone or clay tablets that communicate the location of places of local interest. These early maps focus on local features and descriptions that could help people easily find their way.

STATISTICS

To find out what to include on the map and to find out students needs we decided to conduct a survey . In the survey we asked students which building they found confusing, their dependancy on the existing Campus Map, and what items they would want to include on the Campus Map. Interestingly enough the responses varied due to the major of those taking the survey. With these answers we created the maps.

2. How often do you rely on the City Tech Campus Map?
3. Do you know how to access the City Tech Campus Map?
4. How do you access the City Tech Campus Map?
5. What would be useful to include in the City Tech Campus map?
6. Are there buildings you spend a lot of time in? Is there a building you go to once a month or once a semester?
7. What building is the one do you spend most of the time?
8. What building is the one you spend once a month or once a semester?
9. How do you identify public spaces on the campus? (i.e. Location of the cafeterias in Voorhees and Namm, The library)
10. What do you think - Are there items that should be included in this map?
11. Tell me about a time you found it hard to find a particular office, department, or classroom

photo source: City Tech Website



METHODOLOGY

To create the campus maps, we used two mapping systems; Google Earth and Arc-Gis. After mapping the campus, we traced the lines and created the maps on Adobe Illustrator. The icons for the map were created in Illustrator as well with the intention to clarify and show the different items on campus. For example, places that provide food, the library , the gym, and more. To create the Voorhees floor plan we searched for the actual floor plans of the Voorhees building through registry and made it accordingly. Lastly, for the 3D rendering of the Voorhees building we used Blender and Clip Studio Paint.

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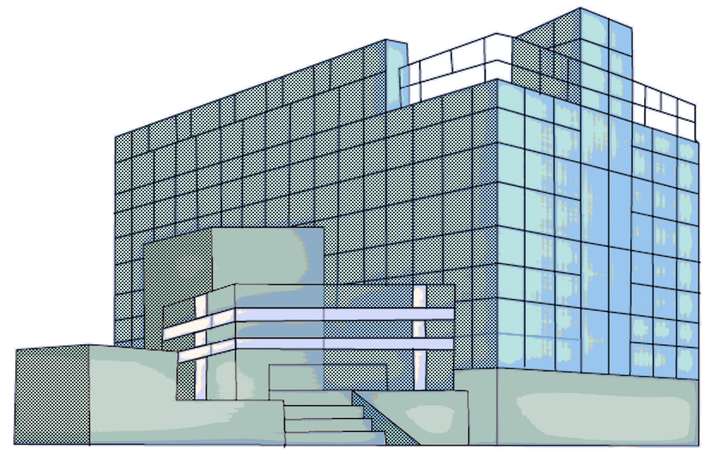
https://www.usu.edu/math/symanzik/teaching/2009_stat6560/Downloads/Friendly_milestone.pdf https://www.johngrimwade.com/blog/2019/05/21/maps-revisited/ https://www.oldest.org/geography/world-maps/ https://www.citytech.cuny.edu/about-us/directions.aspx


New York City College of Technology - Voorhees Hall Building

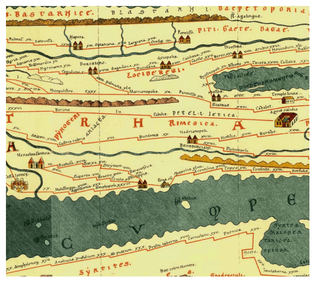


photo source: Wikimedia Commons via Conradi Millieri

photo source:
Wikimedia Commons via Francesco di Antonio del Chierico

CITY TECH
MAPPING THE CAMPUS

- ENTRANCE / EXIT
- NORTH BUILDINGS
- SOUTH BUILDINGS
- PARKS AND OPEN AREAS
- PARKING SPOTS
- FOOD PLACES NEARBY
- DNA LEARNING CENTER
- LIBRARY
- GLASSES CLINIC
- DENTIST CLINIC
- GYM
- CAFETERIA
- ADA ACCESS
- THEATER
- BIKE
- PHOTO-LAB
- BUS STOPS
- BRIDGE

BUILDINGS LISTING

SOUTH BUILDINGS
This is where you are going to find the main campus.

1 Academic Complex 285 Jay St, Brooklyn,

Biological Science Program	Room: A-301
Chemistry Program	Room: A-516
Nursing Program	Room: A-614
Dental Hygiene Program	Room: A-701
Health Services	Room: A-807
Vision Care Technology	Room: A-812

2 Namm Building 300 Jay St, Brooklyn

Registrar Office	Room: NG-15
Financial Aid Office	Room: NG-13
Admissions	Room: NG-17
Busar's Office	Room: NG-06
Public Safety Office	Room: NG-109
Counseling	Room: NG-108
Academic Advising	Room: NG-104
Transfer Students	Room: NG-08

3 Library Building 60 Tillary St, Brooklyn,

Student Help Desk	Room: L-400
Professional Development	Room: L-114

4 Pearl Building Access through Library Building

Vision Care Department	Room: P-312
Eye Glass Clinic	Room: P-300
Contact Lens Clinic	Room: P-302
Vision Care Technology	Room: P-312

5 General Building Access through Library Building

Wellness Center	Room: G-414
Academic Testing	Room: G-207

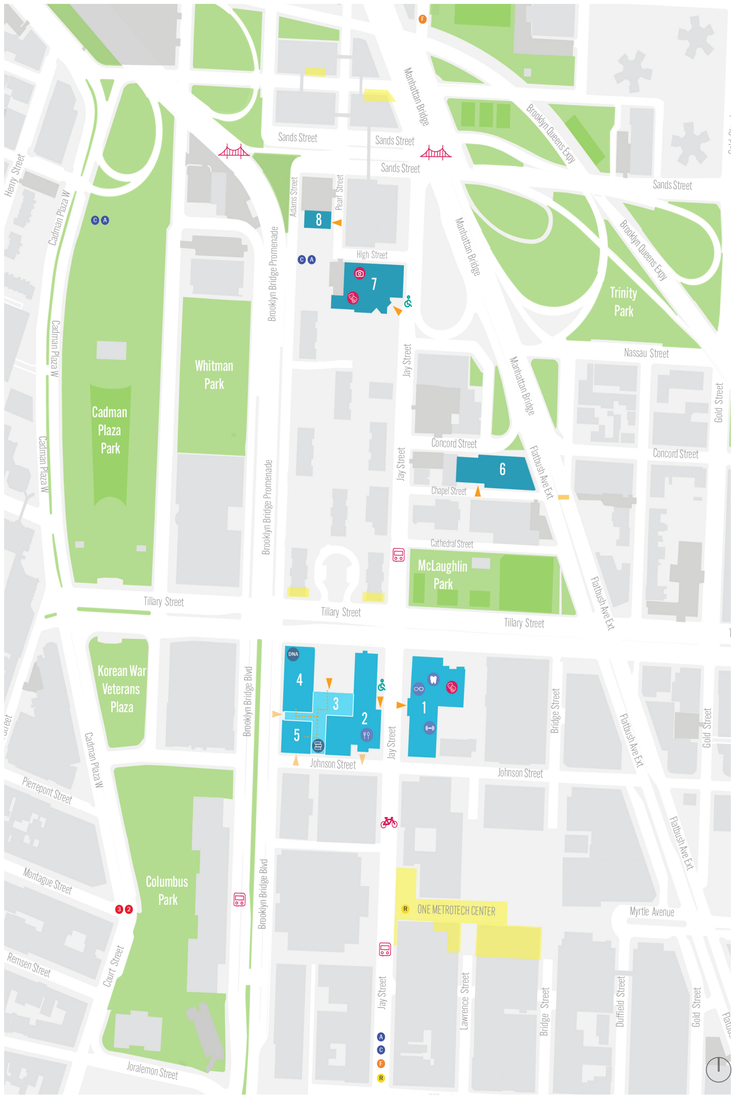
NORTH BUILDINGS
This is where you are going to find the rest of the campus.

6 Horward Building 25 Chapel St, Brooklyn
Wellness Center Room: HB-207

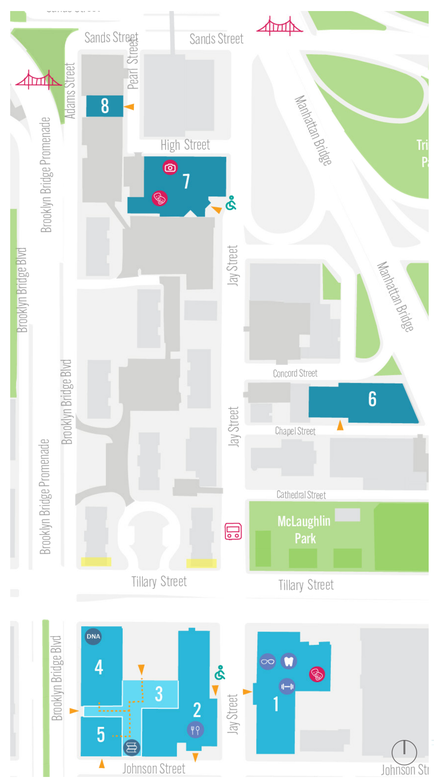
7 Voorhees Hall 186 Jay St, Brooklyn

Architecture Department	Room: V-829
Construction Management	Room: V-433
Entertainment Technology	Room: V-203
Mechanical Engineering	Room: V-520
Computer Engineering	Room: V-633

8 Enviromental Center 172 Pearl St, Brooklyn
ASAP Room: E-203

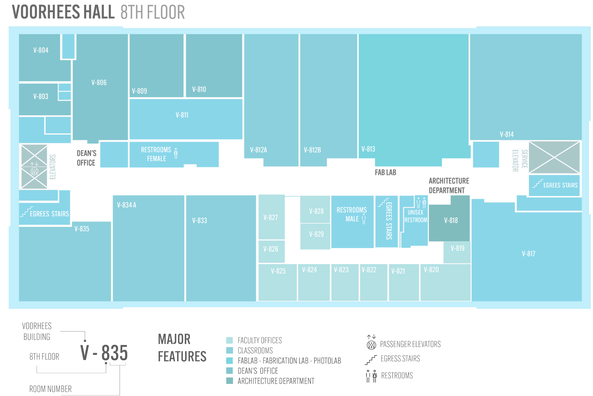


General City Tech Campus Map



Student City Tech Campus Map

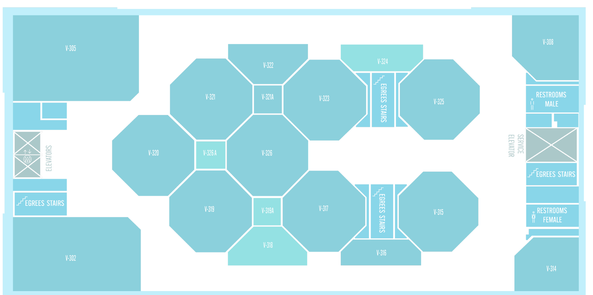
VOORHEES HALL 8TH FLOOR



VOORHEES BUILDING
8TH FLOOR
V - 835
ROOM NUMBER

MAJOR FEATURES
- FACULTY OFFICES
- CLASSROOMS
- FABLAB - FABRICATION LAB - PHOTOLAB
- DEAN'S OFFICE
- ARCHITECTURE DEPARTMENT
- PASSENGER ELEVATORS
- EGRESS STAIRS
- RESTROOMS

VOORHEES HALL 3RD FLOOR



VOORHEES BUILDING
3RD FLOOR
V - 315
ROOM NUMBER

MAJOR FEATURES
- CLASSROOMS
- STORE-ROOMS
- PASSENGER ELEVATORS
- EGRESS STAIRS
- RESTROOMS

Multi-energy broadening in X-rays by Copper and Iron Nitrate filters.

ESP Scholars: Ayesha Arooj (1), Derbie Desir (1), Robert O'Brien (2) Mentor: Subhendra Sarkar (2)

Departments of (1) Biological Sc (2) Radiologic Technology & Medical Imaging; New York City College of Technology

Abstract

The use of X-ray imaging in medical diagnostics and research has significantly advanced in recent years yet challenges still exist in accurately detecting and characterizing certain biological tissues, particularly those containing minerals such as iron and copper. In this study, we explored the potential of copper and iron nitrate filters to modify X-ray images by inducing multi-energy broadening of incident X-ray beams in the 20-36 keV range. Our research has the potential to expand the use of Fe and Cu nitrate filters in medical imaging, particularly in studying the rough surfaces of cancer cells. By using highly scattered X-ray beams in low-energy CT and mammography machines, we can more accurately capture the unique features of these surfaces, which can be indicative of cancer growth and progression. By introducing heterogeneity and texture of bulk medium, we hope to explore the surface effects of the filters and improve the detection of abnormal texture or minerals present in cancer cells, leading to more accurate diagnoses and better treatment options. Our hypothesis was that biological tissues containing Fe and Cu complexes as biominerals may absorb X-rays differently if the beam has various energies matching the energy levels in Fe and Cu-rich areas. Through our experiments using Fe and Cu nitrate salts intermixed with alkali halides as filters, we observed energy broadening of incident X-ray beams. In addition to introducing heterogeneity, we are extending atomic Compton scattering to molecular crystals. Since human tissue works with Cu and Fe complexes, we have selected nitrate salts for in vitro experiments. They both have many valence electrons in the molecular orbitals. Fe(NO3)3 has one more NO3 group than Cu(NO3)2 and perhaps that's why showing more anisotropic Compton scatter. Our findings could contribute to the development of new contrast materials and imaging methods for use in diagnostic and exploratory procedures in medicine.

Introduction

X-ray imaging has long been used as an invaluable resource in medical diagnostics and research, providing invaluable insights into biological tissues' interior structures. Unfortunately, accurately detecting and characterizing certain tissues that contain minerals such as iron or copper remains challenging; In this study we will investigate how copper and iron nitrate filters could modify X-ray images by inducing multi-energy broadening of incident X-ray beams within 20-36 keV range which would enhance cancer cell detection via better mineral detection techniques. Fractionation is an integral component of radiation therapy for cancer treatment, where the total radiation dose is divided into multiple smaller fractions to minimize damage to healthy tissues and increase treatment effectiveness. The fractionation concept for radiation treatment can also be utilized with these filters as they dilute down the X-rays and focus on the cancer region as a lens. Fe and Cu nitrate filters in medical imaging can assist in precise targeting of cancerous tissues by diluting down X-rays to focus on them as a lens, improving detection of abnormal textures or minerals present in cancer cells as well as contribute to new contrast materials and imaging methods development. This approach could potentially increase detection capabilities as well as help facilitate new contrast materials and imaging methods development.

Methods

To test our hypothesis, we performed experiments using Fe and Cu nitrate salts intermixed with alkali halides as filters (Fig 1). These filters were designed to introduce heterogeneity and texture to the bulk medium, with the goal of improving the detection of abnormal texture or minerals present in cancer cells. We used X-ray beams in the 20-36 keV range and observed the energy broadening of incident X-ray beams by measuring the scattered radiation with a high-purity germanium detector. Our experimental setup consisted of a Hologic Selenia Dimension system with Tungsten X-ray source, built-in Ag filter, and the detectors. We performed multiple scans with varying filter thickness and X-ray energies to gather sufficient data for analysis. We also analyzed the anisotropic Compton scattering of the filters, which helped us better understand the energy broadening of the incident X-ray beams. By using Fe and Cu nitrate salt grains as filters, we hope to extend atomic Compton scattering to molecular Compton idea and contribute to the development of new contrast materials and imaging methods for use in diagnostic and exploratory procedures in medicine.

Results

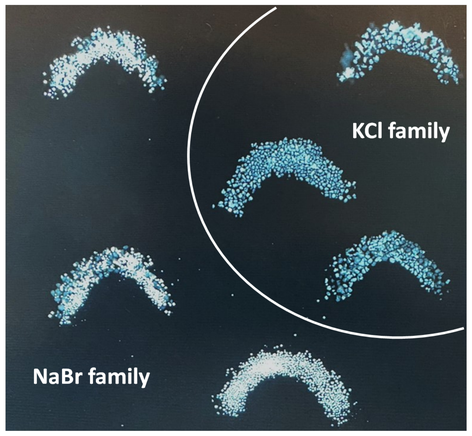


Fig 1. X-ray image of double salt compounds arranged as a "Compton Lens" to focus incident and scattered X-rays, Compounds are annotated in Fig 1.

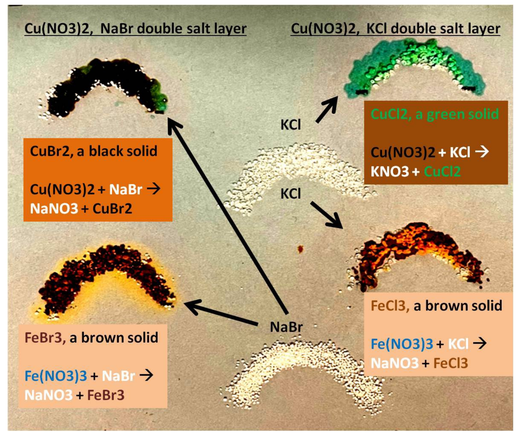


Fig 2. Top two colored double salts are Cu nitrate (blue) and alkali halides. Bottom two colored double salts are Fe nitrate (light purple) and alkali halides. On the right alkali halide is KCL and on left, NaBr. The central white piles are pure KCl and NaBr.

Discussions

Double layer salts are reacting at room temperature and within a few hours Br and Cl seem to be incorporated within Cu and Fe nitrate salts as CuBr2 and FeCl3 causing color change from original blue for Cu nitrate to green (possibly due to CuCl2 at right) and black (possibly due to CuBr2 at left).

Similarly in the bottom row from original light purple for Fe nitrate to light brown (possibly due to FeCl3 at right) and dark brown (possibly due to FeBr3 at left). We model that the following have taken place and one needs to model the Compton from the product salts on right of Rxn 1-4:

Top Left: Chem Rxn 1: $2NaBr + Cu(NO_3)_2 \rightarrow 2Na(NO_3) + CuBr_2$
Top Right: Chem Rxn 2: $Cu(NO_3)_2 + 2KCl \rightarrow CuCl_2 + 2KNO_3$
Bottom Left: Chem Rxn 3: $Fe(NO_3)_3 + 3NaBr \rightarrow FeBr_3 + 3Na(NO_3)$
Bottom Right: Chem Rxn 4: $Fe(NO_3)_3 + 3KCl \rightarrow FeCl_3 + 3KNO_3$

KCl and NaBr at the middle do not change over time and provide reference Compton scatter.(Refer for Compton physics on those alkali halides in another poster by: Somdat/Zuonie/Sabina)

Conclusion

This research demonstrated the utility of using Fe and Cu nitrate filters to modify X-ray images and enhance detection of abnormal textures or minerals present in cancerous cells. By inducing multi-energy broadening of incident X-ray beams, we can capture the unique features of cancer cell surfaces which indicate their growth and progression. Filters also serve as Compton lenses, diluting down and focusing X-rays directly onto areas suspected of cancer for increased accuracy in diagnosis and treatment options. In figure 2, The energy broadening was more pronounced in Fe(NO3)3 filters than in Cu(NO3)2 filters, indicating that Fe(NO3)3 may exhibit more anisotropic Compton scatter than Cu(NO3)2. We also observed the formation of CuBr2 and FeCl3 in the reactions between Cu and Fe nitrate salts and KCl and NaBr alkali halides. The color change of the double salt compounds suggested the incorporation of Br and Cl within Cu and Fe nitrate salts. We modeled the Compton scattering from the product salts on the right of the chemical reactions. Our results also suggest that the anisotropic Compton scattering of the filters could help us better understand the energy broadening of the incident X-ray beams. Overall, our study has the potential to expand the use of Fe and Cu nitrate filters in medical imaging and contribute to the development of new imaging methods for detecting cancer growth and progression. Furthermore, our findings could contribute to the creation of novel contrast materials and imaging methods suitable for use in diagnostic and exploratory procedures in medicine. Though challenges remain in accurately detecting and characterizing some biological tissues containing minerals like iron and copper, this study opens new avenues for improving medical imaging and increasing our knowledge about cancer.

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Windt DL. Monochromatic mammography using scanning multilayer X-ray mirrors. Rev Sci Instrum. 2018 Aug;89(8):083702. doi: 10.1063/1.5041799. PMID: 30184654; PMCID: PMC6095706.

Enrollment Trends at New York City College of Technology for Radiologic Technology & Other Imaging Modalities

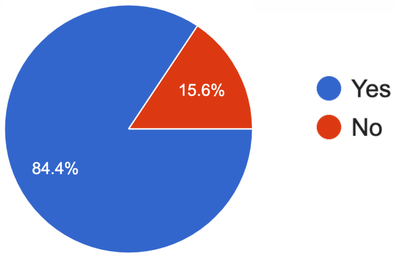
Student: Bich Tram Pham | Mentor: Lillian Amann MSRS, RT(R)
New York City College of Technology
Department of Radiologic Technology & Medical Imaging

ABSTRACT

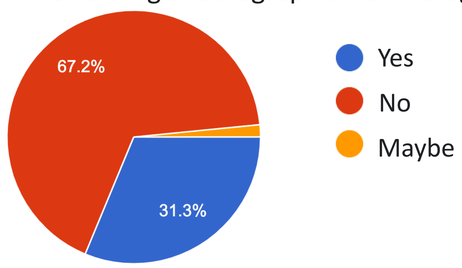
A survey of the incoming class from the Radiologic Technology and Medical Imaging Program at New York City College of Technology was conducted last semester to understand their interests before they completed the program's first semester and to determine if they consider the program as a stepping-stone to other radiologic modalities. The research study was conducted this semester by observing the same group of students during their first clinical rotation to determine whether this experience changed their long-term career goals. Students are only exposed to the X-ray department during the first semester of the clinical phase of the program in order to provide them with hands-on experience with real patients. Did their desire to remain an X-ray technician grow as a result of working in the hospital, or did it cause them to gravitate toward other imaging modalities? The students were asked about their time spent in clinical rotations and how it was to work with actual patients. The study revealed that less than 20 radiographers who are willing to practice for the rest of their careers will graduate from the program. The other students will continue onto their job paths and most likely enroll in one of the bachelor programs offered by New York City College of Technology.

RESULTS

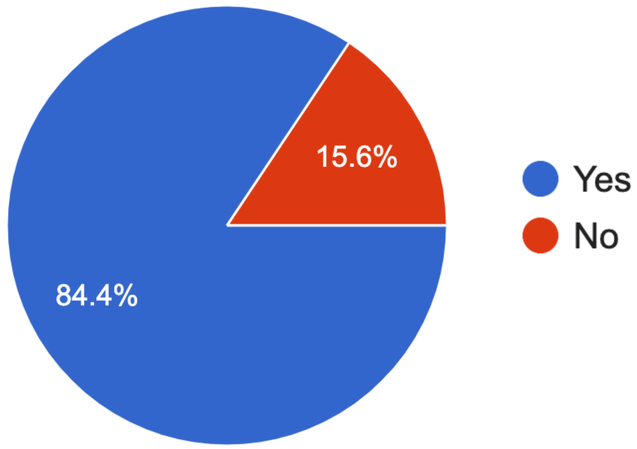
Do you feel that the Radiologic Technology and Medical Imaging Program has prepared you for the clinical rotation?



Does taking care of real patients make you more Interested in remaining a radiographer technologist?



Have you looked into enrolling in other radiologic modalities or bachelor programs post-graduation next summer?



DATA ANALYSIS

Salary is a key factor that motivates students move to others modalities:

$175,000+	3%
$150,000-$174,000	12%
$125,000-$149,000	16%
$110,000-$124,000	15%
$100,000-$109,000	13%
$90,000-$99,000	20%
$80,000-$89,000	21%
$70,000-$79,000	0%

According to our tabulated data above, 59% of Radiology Technology & Medical Imagining students are expecting to earn over $100,000 in annual salary. The starting income for Radiologic Technologist is around $80,000 a year.

CONCLUSION

The first-year students in radiologic technology and medical imaging advanced to their clinical rotation after the first semester in Fall 2022, to get experience working in a hospital setting while providing care for patients. Students' perspectives on advancing their careers, with one of the key considerations being the salary they desired to earn, have been changed through this clinical experience.
The results of the research showed that the New York City College of Technology will produce approximately 20 radiologic technologists, and most of them will switch to other specialties during the first 5 years of their professional careers.

Fleishon, H. B. (2022, February 10). *The radiology labor shortage*. The Radiology Labor Shortage | American College of Radiology. Retrieved November 23, 2022, from https://www.acr.org/Practice-Management-Quality-Informatics/ACR-Bulletin/Articles/March-2022/The-Radiology-Labor-Shortage

The Deception of Social Media

Bryant Ariza
Mentor: Elizabeth Parks
New York City College of Technology, Emerging Scholars Program

Introduction

Facebook, Instagram, Tik tok are some of the most commonly used platforms nowadays. To connect with others, to entertain us for a moment or to spread information. How can we determine how reliable or accurate information can be? Bias is everywhere, we as humans have our own opinions and that can dictate the direction of your research or ideas. We're here to explain how social media platforms work to influence our understanding of a certain topic.

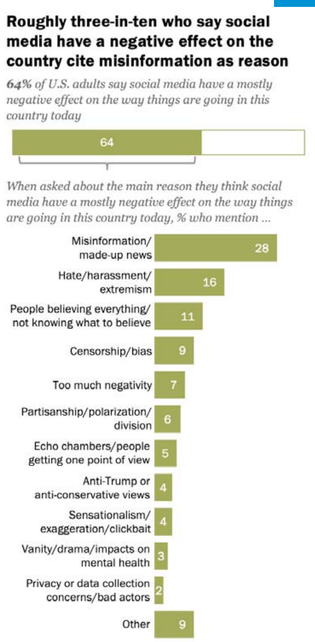
Objective

The focus of this research is to determine how social media can be distorted or manipulated to alter an individuals opinion towards a certain topic or issue.

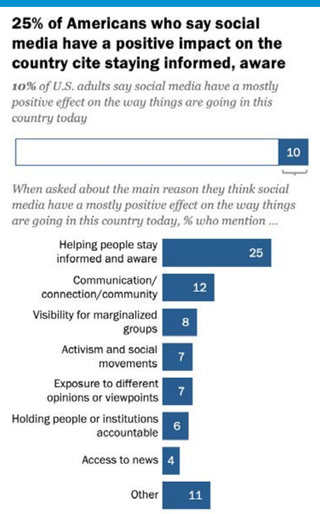
Methodology

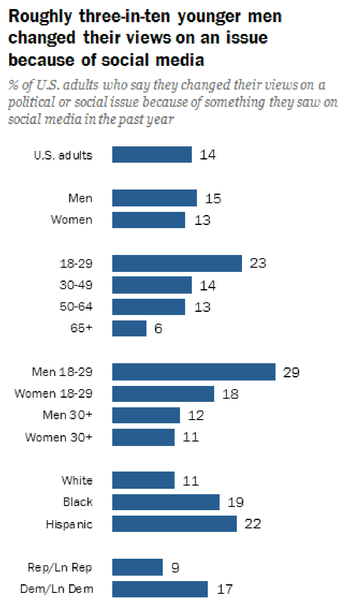
1. Become Neutral
We have to recognize our perspective towards an issue. Look for information based on your topic as well as be open to other arguments that go against your ideas. Do not fall into confirmation bias. Confirmation Bias is when an individual guides their research based on information that backs up their point of view. We become ignorant and scared of information that goes against our opinions.
2.Examine Sources
Try to figure out how these sources collected data. Surveys and analyst experts are the most common to grade bias. Investigate the media company's history to learn about the information they often provide.
3. Take a decision
Many non profit organizations rank media outlets based on how left or right they share their material to the public.
Left: Liberal, progressive
Right: Conservative, Traditional
Although it varies between media corporations, we get a general idea of what to expect.

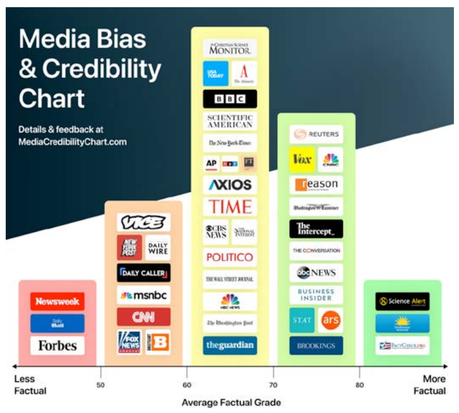
Data & Media Bias Charts



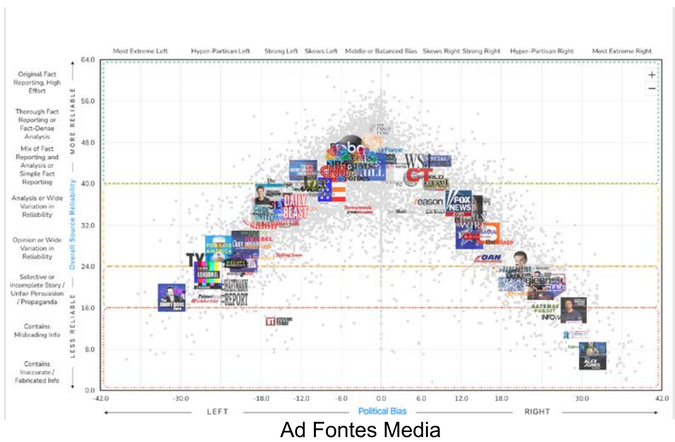
Surveys from PEW Research Center







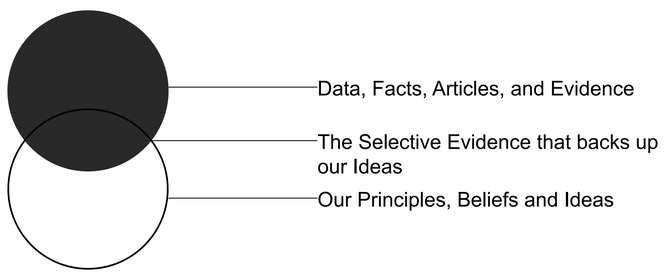
The Factual



Ad Fontes Media

Allsides

Confirmation Bias



How is bias rated?

Factual: The use of a news-rating algorithm concentrates on the writing style, evidence, authors experience and the publisher's history.
Allsides: They use blind bias surveys or editorial review in which analysts with different views rate how bias an article may be.
Ad Fontes Media: Three analysts with different views discuss and determine an overall score to decide in which category their from.
PEW Research Center: Surveys to the public.

Conclusion

As the research developed we are able to present your viewpoint on a certain issue or topic in a more reasonable manner. The tools gained can be shared with others, allowing them the ability to express their opinion based on accurate data. As a society we must acknowledge the amount of information revolving around us. The ability to separate facts from opinions can open our minds to alternative interpretations.

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4. Pew Research Center- Social Media Fact Sheet
https://www.pewresearch.org/internet/fact-sheet/social-media/
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7.The Impact of Social Media on Public Opinion
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Acknowledgments

I want to express my appreciation to Emerging Scholars Program for this opportunity.
A great appreciation towards my mentor Professor Parks for guiding me through this research process.

Exact Solvable Two-Body Problem in Two-Dimensional Quantum Mechanics

Claudio Malvino, Jianning Luo, Roman Kezerashvili

CUNY New York City College of Technology, Physics Department

Abstract

With the advent of two-dimensional materials, such as graphene and monolayer transition metal dichalcogenides, the need for solutions of non-relativistic two-dimensional quantum mechanical systems have increased. We will be showing how to make the transformation from a three-dimensional non-relativistic Schrodinger equation to a two-dimensional configuration in the case of two body non-interacting systems. We will also be achieving an exactly solvable solution by utilizing the Nikiforov-Uvarov method and transforming the Schrodinger equation into an equation of the hypergeometric type. With this method, we will be able to extract exactly solvable solutions as the solution to an equation of hypergeometric type is exactly solvable and known. Specifically, we will be considering the Infinite Circular Well and Harmonic Oscillator.

Transformation into the Two-Dimensional Schrodinger Equation

We begin with the three-dimensional Schrodinger equation involving a two body system in Cartesian coordinates

$$[-\frac{\hbar^2}{2m_1}\nabla_1{}^2-\frac{\hbar^2}{2m_2}\nabla_2{}^2+V(|\mathbf{r_1}-\mathbf{r_2}|]\,\Phi(x_1,y_1,z_1;x_2,y_2,z_2)=E\,\Phi(x_1,y_1,z_1;x_2,y_2,z_2 \tag{1}$$

After making the appropriate substitutions that allow us to separate the motion of the center of mass and the relative motion and making the transformation from Cartesian to polar coordinates we arrive at the following equation

$$\frac{d^2\phi(r)}{dr^2}+\frac{1}{r}\frac{d\phi(r)}{dr}-\frac{m^2}{r^2}\phi(r)+\frac{2\mu}{\hbar^2}[E-V(r)]\phi(r)=0 \tag{2}$$

where μ is the effective mass of the two particles in the system and by applying the substitution $\phi(r)=r^{-1/2u(r)}$ we get

$$\frac{d^2u(r)}{dr^2}-\frac{m^2-\frac{1}{4}}{r^2}u(r)+\frac{2\mu}{\hbar^2}[E-V(r)]\phi(r)=0 \tag{3}$$

The Nikifurov-Uvarov Method

The Nikifurov-Uvarov method utilizes the propensity of special functions to arise as solutions of differential equations and utilizes this facet of mathematics to transform differential equations into special functions of hypergeometric form. The differential equation must be in the following form

$$\frac{d^2u(r)}{dr^2}+\frac{\widetilde{\tau}}{\sigma(r)}\frac{d\phi(r)}{dr}+\frac{\widetilde{\sigma}(r)}{\sigma^2(r)}\phi(r)=0 \tag{4}$$

where $\widetilde{\sigma}(r)$ and $\sigma(r)$ are polynomials at most of second degree and $\widetilde{\tau}$ is a polynomial of at most first degree. The Nikifurov-Uvarov method hinges on making the appropriate substitution $\phi(r)=\chi(r)u(r)$ such that for a particular $\chi(r)$ we can transform Eq.(5) into

$$\sigma(r)\,\frac{d^2u(r)}{dr^2}+\tau(r)\,\frac{du(r)}{dr}+\lambda u(r)=0 \tag{5}$$

where $\sigma(r)$ is a polynomial of at most second degree, τ is a polynomial of at most first degree, and λ is a constant. By the means of specific transformations, we are able to arrive to an equation of the hypergeometric type, whose solutions are known. The specific substitutions will vary depending on the potential V(r).

Circular Infinite Well

The circular infinite well as the potential

$$V(r)=\begin{cases}0, & \text{if } r<R\\ \infty, & \text{if } r>R\end{cases} \tag{6}$$

We were able to transform Eq.(3) into an equation of the form of a Bessel differential equation. We utilized the fact that the Bessel function, $J_m(\kappa r)$, can be rewritten into hypergeometric form, and acquired a the wavefunction for the circular infinite well

$$\Psi(r,\varphi)=\sqrt{\frac{2\alpha_{m,n}}{\pi}}(R^2(\alpha_{m,n}\,J_{m-1}(\alpha_{m,n})^2-2\,n\,J_{m-1}(\alpha_{m,n})\,J_m(\alpha_{m,n})+\alpha_{m,n}\,J_m(\alpha_{m,n})^2))^{-1/2}\frac{e^{-i(\kappa r+l)}}{\Gamma(n+1)}(\frac{\kappa r}{2})^n{}_1F_1(n+\frac{1}{2}.2n+1,2i\kappa r) \tag{7}$$

Figure 1. Graph comparing the energy of the circular and spherical infinite well potentials at various n, m, and l.

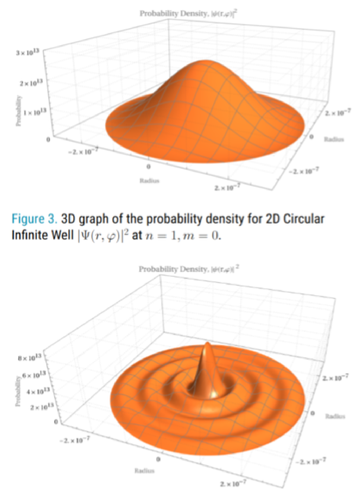

Figure 2. 3D graph of the probability density for 2D Circular Infinite Well $|\Psi(r,\varphi)|^2$ at $n=4, m=0$.

Figure 3. 3D graph of the probability density for 2D Circular Infinite Well $|\Psi(r,\varphi)|^2$ at $n=1, m=0$.

Two Dimensional Harmonic Oscillator

The two-dimensional harmonic oscillator has the following potential

$$V(r)=\frac{1}{2}\mu\omega^2r^2 \tag{8}$$

where μ and ω are our effective mass and angular frequency, respectively. After making the appropriate substitution $\phi(z)=z^{|m|/2}e^{-z/2}u(z)$ we get the hypergeometric function

$$z\frac{d^2u(z)}{dz^2}+(|m|+1-z)\frac{d\phi(z)}{dz}+\frac{1}{4}[\beta-2(m+1)]\phi(z)=0 \tag{9}$$

where $\beta=\frac{\kappa^2}{\gamma}$, $\gamma=\sqrt{\frac{\mu^2\omega^2}{\hbar^2}}$, and $z=\gamma r^2$. Which gives us the solution for the wavefunction

$$\Psi(r,\varphi)=\frac{n_r!}{2\gamma(n_r+m)!}\frac{1}{\sqrt{2\pi}}(\gamma r^2)^{m/2}e^{-\gamma r^2/2}L_n^m(\gamma r^2)e^{im\varphi} \tag{10}$$

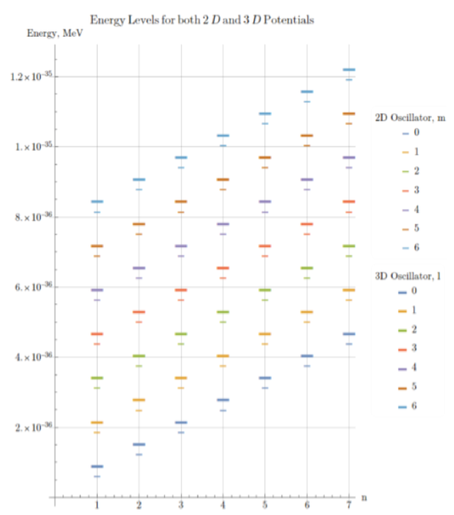

Figure 4. Graph comparing the energy of the 2D and 3D harmonic oscillator potentials at various n, m, and l.

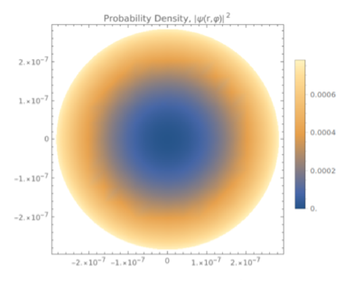

Figure 6. A "heat map" of the probability density for the 2D harmonic oscillator $|\Psi(r,\varphi)|^2$ at $n=3, m=1$

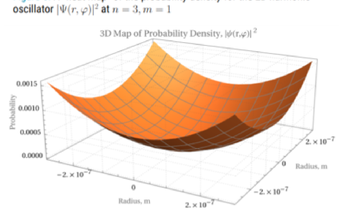

Figure 5. 3D graph of the probability density for the 2D harmonic oscillator $|\Psi(r,\varphi)|^2$ at $n=3, m=1$

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Conclusion

With our methods we have concluded that by selecting the appropriate substitution, while operating within the framework of the Nikiforov-Uvarov method, we are able to transform the two-dimensional Schrodinger equation into an equation of the hypergeometric form for the case of the infinite circular well and harmonic oscillator. Furthermore, we were able to show that there is a difference between the energy eigenstates between the a 2D system and its 3D counterpart. The difference between the energy eigenstates for the circular and spherical infinite well increases as n, l, and m increases. As for the 2D and 3D harmonic oscillator, the difference between the energy eigenvalues is 1/2. We concluded that this is due to the extra degree of freedom allotted to the 3D configurations.

DRIVING FORCES BEHIND CHOOSING RADIOLOGICAL TECHNOLOGY AS A CAREER

Mentor : Professor Zoya Vinokur

Created by Peber DeJesus, Tatiana Ryzhakova and Mikhail Kun

Abstract

Healthcare covers a wide range of services. One aspect is medical imaging and all its various modalities, such as radiographic technology, ultrasound, CT/MRI, and mammography. We would like to explore the reasoning behind how people choose radiographic technology as a career. Was it a first choice or a career change? The perfect career is hard to choose. Many people change their careers in mid-age life. Radiology technology is a unique career that has many pathways after completing school and passing the licensing exam. It allows for cross-training into other modalities and administration. The pros and cons will be described on making a career choice where people tend to come from different jobs and degrees to start all over again to apply for a medical imaging modality.

Introduction

People's hardest decision is choosing the career they want. Radiology technology is one of the careers that people find an option to choose from, no matter what other job or major they come from. People from all over choose to become radiology technologist, but what is the driving forces that's making them choose this career? Radiology technologist contains is pros and cons as any other career.

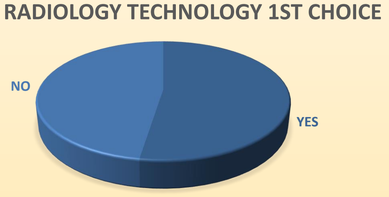
Methodology

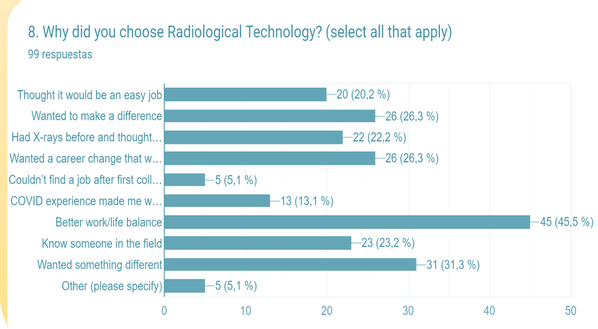
In order to do an analysis of the quantity of people that had come from other jobs or changed their careers to start a degree in medical imaging, surveys are going to be disseminated. The use of surveys is the most ideal applications for this research studies because of their high reliability. Surveys are going to be widely spread to student in which include graduates in 2023 and 2024.

After Google surveys are disseminated, an analysis will be made by using Excel and data will be compared. Data will be represented on charts to be created as graphs. Other data will be use in order to be evaluated and compare to encountered final results.

Results

Before becoming a Radiologic Technology, some people already had another career choice on their mind, or their major was another option. 52.5% of the respondents were chosen by people that radiology technology was not their first career choice. Why is this career chosen? Radiologic technology has its pros and cons. The survey that was disseminated included its pros and cons options.





The survey was responded by students answered that they choose radiologic technology primarily because of the better work/life balance (45.5% of responses). One of the main benefits of radiology technology is the work balance that it brings to an individual. When becoming a radiology technology program, people have to work either part-time or full-time. When working in hospitals, some rotations such as the ER include the 12-hour shift if available. Hours are flexible, and it depends on the employee needs on what time is suitable for them.

The option in second place chosen by students was wanting something different (or a life change) (31.3% of respondents). No matter what major or job they have had before, they choose to start over again and major as a radiology technologist in order to look for a life-change.

Conclusion

Overall, Career choice must be an accurate decision for an individual because this decision will become part of a person for the rest of their life. Every career has its pros and cons. Some people called Radiology technologist a basic "Button pusher" but that's is not what makes a radiology technologist. Even though it may look like an easy job, people need to have educational skills background in order to mandate and control ALARA policy on a patient. Driving forces from all over the united states is making them choose becoming radiology technology besides having its cons; the pros of this career makes it enough to being the right fit for it.

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Potential application of alkali halide filters for imaging of key minerals in fresh porous fruits.

CSRP Researchers: Angela Moore, Katie Tam, Mentors: Subhendra Sarkar, Evans Lespinasse
Departments of Radiologic Technology & Medical Imaging
ESP Scholar: Daler Djuraev (Bioinformatics)
New York City College of Technology, City University of New York, New York, USA

Abstract

There is a significant interest in quality control of salts by mammography imaging and electrical resistance measurements. This experiment shows X-rays can be manipulated by salt filters to generate modified beams based on Compton scattering. This can be used to enhance or steal intensity from nearby iron complexes that are difficult to image by high energy commercial X-ray beams. This will be extended for various salts including effects of Gd complexes to prepare scattered X-ray beams (dispersed in energy spectrum). While it is accepted that dry fruits maintain the nutrient content, our prior works by this group have shown a dynamic readjustment in mineral distribution with heat shocks and drying of fruits. The researchers hypothesize that iron (Fe), copper (Cu) and manganese (Mn) distribution depend on surface charges and surface areas available and is responsible for biomineral distribution at cortex and cores of fruits. A drawback of current characterization tools is the lack of knowledge about oxidation or charge states of nutrients and minerals during ripening and drying of fruits. The role of moisture in tissue is hard to understand but seems to control internal tissue geometry. This work plans to demonstrate if spectrally multi-energetic X-ray beams produced by alkali halide filters can characterize the porosity changes between fresh and dried states in model fruits. A potential application would be the tissue structure changes in radiation resistant tumors and during wound healing where tissue fluid affects imaging results. Current radiological tools with X-rays or MRI do not address such internal tissue texture changes. This work focuses on the role of moisture or tissue fluid on X-ray scatter compared to dry tissue.

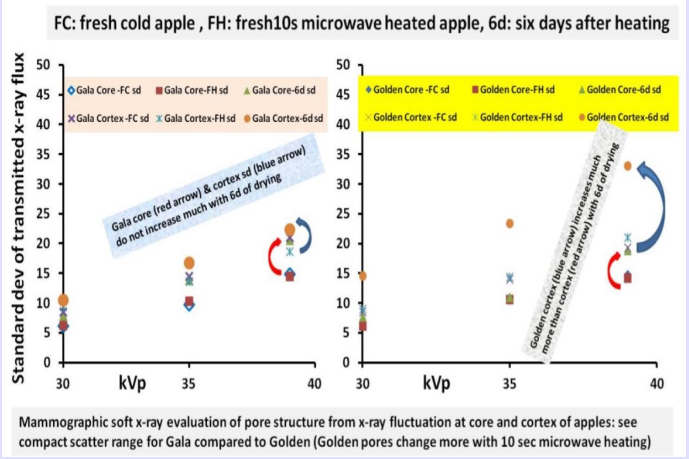
Method

Four salts were utilized in this experiment (alkali halides): Sodium Bromide (NaBr), Potassium chloride (KCl), Sodium chloride (NaCl), Potassium bromide (KBr).
However, two were preferred: NaBr and KCl.
This was because Sodium chloride (NaCl) was too light and not capable to absorb valuable amounts of energy. Potassium bromide (KBr) proved to be difficult to analyze. NaBr and KCl were best options due to their similarity: both NaBr and KCl have a total of 18 electrons, with 7 electrons in the outermost shell of the anion (−Br and −Cl) atoms and 1 electron in the outermost shell of the cations atom (+K and +Na).
Materials used: Hologic Mammography machine (high sensitivity x-ray machine); Various ionic salts: NaCl, KCl, NaBr, KBr, Radiolucent Materials (materials that do not significantly affect an x-ray beam): Paper, Paper Plates and positioning aids.
The salt was arranged on the receptor plate as shown in Figure 2 which indicates a 15 cm x 15 cm exposure field. Individual pen caps were used to separate the individual grains of salt.
Took 4 different types of apples: Fuji apple, Golden apple, Granny Smith and Gala apple. Took a slice of each apple and made an exposure of it and labeled it as cold. Heated each apple slice for 10 seconds in a microwave and made exposures to show mineral content. These heated apple slices were labeled as hot. The absorption pattern of each filter was analyzed and used to identify varying minerals in the apples.

Background

Compton scatter involves the production of scattered x-rays of relatively high energies (relative to k-edges and l-edges) from high energy x-rays in the primary beam.
The x-ray beam is attenuated by mostly Compton and photoelectric interactions. Minimum readout value and maximum readout value within an ROI with a salt (compared to air shots) are important in our experiments. The min values indicate the pixels with the maximum attenuation. The max values (as increased from air shots) indicate scattered x-ray photons reaching a certain pixel or regions of no attenuation (if no relative increase from air shots).
The X-rays photons interact with the electrons in the atoms of substances to produce an image. This happened in two ways, scatter, or absorption. Scatter is where the energy of the photon is partially absorbed and the direction changes, while absorption is where x-ray beams photon is completely absorbed by the atom. The main form of scattering (97%) comes from Compton interaction.
Absorption is also known as photoelectric absorption or photoelectric election. In this interaction the x-ray photon interacts with an inner shell electron. The energy of the photon is absorbed by the electron(photoelectron) which is ejected from the atom. The x-ray photon ceases to exist, and no radiation leaves the atom.
Salts are ionic compounds composed of different metals and non-metals of varying atomic numbers. Furthermore, these salt crystals have different sizes and shapes. The orbital electrons and shapes of these crystals will absorb and scatter different photons from our x-ray beam to produce an image on the image receptor of the x-ray machine.

Results



Mammographic soft x-ray evaluation of pore structure from x-ray fluctuation at core and cortex of apples: see compact scatter range for Gala compared to Golden (Golden pores change more with 10 sec microwave heating)

Fig 1.

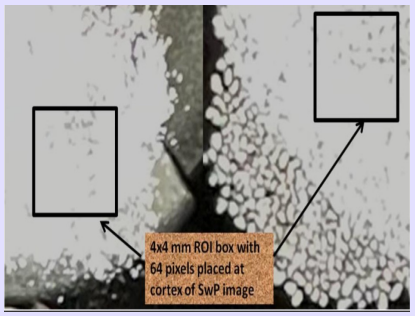


Fig 1. Alkali halide filtered analyzed regions for fresh apples

Fig. 2.

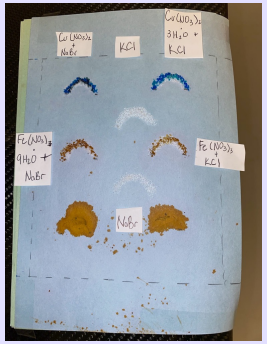


Fig 3.

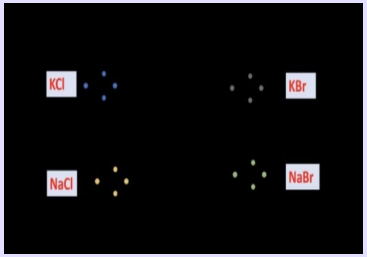


Fig 3.
Showing salts energy levels
Used KCl and NaBr which are the similar brightness meaning has similar energy level.

Conclusion/ Next Steps

The results indicated that Compton scatter can be manipulated via the different types of salts. One may conclude that in our simple salts x-rays are trapped before getting scattered and harmonic detection may explain bright intensity observed in some of the salt clusters. Spectrally multi-energetic x-ray beams utilized on dried heated Golden and Gala apples, indicated changes in porosity of both apples. X-ray evaluation of pore structures of Gala and Golden apples demonstrated Golden apple's pore structure had a greater difference when compared to Gala's pore structure.

At the current moment, we are still experimenting with different filters and halide salts. Thus, we do not have a concrete conclusion. This ongoing research will be continued during the summer utilizing other advanced structures along with the halide salts.

Acknowledgment

Sincere gratitude is expressed to the faculty and staff of NYCCT for providing this opportunity to be engaged in this experiment. As well as the stipend from CUNY research scholars program. Special thanks to Aaliyah Salmon, Aravis McBroom and Joanna Syska,Somdat Kissoon, Ayesha Arooj, Derbie Desir, Robert O'brien, Zuonie Ke, Sab Rakhmatova, Jennifer Padilla, Anjalee Rabbani, Anam Riaz. Thank you for the continuous support.

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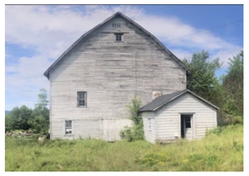
Undergraduate Research / Emerging Scholars Program Spring 2023

Title: **“COUNTRY TECH / CITY TECH: THE RE-BIRTHING OF A WINDSWEPT DAIRY BARN IN THE CATSKILL MOUNTAINS”**

ESP Research Scholars: Dahrel Cadore, Rokhaya Ndiaye, Felix Alvarado
Faculty Mentor: Prof Kenneth Conzelmann
Department of Architectural Technology, NYC College of Technology CUNY




ABSTRACT:

The Overview:

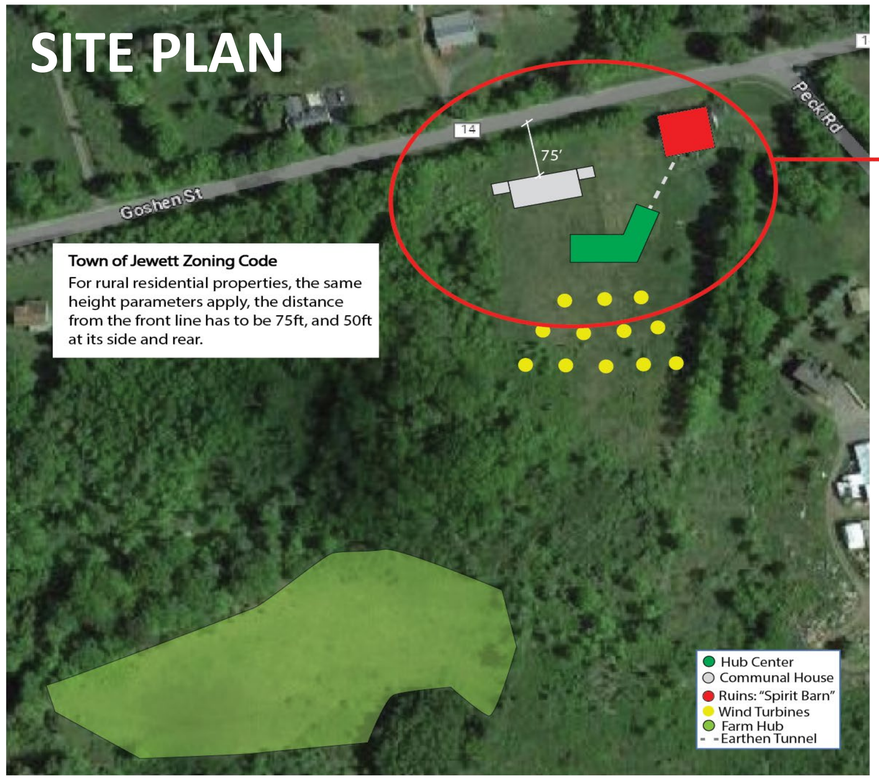
This is the third and final phase of our team’s yearlong research and design undertaking. This real-world project centers on the birth, life, abandonment, collapse, and rebirth of a ca. 1911 dairy barn and its farmland in the Catskill Mountains. Our first phase and poster presented the life of the barn, and the world it observed, from birth through collapse. Our design proposal for the site was wild and visionary and included a soaring Skywalk. Our second phase and poster worked to preserve the remains of the fallen barn, to transform it into a living memorial and learning experience in tandem with a new Environmental Study Center. This final phase focuses on the residential component, the Communal House. By designing with the use of smart passive house principles and sustainable construction practices, this off-grid retreat will serve as a place to connect with nature and to gather with family and friends.

The Story:

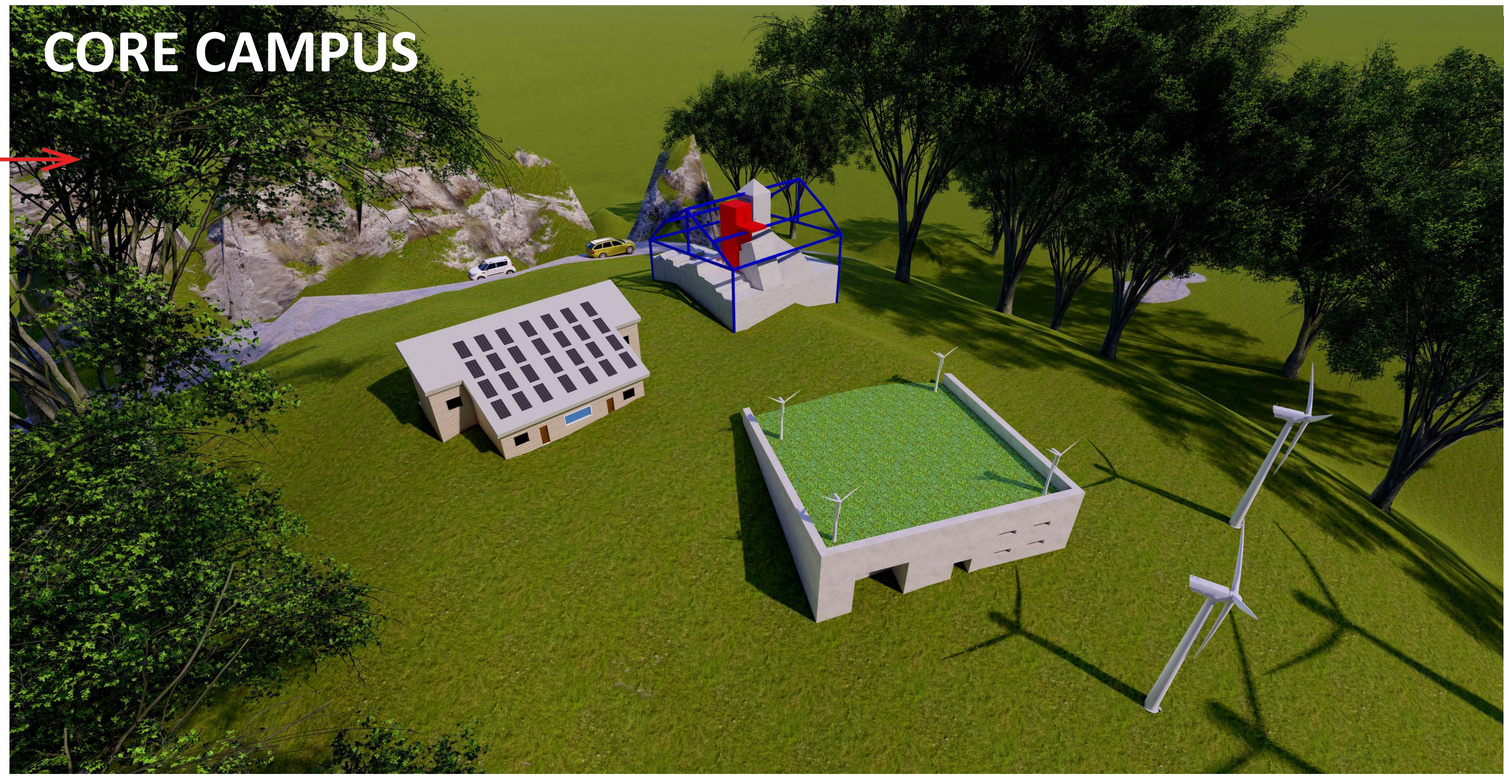
The barn sits in the north-east corner of a 20-acre parcel of land which was purchased by its current owners in 2020. The owners joyfully took to the barn, with their own hands restoring and securing it for structural stability and future reuse. Then, in the late winter of 2022, a windstorm pulled the barn from its foundation and left the building teetering in the landscape. While performing research with the CSTEP Program in June 2022, our team’s visit to the barn offered a firsthand experience and interaction with the landscape, its topography, vegetation, and sun/wind dynamics. We performed on-site documentation using traditional methods (tape measures, photography, freehand sketching) and then in the studio utilized 3D digital software and printing technologies to generate diagrams and models of design scheme iterations for our discussion and debate. Design concepts for the site include the application of progressive building technologies, renewable energy solutions, and advanced agricultural practices. This fully off-grid compound will preserve and feature the ruins of the fallen barn as an historical, interactive, and architectural place-based learning experience. Our design proposal integrates the remains of the barn ruins and features an elevator lift that takes visitors either to the top of the structure to overlook the field and sky above, or to an earthen tunnel that offers the experience of the cool and fragrant underground world. Wind turbines, solar panels, guest lodging cabins and tree houses will also be distributed throughout the site.

ESP has again offered an opportunity for the team to continue and develop our initial visions and ideas begun with the CSTEP program. Our current focus is on the residential component for the site, the Communal House. The owners envision this as a retreat - a fully off-grid structure - a place for them and members of their family and friends to gather and commune, to engage deeply with nature, and to live off the land, with appreciation.

SITE PLAN



CORE CAMPUS



SMART BUILDING

The Super Insulation



Foam Panels and Spray


Wood Fiber Boards


Fiberglass Batt and sprayed


Hemp

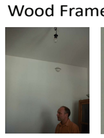
The Mechanics


Heat Distribution


Heat/Energy Storage

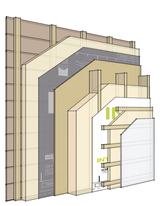

High Efficiency Wood Burning Stove

Wood Frame


The Air


Supply

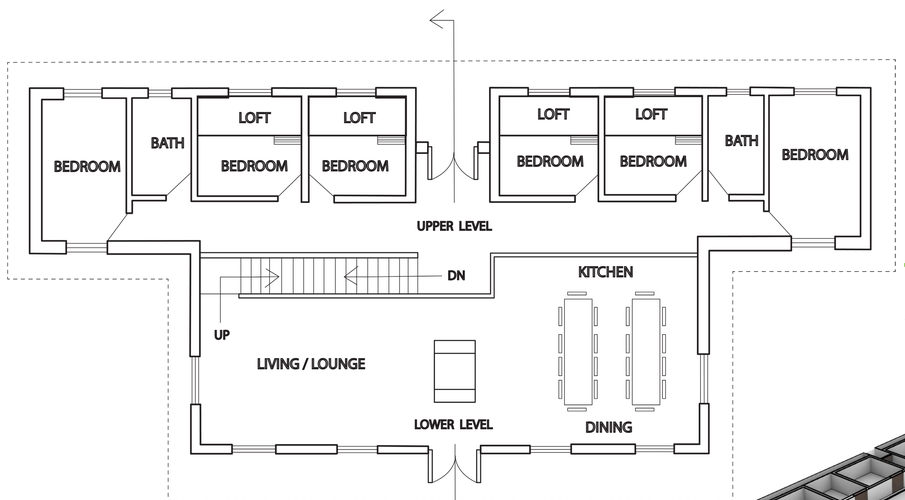

Return


Smart Enclosure by 475

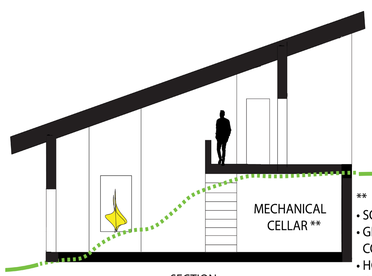

Photovoltaic Panels


Green Roof

COMMUNAL HOUSE



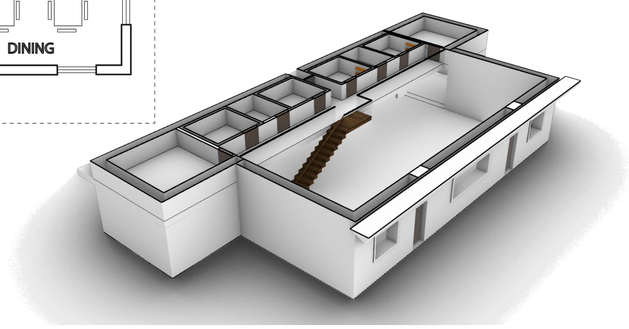
FLOOR PLAN



**
- SOLAR BATTERY STORAGE
- GEO THERMAL LIQUID BASED SYSTEM WITH HEAT RE-COVERY EQUIPMENT
- HOT WATER HEAT STORAGE TANKS
- RAIN WATER CISTERNS FOR GRAY WATER / IRRIGATION
- HIGH EFFICIENCY WOOD BURNING FURNACE
- FIRE WOOD STORAGE

LOWER LEVEL:
- Kitchen / Dining
- Lounge / Library
- Pool Table
- Fitness Room
- Sauna / Bathing
- Root & Wine Cellar
- Mechanical Room

UPPER LEVEL:
- Bedrooms
- Sleeping Lofts
- Bathrooms
- Entry from road front



THE ETHICS OF AI:

EXPLORING POSSIBLE IMPLICATIONS AND CHALLENGES

This research investigates the ethical challenges of Artificial Intelligence (AI) and highlights the importance of incorporating ethical principles into AI frameworks.

AUTHOR

Denitsa Dineva

FACULTY MENTOR

Professor Patrick Slattery

Introduction

Artificial Intelligence (AI) is a rapidly evolving field with immense potential to accelerate development across numerous industries. However, the increasing advancement in AI raises several ethical concerns, including issues related to privacy, bias, and accountability. These concerns must be addressed to ensure the growth and implementation of AI technologies have a strong foundation of ethical principles and do not harm society. This research aims to investigate the ethical implications and challenges of AI, focusing on its impact on society, individual rights, and values. Additionally, it will discuss various ethical frameworks that can guide the development and use of AI systems in the direction of promoting ethical practice.

Ongoing Ethical Issues

The major ethical concerns that are associated with AI include, but are not limited to:

- Bias and discrimination - the use of AI in decision-making processes opens up the potential to perpetuate or amplify biases that are implemented into it development.
- Privacy and security - AI systems intake enormous amounts of personal data, and without the correct frameworks, pose a risk for access or misuse by unauthorized parties.
- Human job displacement - AI has the capability to automate a variety of tasks that are currently performed by humans, sans the role of human judgment, which may lead to widespread job loss.

Fairness

Accountability

Data Protection & Security

Transparency

Objective

The research intends to answer the following questions: What ethical issues does AI raise, and how do they currently and potentially impact society? How can ethical principles be incorporated into the design and implementation of AI technologies? What ethical foundations can guide the development and use of AI towards promoting ethical practice?

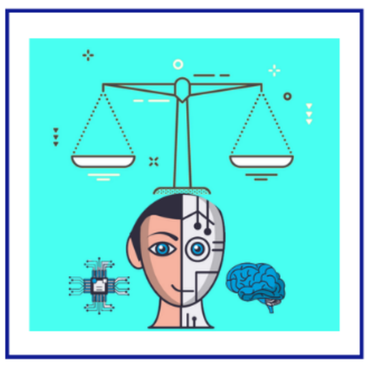
Methodology

To conduct the research, secondary data analysis techniques will be employed in order to draw conclusions based on existing studies within the field of AI. By examining relevant research and literature, the study will identify ethical concerns and evaluate the effectiveness of existing ethical frameworks. The paper aims to conclude that ethical considerations are vital in the design and implementation of AI technologies, emphasizing the need for a comprehensive ethical framework to ensure AI is developed and utilized in ways that do not adversely affect society.

Incorporation of Ethical Principles

Incorporating ethical principles into the design and implementation of AI technologies is essential to address the potential ethical issues that AI raises. AI systems must be built around the following principles:

- **Transparency and accountability** - be able to provide clear, auditable explanations in terms of their decision-making.
- **Fairness** - methods must be developed that consider and mitigate potential biases in data and the algorithms used in AI systems.
- **Privacy** - appropriate data protection measures must be implemented, including but not limited to minimization and encryption.



Key takeaway:
AI needs to work in conjunction with the human mind in order to be of benefit and not cause harm to society.

Conclusion

In conclusion, despite the rapid development of Artificial Intelligence (AI) holding vast potential for various industries, it can easily be weaponized in the absence of ethical frameworks. The ethical concerns that are raised are in relation to to privacy, bias, and transparency. These concerns can potentially arise issues of bias and discrimination, privacy and security, and human job displacement. The incorporation of ethical principles in the design and implementation of AI technologies is essential in ensuring that these technologies do not harm society. The foundations that can be used in order to guide AI towards promoting ethical practice include, but are not limited to, beneficiality, autonomy, and justness. It is crucial to address these concerns in allowing the successful, ethical integration of AI into society and to prioritize the development of the mentioned frameworks to prevent and mitigate the potential risks associated with AI. Afterall, AI is built to be used as a tool to humans, and not the other way around.

Guiding Ethical Foundations

Ethical foundations that can guide the development and implementation of AI in the direction of promoting ethical practice are principle-based. These principles include, but are not limited to:

- **Beneficiality** - AI systems must have a human-centered framework that prioritizes human welfare, and must avoid causing harm to society.
- **Autonomy** - This pertains to respecting the individual human rights and freedoms of those who are directly affected by the use of the technologies.
- **Justness** - This is concerning the equal treatment and avoidance of bias that may be implemented into the frameworks.

RESOURCES

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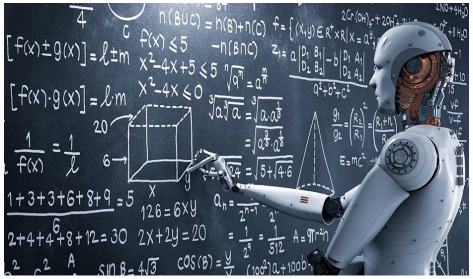
MACHINE LEARNING IN FINANCES

ELMA KASTRAT, SATYANAND SINGH

DEPARTMENT OF MATHEMATICS

ABSTRACT

In our study we work on an optimization of an appropriate stock portfolio based on available information. Our work takes into consideration the average return and any associated risk. We produce an investment strategy that predictively allows a portfolio to grow with high yields.



INTRODUCTION

"Purchase low, sell high" may seem like wise guidance, however it is difficult to follow. Assuming we open the everyday paper to the stock citations and see that right now a portion of IBM stock sells for 103¾, down from 105½ the other day, is the stock presently "low" and prepared for a development, or is it "high" and on the way down? Even if a stock has been relatively stable over a period, its daily volatility may cause us anxiety. We need a fair profit from our speculations, however not at the expense of having an uncertain outlook on their dangers.

There are numerous types of data that can be used to predict stock performance: general economic conditions, the health of the industry that the stock represents, the company's productivity as shown in its annual report, and so forth. Our goal here isn't to show you how to win at the stock market, but rather to show how, with stock quotes and some statistics, you can figure out the average rate of return on investment and the risk of investing. We will use Lagrange multipliers to construct an optimal investment portfolio based on these estimates.

METHODS

There are several methods we went through in this project.

1. **Average Rate of Return and Risk**
2. **Risk and Risk Aversion**
3. **Solving the Optimization Problem**
4. **The Portfolio Separation Theorem**

We prefer high rates of return versus low rates of return. However, we don't know a stock's rate of return on any given day since we have to wait for its price to be monitored the next day. However, we have missed our investing chance to sell or acquire more stock. To deal with this, assume that, at least over a short time period, there is a constant but unknown "average" or expected rate of return on the stock, denoted , about which swings daily. A decent technique to determine this theoretical anticipated rate of return is to track the stock for as many days as possible and compute the average total $\overline{R} = \frac{1}{n}\sum_{t=1}^{n} R_t$ its daily rates of return. The variance of the stocks daily rates of return is:

$$S^2 = \frac{1}{n-1}\sum_{t=1}^{n}\left(R_t - \overline{R}\right)^2$$

Maximizing the risk averse expected return time $\mu - a\sigma^2$ the portfolio problem gets reduced to the constrained optimization problem:

Maximize :$(w_1, w_2, w_3, w_4) = w_1\mu_1 + w_2\mu_2 + w_3\mu_3 + w_4\mu_4 - a(w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + w_3^2\sigma_3^2 + w_4^2\sigma_4^2)$

PROBLEM 3.1

Use the partial derivatives. $\frac{\partial L}{\partial w_i}\ (i = 1,2,3,4)$ and $\frac{\partial L}{\partial \lambda}$ of the Lagrangian

$$L(w_1, w_2, w_3, w_4) = f(w_1, w_2, w_3, w_4) - \lambda g(w_1, w_2, w_3, w_4)$$

to obtain system of five equations in the unknowns $\lambda, w_1, w_2, w_3, w_4$. Show that the solution to the system's simulations equations is:

$$w_2 = \frac{\sigma_1^2}{\sigma_2^2}w_1 + \frac{\mu_2 - \mu_1}{2a\sigma_2^2}, w_3 = \frac{\sigma_1^2}{\sigma_3^2}w_1 + \frac{\mu_3 - \mu_1}{2a\sigma_3^2}, w_4 = \frac{\sigma_1^2}{\sigma_4^2}w_1 + \frac{\mu_4 - \mu_1}{2a\sigma_4^2}$$

Where,

$$w_1 = \frac{1 - \frac{\mu_2 - \mu_1}{2a\sigma_2^2} - \frac{\mu_3 - \mu_1}{2a\sigma_3^2} - \frac{\mu_4 - \mu_1}{2a\sigma_4^2}}{1 + \frac{\sigma_1^2}{\sigma_2^2} + \frac{\sigma_1^2}{\sigma_3^2} + \frac{\sigma_1^2}{\sigma_4^2}}$$

SOLUTION

We find partial derivatives for *L*, with respect to $\boldsymbol{w_1, w_2, w_3, w_4, \lambda}$, we get that each of the variables $\boldsymbol{w_1, w_2, w_3, w_4, \lambda}$, have solutions:

$$w_2 = \frac{\sigma_1^2}{\sigma_2^2}w_1 + \frac{\mu_2 - \mu_1}{2a\sigma_2^2}, w_3 = \frac{\sigma_1^2}{\sigma_3^2}w_1 + \frac{\mu_3 - \mu_1}{2a\sigma_3^2}, w_4 = \frac{\sigma_1^2}{\sigma_4^2}w_1 + \frac{\mu_4 - \mu_1}{2a\sigma_4^2}$$

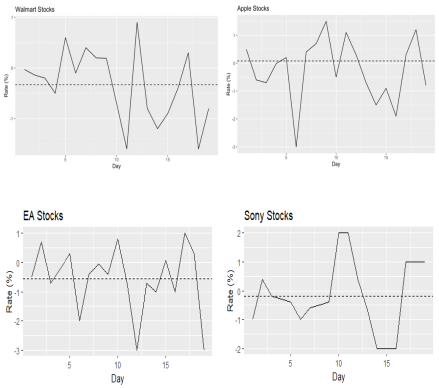
And

$$w_1 = \frac{1 - \frac{\mu_2 - \mu_1}{2a\sigma_2^2} - \frac{\mu_3 - \mu_1}{2a\sigma_3^2} - \frac{\mu_4 - \mu_1}{2a\sigma_4^2}}{1 + \frac{\sigma_1^2}{\sigma_2^2} + \frac{\sigma_1^2}{\sigma_3^2} + \frac{\sigma_1^2}{\sigma_4^2}}$$

RESULTS

Based on the application of the average rate of return method, the following results are gotten for Walmart, Apple, EA and Sony Stocks:

	Walmart	R1		Apple	R2		EA	R3		Sony	R4
1	150.06			166.69			129.25			91.78	
2	150.01	-0.03%		167.63	0.50%		128.18	-0.50%		90.97	-1%
3	149.85	-0.14%		166.47	-0.60%		129.04	0.70%		91.31	0.40%
4	149.52	-0.20%		165.23	-0.70%		128.08	-0.70%		91.15	-0.20%
5	148.48	-0.50%		165.21	-0.01%		127.87	0.20%		90.86	-0.30%
6	149.49	0.60%		165.56	0.20%		128.28	0.30%		90.49	-0.40%
7	149.34	-0.10%		160.1	-3%		126.13	-2%		89.44	-1%
8	150.07	0.40%		160.8	0.40%		125.58	-0.40%		88.91	-0.60%
9	150.51	0.20%		162.03	0.70%		125.62	-0.05%		88.51	-0.50%
10	150.8	0.19%		164.66	1.50%		125.16	-0.40%		88.17	-0.40%
11	149.67	-0.70%		163.76	-0.50%		126.15	0.80%		89.65	2%
12	147.23	-1.60%		165.63	1.10%		125.24	-0.70%		91.01	2%
13	148.69	0.90%		167.17	0.30%		121.35	-3%		91.33	0.40%
14	147.45	-0.80%		164.9	-0.70%		120.45	-0.70%		90.65	-0.70%
15	145.67	-1.20%		162.36	-1.50%		119.1	-1%		89.31	-2%
16	144.23	-0.90%		160.77	-0.90%		119.19	0.07%		87.87	-2%
17	143.61	-0.40%		157.65	-1.90%		118.02	-1%		85.82	-2%
18	144.17	0.30%		158.26	0.30%		118.64	1%		86.64	1%
19	141.8	-1.60%		160.25	1.20%		119.03	0.30%		87.53	1%
20	140.65	-0.80%		158.93	-0.80%		116.04	-3%		88.27	1%
21	R1 Mean=-0.335%			R2 Mean = -0.232%			R3 Mean = -0.552%			R4 Mean = -0.174%	
22	σ = 0.706%			σ = 1.127%			σ = 1.256%			σ = 1.461%	



PROBLEM 3.2

Let us see what happens if one of the assets has no risk (i.e., $\boldsymbol{\sigma = 0}$):

(a) Suppose that there are three mutually independent assets, with $\boldsymbol{\mu_1 = 5\%, \sigma_1 = 0\%, \mu_2 = 8\%, \sigma_2 = \sqrt{2}\%(i.e.\ \sigma_2^2 = 2), \mu_3 = 12\%, \sigma_3 = 2\%}$. What is the risk-averse optimal portfolio for an investor whose risk aversion is *a=2*? And for *a=3*?

(b) How do these expected returns compare with the maximum risk-free expected return?

SOLUTION

Using the formulas for $\boldsymbol{w_1, w_2, w_3, w_4, \lambda}$ from **Problem 3.1** and substituting values of $\mu_1, \sigma_1, \mu_2, \sigma_2, \mu_3, \sigma_3$, and ***a=2,*** we get that $\boldsymbol{w_1 = \frac{3}{16}, w_2 = \frac{3}{8}, w_3 = \frac{7}{16}}$.

To consider the portfolio's actual daily rate of return we use formula:

$$\boldsymbol{R_p = w_1R_1 + w_2R_2 + w_3R_3}$$

Therefore, then $\boldsymbol{R_{a=2} = 0.091875}$

For ***a=3***:

We get that $\boldsymbol{w_1 = \frac{11}{24}, w_2 = \frac{1}{4}, w_3 = \frac{7}{24}}$.

CONCLUSION

In this section, we see that if, in addition to risky investments such as stocks ($\sigma^2 > 0$), we consider a risk-free investment option such as a bond or a savings account ($\sigma^2=0$), then under reasonable conditions the weights Risky investments are always positive. In other words, in this more realistic context, the problem of negative equity weights does not arise. We find that as risk aversion increases, more wealth moves from the more speculative stocks, Walmart and Apple to the EA and Sony. To continue, we use our results to prove important theorem in investment economics.

Portfolio Separation Theorem. If one possible investment in the portfolio is risk-free, the proportions of the optimal weights of the remaining investments do not depend on the investor's risk capacity.

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ACKNOWLEDGEMENT

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Identity-Only Politics as Technologies of Power

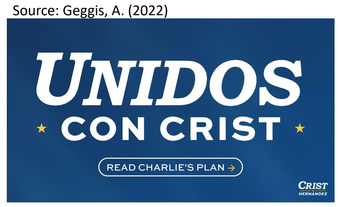
Sahar Nasim, Emily Bieber, Aayiana Marrero
Mentor: Xavier Moyssén Álvarez
New York City College of Technology Department of Social Sciences

ABSTRACT:

This research aims to understand the ways in which the Latinx identity electoral strategies are used as technologies of power to reinforce the white-supremacist system in American politics. Through critiquing identity politics pertaining to sexuality, the Muslim diaspora, and Black feminist identity, we define a shift from identity politics, to something we refer to as the *identity-only politics*. The Latinx population is the second largest ethnic group in the United States; however, their misrepresentation as a monolithic block has led to further ethnic prejudice and their status as a marginalized group in American society.

Electoral strategies in Florida and Texas and their outcome:

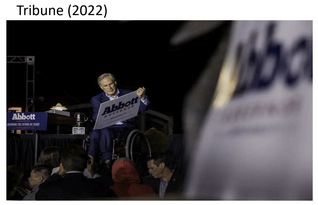
Source: Geggis, A. (2022)



Democrat candidate Charlie Crist used "Unidos con Crist (United with Crist)" as a slogan "to show each nationality in Latin America and the Caribbean how Crist's platform jibes with the issues they care about."(Geggis. 2022)

- Rep. DeSantis won, as the high population of Cubans in Florida tend to lean Republican. "Unidos con Crist" also seems to pander to Catholic identity.

Source: Michael Gonzalez for The Texas Tribune (2022)



Rep. Candidate Greg Abbott spent millions of dollars to run his campaign ads on Spanish speaking platforms
"This initial installment of Hispanic media will play a critical role in our campaign's goal to win the Hispanic vote this election" (Texans for Greg...)

- Abbott emerged successful in the election

Methods:

- Researching descriptive statistics regarding size and ethnic breakdown of Latino population in election states.
- Analysis of Latino-based platforms politicians used to sway the Latino vote
- Review of identity-only politics in other minority groups
- Utilizing Critical Race Theory as it relates to race-based laws perpetuating the white-supremacist system.

Literature Review:

For our literature review, we read Racial Formation Theory (Omi & Winant) together with Critical Race Theory (Haney Lopez). Pertaining to identity politics, we read the Combahee River Collective Statement, and academic articles criticizing Identity Politics when applied to other minority groups (the LGBTQ+ community, and Muslims).

Results:

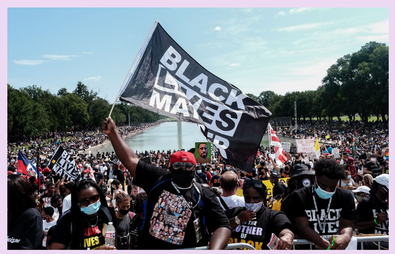
1) *Identity-only politics* applies to multiple minority groups in America, not just the Latinx community, such as:

2) Latinx identity-only politics have swayed the vote towards the right-wing

3) *Identity-only politics* serves to reinforce a white-dominant America

4) Right-wing politicians elected have been implementing laws banning the "teaching" of CRT in K-12 schools

Source: Russo, J. (2019)



Source: Wines M., Kavi A. (2020).

Source: Alter C. (2017)

Source: Mansoor S. (2020)

Source: Chet Strange/ Getty Images

Source: Office of Governor Ron DeSantis/FaceBook

Ultimately...

Our criticism is that Identity politics has been co-opted by politicians and consequently transformed into identity-only politics. Having a "latino" last name is being used as an electoral tool, with little to no attention being put into the actual political platform beyond ethnic identity. Also, there is a misrepresentation of the Latinx community in American politics, in which Latinos are grouped into a monolithic, homogenous group. In reality, the Latinx community has a diverse ethnic background, with different cultures and ideologies.

ACKNOWLEDGEMENTS

We would like to thank Professor Xavier Moyssén Alvarez and the CityTech Undergraduate Research Department for this amazing opportunity.

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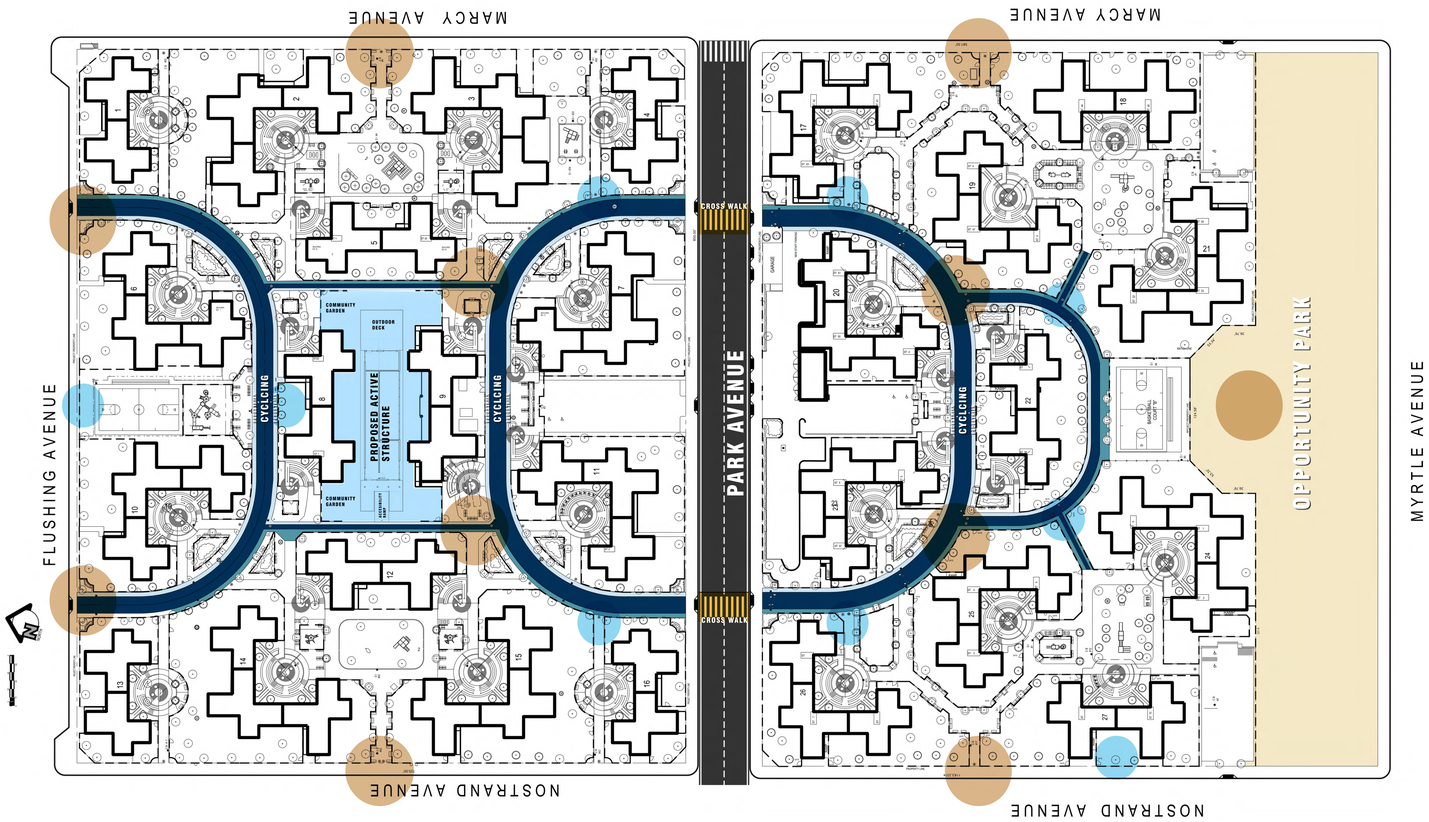
NYCHA + City Tech ARCscholars
Marcy Houses: MActive

Jason Voss (FX Collaborative) | Nina Lesser (Peter Gisolfi Associates) | Farai Matangira (Architectural Research Office) | Amal Toaimah (City Tech) | Erickson Diaz (City Tech) | Dazmel Singh (Resident) |Rayna Fever (Resident) | Diosmel Reyes (Resident) | Steve Murren (Resident) | Yandel Fernandez (Resident) | Barack Johnson (Resident) | Fantasia Dixon (Resident)

SITE PLAN



SITE PLAN LEGEND

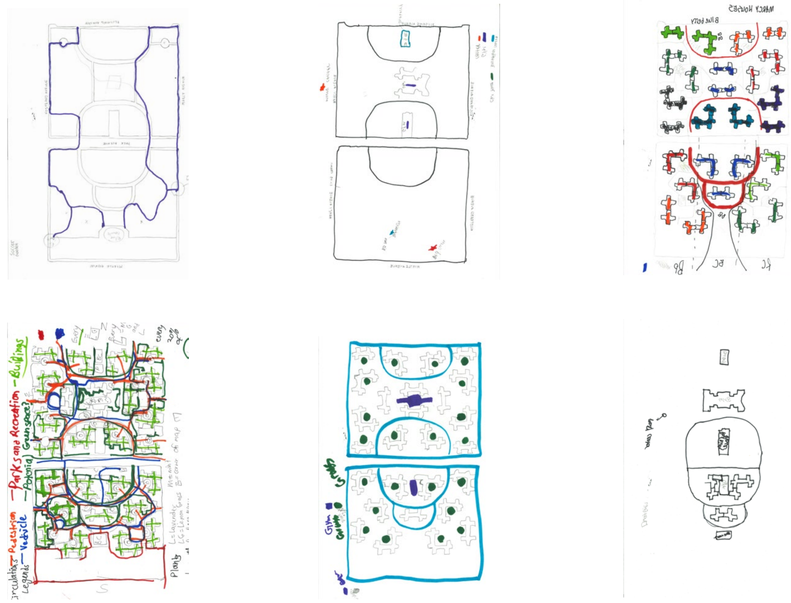
PROPOSED GATHERING SPACE

PROPOSED WATER STATIONS

PROPOSED PEDESTRIAN CROSSWALK

PROPOSED LIVING PEDESTRIAN WAY

CONCEPTUAL SKETCHES



WHO ARE WE?

We are a diverse group of scholars ranging in age, gender, and background from all over New York City. We share a common interest in solving our urban challenges through studying and proposing improvements to the built environment. From professors at CUNY CITY TECH to NYCHA Design & Implementation specialists and NYCHA residents, we encompass a group of scholars united by this common purpose.

WHAT ARE WE HERE TO ACCOMPLISH?

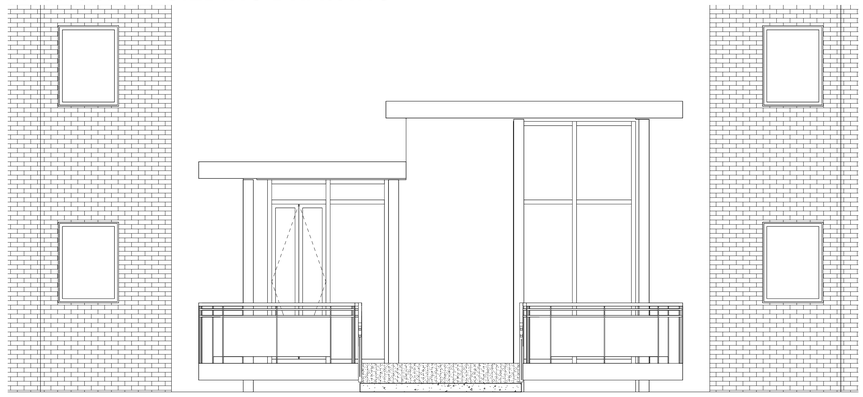
This team of ARCscholars is working collaboratively, sharing lived experiences, creatively thinking & planning and applying our research discoveries to the proposed design interventions. We seek to address and combat critical issues to foster a measurable improvement in community health, understanding, and relationships. Through enhancing the community at large via housing equity and durability and beauty, we hope that the proposed design improvements will have a direct, indirect, and long-lasting positive effects on the NYCHA communities.

OUR TEAM GOALS:

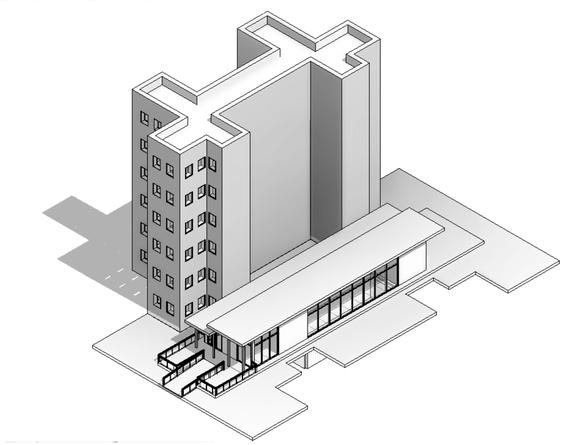
The MActive group is focused on equalizing the number of active spaces across the entire campus. The team's goal is to create a living pedestrian way to increase activity and interaction between both sides of the campus. The living pedestrian way will facilitate movement between buildings by including lanes for walking, running, and cycling.

PRECEDENT RESEARCH

PROPOSED BUILDING DRAWING



BUILDING 3D ISOMETRIC



National Leaders

By Anthonio Forbes

Mentor: Professor Elizabeth Parks

New York City College of Technology (Department of Architectural Technology)

Abstract

I was born on a small famous island, Jamaica. A country that's known for many things: agriculture, language, fashion, music, and more. What the glossy advertisements don't show you is how hard it was for Jamaica to become this place of tourist attraction. The amazing things that bring people there, also cause hardships. These hardships were spearheaded by our founding fathers and mothers of the land, people who fought, bled, and died for the prosperity of this small island. We regard them as Jamaica's National Heroes and Heroines.I want to shed some light on some of these heroes and heroines, those I find significantly important to the culture of Jamaica, and also those who represent black leadership and black power. There are four people specifically that I believe to be the best example of black leadership and power. First is Jamaica's only National Heroine, Nanny of the Maroons. During the beginning of the war in Jamaica, Nanny was a woman who was no slave but was a respected and outstanding leader as well as the known spiritual leader of the "Windward Maroons" in the 1740s, they were a group of female warriors. She was also known as the queen of a forest, as she was unbeaten in them. She was known as a symbol of unity and strength to the people of Jamaica. Second is Samuel Sharpe, a slave named after his master. Known as Sam Sharpe of Montego Bay, he led the slave rebellion in St James, which led to the abolition of slavery in the 1830s. Third was Sir Alexander Bustamante, a man who went abroad to learn about the world we live in. After his travels, Bustamante returned to Jamaica and could see that the country was too unstable and unorganized. He took it upon himself to incite change and form one true government. He started the political party Jamaica Labor party (JLP) and later became the first Prime Minister of Jamaica in 1962. Fourth is Norman Manley. Manley was active during the same time as Alexander Bustamante, as they were two edges of the same sword. Norman Manley started the People's National Party (PNP) and ran in the election against Sir Alexander Bustamante. While he didn't become Prime minister, he moved Jamaica towards internal self-government in 1959 and then later Jamaica became an independent country in 1962. All of these powerful black heroes and heroines created different narratives for the prosperity of Jamaica. Each of them showed outstanding leadership that went beyond them, putting the country first and allowing it to flourish for further generations. I believe it is important for us to study and research these black, powerful, and once influential people because there is so much we can take away from their history. By studying them, we may be able solve current world problems such as, proper leadership. Instead of focusing on the negatives, let's pay more attention to their positives, they stepped up and faced the horrors ahead with fierce leadership. By not dwelling on the struggle, we fully acknowledge the brilliance of these people, not letting the negative define their success is what it means to be black excellence.

Introduction

All great economies have thrived under great leaderships. The best interest for the many has always been the goal. Some of the greatest leaders in history were black men and women. We forgot the greatness of black people because our minds automatically think of the negative things that happen us instead of the great things we've accomplished. I took it upon myself to conduct some thorough research on the leadership of black people in history. The national heroes and heroines of Jamaica are perfect example outstanding leadership. I believe It is important to study these leaders in order to strengthen our own.

Methods

- Select 4 of the 7 national heroes and heroes.
- Conduct thorough research on each one about their leading tactics
- Research each one of there circumstances for leadership
- Find similarities and differences in their leadership skills
- The people's response to their leadership
- The results of their leadership
- The continued effects of their leadership
- Compare to leadership of recent times

Acknowledgement

All research and information on this board was gathered by Anthonio Forbes. All research and information were reviewed and approved by Professor Elizabeth Parks.

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Fig. 1. Nanny

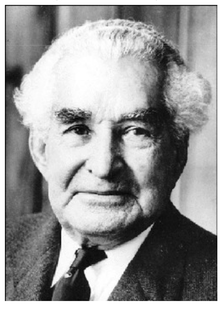

Fig. 2. Sir Alexander Bustamante

Fig. 3. Norman Manley

Fig. 4. Sam Sharpe

Results

After researching and comparing the leadership of the four national heroes and heroines of Jamaica, I came up with why their leadership was recognized for what it was and why leadership all around the world today is lacking.

- Not only do many not accept those who are black in leadership positions, they also don't respect women as well. In 1740s in Jamaica, the first and only national heroine was Nanny of the Maroons. Because she was accepted as a leader regardless of her gender and race, the country was able to thrive. Alexander Bustamante was a white-skinned man who many believed was actually white but yet that fact didn't affect his run as prime minister.
- Putting the people above yourself is a key characteristic for being a great leader. Norman Manley who ran for prime minister against Bustamante obviously lost the election but he didn't let that stop him from making the economy thrive, He moved Jamaica towards internal self government which then led to independence.
- I believe the most important characteristic for those who are leaders should be empathy. It's hard to understand everyone when you are a leader of many people, but one can properly lead by being able to empathize with your people. Sam Sharpe, a slave in Jamaica during the 1830s was executed in front of many for leading the rebellion to stop slavery, All because he felt and understood the pain of all slaves. This started a spark within him which he was willing to die for. While in recent times, there are so many different types of people around the world which makes it hard to understand everyone but even so being open minded to all and welcoming to all will help you empathize with everyone.

Conclusions

As we move forward in history, people and times change. I believe by looking into the past, looking past race and stop letting those things define us them I'm sure we'll find the perfect people for leadership. It's the person's character that matters, nothing else. And as a black man myself, I would love to be a leader some day, but not because my ancestors were treated cruel but because great leaders can come from all races, including mine. There are so many different types of people around the world, it is hard to understand everyone. But even so being open minded to all and welcoming to all will help you empathize with everyone.

Sperner's game

Yitao Li
Mentor: Prof. Ariane Masuda
Department of Mathematics

Abstract

We consider a game in honor to a German mathematician named Sperner. The game involves two players, say, A and B. Suppose n is an integer greater than or equal to 2. On each turn, both players place their letter in one of the n positions, placed next to each other, without a letter. We say that a collision occurs when there is a letter change from left to right. If all positions are filled, player A wins if the number of collisions is odd; otherwise, player B wins. It turns out that there is a winning strategy for player A regardless of player B's movements. To prove that this winning strategy always works, we use a mathematical technique called proof by strong induction. This is the one-dimensional case of a famous result named Sperner's Lemma. We also present the two-dimensional case, also known as Sperner coloring.

Introduction

In Algebraic Topology, Sperner's Lemma is a variant of the Brouwer Fixed-Point Theorem that can be presented in different combinatorial ways. It has important applications in a variety of fields such as Game Theory and Algorithmic Analysis.

Consider a triangle whose vertices are labeled with three different colors. A **triangulation** consists of breaking the triangle up into smaller triangles. A triangulation has **Sperner coloring** if the following holds: the vertices that lie along any edge of the outer triangle have only two colors, which are the two colors at the endpoints of the edge.

The two-dimensional case of Sperner's Lemma states that if a triangulation is colored with a Sperner coloring, then at least one of the small trianglular faces will have its three vertices colored with three different colors.

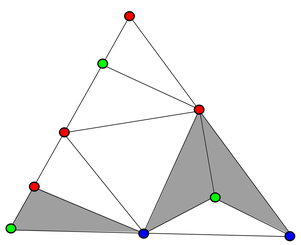

Figure 1. The two-dimensional case.

In this project, we focus on a one-dimensional variant, which we present in the form of a game. Our goal is to enhance the understanding of Sperner's Lemma and its implications.

Figure 2. One-dimensional case.

Game Theory

Consider a two-player game where the players alternate in the game. Suppose that (1) there are no ties and the game does not involve any luck; (2) the game always ends after a finite number of turns; (3) the number of choices for each player is always finite. Then one of the players has a strategy to win the game no matter what the other player does. This result guarantees that the strategy exists.

We describe a game that fits in the situation described above. The game involves two players, say, A and B. Suppose n is an integer greater than or equal to 2. On each turn, both players place their letter in one of the n positions, placed next to each other, without a letter. We say that a collision occurs when there is a letter change from left to right. If all positions are filled, player A wins if the number of collisions is odd; otherwise, player B wins. The strategy for A to win is revealed in the following theorem, which is the one-dimensional case of Sperner's Lemma.

Theorem (the one-dimensional case)

Consider a finite 2-letter sequence. Then one of the following holds:

(a) If the initial and final letters are the same, then the number of collisions is even.
(b) If the initial and final letters are different, then the number of collisions is odd.

Proof: The proof goes by strong induction on n, where n is the length of the sequence. Suppose $n = 1$. Then the sequence is either A or B for which the number of collisions is zero. Then (a) is satisfied. Suppose that the statement is true for all positive integers $n \leq k$ for $k > 0$. Consider a sequence of length $k + 1$. There are two cases.

- Case 1: All letters are the same.
  Suppose without loss of generality that all letters are A. Then the number of collisions is zero and (a) follows.
- Case 2: Not all the letters are the same.
  In this case, both A and B appear in the sequence.
  - Case 2.1: The initial and final letters are the same.
    Suppose without loss of generality that the initial and final letters are A.

$$\underbrace{A \quad A \quad \cdots \quad A}_{k+1} \quad B \quad \cdots \quad A$$

    If we remove the subsequence of consecutive A's, then we have the following subsequence:

$$\underbrace{B \quad \cdots \quad A}_{k \geq 1}$$

    By the induction hypothesis, this subsequence has an odd number of collisions. Since there is one collision between the two subsequences, we conclude that the original sequence of length $k + 1$ has an even number of collisions.

  - Case 2.2: The initial and final letters are different.
    We may assume the initial letter is A and the final letter is B.

$$\underbrace{A \quad A \quad \cdots \quad A}_{k+1} \quad B \quad \cdots \quad B$$

    Similarly to the previous subcase, we consider the first subsequence that starts at B followed by a subsequences of A's.

$$\underbrace{B \quad \cdots \quad B}_{k \geq 0}$$

    This subsequence has an even number of collisions, and the result follows.

■

Play the game!

We coded the game in Python. To play the game, use the QR code below.

Figure 3. An example of the Sperner's game

Figure 4. QR code for the game code.

Conclusion

In conclusion, we explore two cases of Sperner's Lemma: the one- and the two-dimensional case. At first, Sperner's game does not seem to be related to a mathematical theorem, so it is surprising that a strategy can be shown to always work using strong induction. This is just a special case of a more involving and advanced result in Algebraic Topology. It would be interesting to study the proof of the two-dimensional case. This would involve tools from Graph Theory.

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How is "AI" influencing our generations' engagement in education and recruitment systems?

Team: Ethan Pruzhansky, Jason Lin, Tanvir Rahman
Mentor: Professor Patrick Slattery

What is the aim of this project?

The purpose of this research is to examine how AI will affect higher education and jobs. We will review a range of sources to weigh the benefits and drawbacks of AI, concentrating on how it affects our interactions and surroundings. Our goals include developing AI use cases in education and hiring, assessing their efficacy, and talking about ethical issues. According to preliminary studies, AI may improve productivity in the workplace and in education, such as using ChatGPT for text production and AI-assisted coding. But as AI develops, dangers like false information and job loss might materialize. By examining particular applications and larger social ramifications, our study will contribute to conversations and choices regarding the future of AI.

How is it affecting our recruitment system?

AI is revolutionizing the recruitment process by streamlining tasks such as resume screening, job matching, interview scheduling, and video interview analysis. It also assists in predicting talent acquisition trends and personalizing onboarding and training for new hires. By potentially reducing biases in the hiring process, AI can lead to more efficient and fair outcomes. However, it's crucial to balance AI's benefits with human judgment and empathy for a well-rounded hiring experience.

So what is AI?

The term "artificial intelligence," or "AI," refers to a machine's or computer's capacity to carry out operations that ordinarily call for human intelligence, such as comprehending natural language, spotting patterns, making judgments, and picking up knowledge from experience.

How is AI affecting us?

Today, artificial intelligence plays a significant role in many aspects of our life, from business to healthcare to education. We cannot disregard the ethical issues that AI poses, including privacy concerns, biased algorithms, and possible job losses, even while it has the ability to revolutionize businesses via improved efficiency, personalization, and smart decision-making. Governments, businesses, and educational institutions must collaborate to strike the ideal balance between innovation and responsibility if we are to maximize the benefits of AI while avoiding its drawbacks. We can unleash the full potential of AI and build a future that is both governed by technology and based on moral values by confronting these difficult questions head-on.

How is it affecting our education system?

Intelligent tutoring systems, like Carnegie Learning and ALEKS, are smart tools that use artificial intelligence to offer personalized lessons and feedback. This helps students stay engaged and perform better in their studies. Two great examples of these systems are Carnegie Learning MATHia and ALEKS, which adjust to each learner's needs and have been proven to enhance student outcomes in numerous research studies. By receiving tailored instruction and instant feedback, students can develop a solid understanding of their subjects, which ultimately leads to better long-term success.

Conclusion

In conclusion, artificial intelligence is playing an increasingly important role in both higher education and the job market. Intelligent tutoring systems, such as *Carnegie Learning*'s MATHia and ALEKS, improve students' learning experiences through personalized instruction and feedback, while AI-enhanced recruitment processes offer more efficient and unbiased hiring experiences. However, as AI continues to advance, potential drawbacks like misinformation and job losses must be carefully considered. The key is to strike a balance between leveraging AI's capabilities and maintaining human judgment and empathy. By conducting thorough research and encouraging interdisciplinary discussions, we can guide AI's development to maximize its benefits and minimize its risks. Ultimately, this approach will allow us to harness the full potential of AI, transforming both education and employment landscapes while preserving ethical values.

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ETHICAL AND SOCIAL ISSUES IN INFORMATION SYSTEMS

BY: FAHIMA ZANNAT -MENTOR: PROFESSOR PATRICK SLATTERY
COMPUTER SYSTEMS TECHNOLOGY DEPARTMENT

ABSTRACT:

The digital age has brought significant advancements in the realm of intellectual property (IP) and information systems, but it has also introduced numerous ethical challenges and privacy concerns. This undergraduate research project aims to provide a comprehensive overview of these issues, focusing on copyright infringement, patent trolls, open-source software, user privacy, and security, while seeking to answer the following questions: How can ethical challenges in IP protection be effectively addressed? How can user privacy and security be ensured in online transactions and social media platforms?

OBJECTIVE:

The objective is to inform people about the risks associated with the internet and to give people ways to reduce those risks and secure their digital privacy.

RESOURCES:

Gagliano, Cara, et al. “Fair Use.” Electronic Frontier Foundation, 29 Jan. 2009, https://www.eff.org/issues/intellectual-property.

Silva, Maria Aparecida de Oliveira. “Ethical and Social Issues in Information Systems - Stoa.” Ethical and Social Issues in Information Systems, 2005, http://wiki.stoa.usp.br/images/0/02/MIS-cap4.pdf.

ACKNOWLEDGMENTS:

Thank you so much to Professor Patrick Slattery and Anmona Anwar for helping/ supporting me during my first research project.

RESEARCH/RESULTS:

Questions:

- What do you use in order to ensure your safety online every day?
- Did you ever have any doubts that your computer might not be safe?
- What are some tips and tricks you can use to secure your data online?

Answers:

- **Sabina Yasmin:** "I steer clear of any websites that look sketchy or unsafe. I haven't yet experienced any issues with my devices or concerns about my information being stolen. so I've never really used services or VPNs to keep my information safe."

- **Bushra Moumi:** “I usually don’t do anything that would get me a virus but just in case I try to use VPN. And I do think about people tracking me using my IP address but I don’t really do anything to protect it. Nowadays you can use a good VPN and phones have built-in systems to lock the apps and other apps that help keep your information safe”

- **Fatema Jannat:** "I don't really do anything to make sure that the websites that I use are safe. Except for being aware of which website I am going into. For example, You can tell that some websites are not secure by the lock of Security that Google provides you. Also, Google alerts you that the site that you might be going into gives people online full access to your private information."

METHODS:

These apps will help you protect your passwords, IP address, and files, and ensures only the sender and recipient can read messages. It also gives protection against viruses, malware, or any other cyber threats.

Apps:

- **Password Managers:** LastPass, Dashlane, and 1Password
- **Two-Factor Authentication Apps:** Google Authenticator, Authy, and Microsoft Authenticator
- **Encrypted Messaging Apps:** Signal and WhatsApp
- **Virtual Private Network (VPN) Apps:** ExpressVPN, NordVPN, and Surfshark
- **File Encryption Apps:** VeraCrypt and AxCrypt
- **Anti-Virus and Malware Protection Apps:** Norton, McAfee, and Bitdefender
- **Cloud Storage with Encryption:** Sync, Tresorit, and pCloud

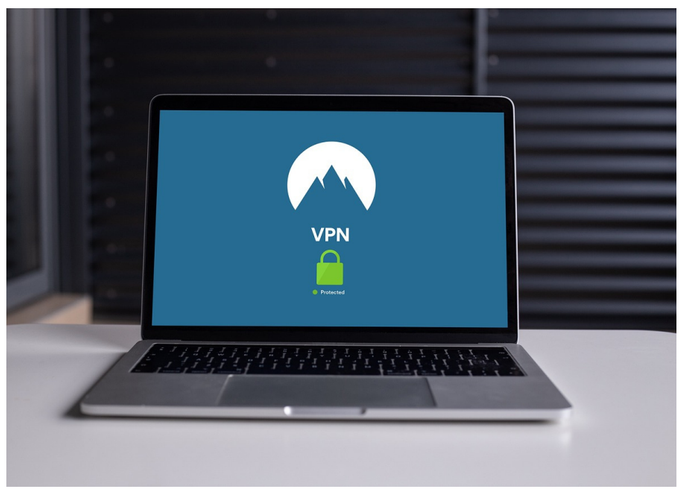
DASHLANE

Norton by Symantec

NordVPN

CONCLUSION:

After completing this research project I can concur that many people are not aware or prepared for the dangers that the internet has. It is always best to take extra measures to keep information safe. In this day and age, it is very easy to get access to someone else's information. Everything on the internet is recorded



Exact Solvable Two-Body Problem in Two-Dimensional Quantum Mechanics

Jianning Luo, Claudio Malvino, Roman Kezerashvili

New York City College of Technology

Abstract

Over hundreds of years, people believe all matters exist with 3-dimensional form in the world until the discovery of 2-dimensional material graphene in 2004. It is totally formed with 1 layer of carbon atoms, the width of graphene is the width of a carbon atom, thus the study of 2-dimensional material will be the study of 2-dimensional quantum mechanics.

The objective of this research is the following: Consider two particles problem in 3-dimensional (3D) coordinates space that are exactly solvable for a given central two particle interaction V(r) and find the analytical solution with the same potential in 2-Dimensional space. This should be done by solving the stationary two-particles Schrodinger equation in 2D. We would use Nikiforov-Uvarov method to determine what kind of variation of parameter we should use. We would expect the solution of wavefunction to be written in terms of special functions such as confluent hypergeometric function or Laguerre polynomials.

Frame of reference of relative motion

It is not easy to work in inertial frame of reference because 2 particles will have 4 coordinates need to be determined. Instead, we can study the relative motion between 2 particle so that we need to determine 2 variables only.

The angular wave function is:

$$\Phi(\theta) = e^{im\theta} \tag{1}$$

The radial Schrodinger equation can be written as the following:

$$(\frac{d^2}{dr^2} + \frac{1}{r}\frac{d}{dr} - \frac{m^2}{r^2})\phi(r) + [\frac{2\mu}{\hbar^2}(E - V_{12})]\phi(r) = 0 \tag{2}$$

Coulomb potential

Consider the Coulomb potential as following:

$$V(r) = -k\frac{e^2}{r} \tag{3}$$

By several substitution, the wave function of the two interacting particle via the Coulomb potential in 2D space is:

$$\psi(r,\theta) = \sqrt{\frac{(n-|m|)!}{(2n+1)(n+|m|)!}(2\beta)^{2(|m|+1)}} \cdot r^{|m|}e^{-\beta r}L^{2|m|}_{n-|m|}(2\beta r) \cdot e^{im\theta} \tag{4}$$

We also obtain the eigen-engergy in terms of principle quantum number n:

$$E_n = -\frac{k^2e^4\mu}{2\hbar^2}\frac{1}{(n+\frac{1}{2})^2} \qquad n = 0, 1, 2, ... \tag{5}$$

Modified Kratzer potential

Consider the modified Kratzer potential as following:

$$V(r) = -\frac{e^2}{4\pi r_0}(\frac{a}{r} - g^2\frac{a^2}{r^2}) \tag{6}$$

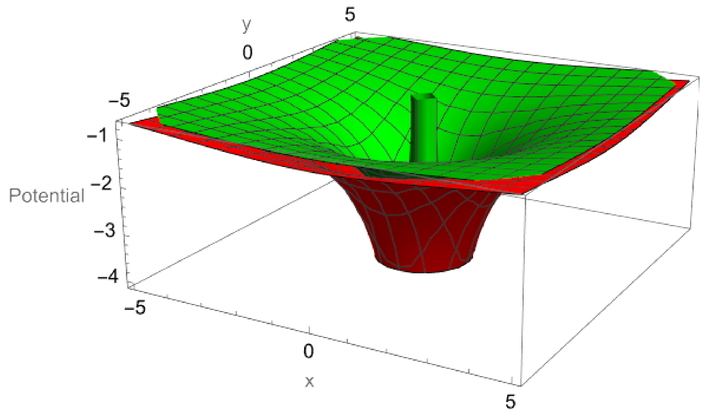
We obtained the wave function as the following:

$$\Psi(r,\theta) = C(\frac{r}{a})^{\lambda}e^{-\frac{k}{a}r}\ {}_1F_1(\frac{1}{2} - \frac{\gamma^2}{k} + \lambda, 1 + 2\lambda, 2k\frac{r}{a})e^{im\theta} \tag{7}$$

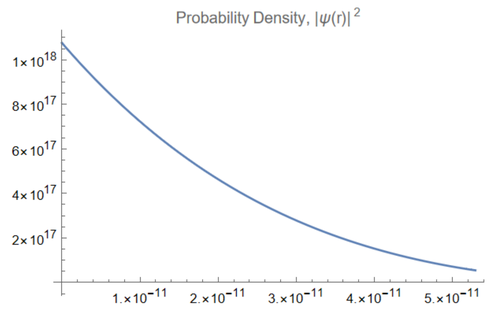
Meanwhile, the eigen-energy is:

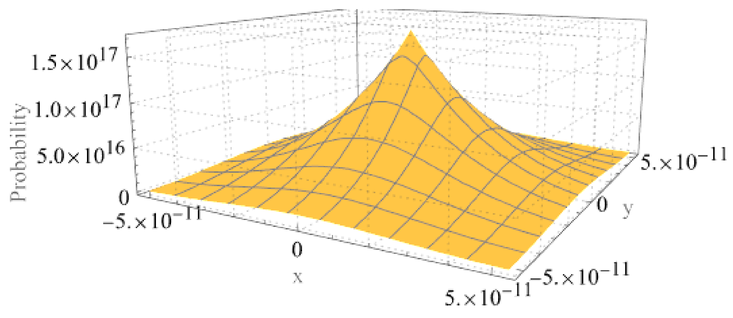
$$E = -\frac{k^2e^4\mu}{2\hbar^2}\frac{1}{(n+\frac{1}{2}+\sqrt{2g^2\frac{\mu a^2}{\hbar^2}\frac{e^2}{4\pi r_0} + m^2})^2} \tag{8}$$

Figures of Coulomb potential (red), Kratzer potential (green)



Probability for Coulomb potential





Nikiforov-Uvarov method

Nikiforov-Uvarov method is used to solve Schrodinger equation. We used it to check if a Schrodinger equation with the particular potential energy has analytical solution.

Nikiforov-Uvarov method starts from a differential equation of the form:

$$\frac{d^2\phi(r)}{dr^2} + \frac{\tilde{\tau}(r)}{\sigma(r)}\frac{d\phi(r)}{dr} + \frac{\tilde{\sigma}(r)}{\sigma^2(r)}\phi(r) = 0 \tag{9}$$

Using change of variable $\phi(r) = \chi(r)u(r)$, we can simplify the differential equation in the form:

$$\sigma(r)\frac{d^2u(r)}{dr^2} + \tau(r)\frac{du(r)}{dr} + \lambda u(r) \tag{10}$$

where $\sigma(r)$ and $\tilde{\sigma}(r)$ are polynomials at most of second degrees, $\tilde{\tau}(r)$ is a polynomial at most of first degree, $\tau(r)$ is a polynomial of at most first degree and λ is a constant. Choose $\chi(r)$ so that:

$$\frac{\chi''(r)}{\chi(r)} = \frac{p(r)}{\sigma(r)}; \quad p(r) = \frac{\tau(r) - \tilde{\tau}(r)}{2} \tag{11}$$

$p(r)$ should make $\bar{\sigma}$ to be divisible by $\sigma(r)$:

$$\bar{\sigma}(r) = \tilde{\sigma}(r) + p^2(r) + p(r)[\tilde{\tau}(r) - \sigma'(r)] + p'(r)\sigma(r) \tag{12}$$

$$\bar{\sigma} = \lambda\sigma \tag{13}$$

If equation (11) and (13) satisfied, equation (10) has an analytical solution.

Conclusion

We derived the radial Schrodinger equation in 2 dimensional space. For Coulomb potential, we noticed that the eigen-energy is inversely proportional to $(n+\frac{1}{2})^2$ while eigen-energy is inversely proportional to n^2 in 3 dimensional space. For Harmonic oscillator potential, we obtained that the eigen-energy relates to a factor that contains constant 1 while the eigen-energy relates to a factor that contains constant $\frac{3}{2}$ in 3 dimensional space.

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An Exploration of Web Design and Development: The Sizzling Spice Restaurant Website

Fahmeda Khanom & Touheda Khanom

Mentor's Name - Dr. Farrukh Zia

Department of Computer Engineering Technology, EMERGINHG SCHOLARS PROGRAM

https://touheda812.github.io/ESP-Sizzling-Spice/

The project aims to develop a restaurant website using HTML, CSS, and JavaScript. The website will be designed to showcase the restaurant's menu, location, contact information, and other essential details. The primary goal of the website is to attract potential customers and provide them with a user-friendly interface that is easy to navigate. To achieve this goal, we will use HTML to create the website's structure, CSS to style the website and make it visually appealing, and JavaScript to add interactive features such as dropdown menus, image galleries, and a reservation system. The website will be fully responsive and optimized for desktop and mobile devices. Our project team will work together to develop the website's design and functionality, utilizing our individual strengths and skills. We will conduct regular team meetings to ensure that our progress is on track and to collaborate on any challenges we may encounter. In conclusion, the restaurant website developed using HTML, CSS, and JavaScript will provide customers with an engaging and informative experience that will encourage them to visit the restaurant. We hope that this project will serve as a valuable learning experience for our team and provide a useful tool for the restaurant's marketing efforts.

INTRODUCTION

In today's digital age, having a website is essential for any business, and restaurants are no exception. A well-designed website can attract more customers, increase brand recognition, and even drive sales. However, not all restaurant websites are created equal. Some are easy to navigate, visually appealing, and provide useful information, while others can be confusing, unappealing, and frustrating for users. Therefore, in this project, I aimed to investigate the factors that contribute to the success of restaurant websites and identify the best practices for their design and user experience. I hope that my findings will be useful for restaurant owners, web designers, and anyone who is interested in improving the online presence of their favorite restaurants.

DISCUSSION

Our project aimed to explore the use of technology in the food industry and how it can enhance the customer experience. Through the development of a website for a fictional restaurant, various components and features were incorporated to provide a seamless user experiences. One of the key components of the website was the use of HTML, CSS, and JavaScript for the design and functionality. The website utilized a responsive design, allowing it to be viewed on different devices, such as desktops, tablets, and mobile phones. Another important aspect of the website was the integration of a shopping cart feature using JavaScript session storage. This allowed users to add items to their cart and place orders online. The cart was designed to be user-friendly and easily accessible from any page on the website. Furthermore, the website incorporated a dynamic menu feature that displayed the restaurant's menu items with prices and descriptions. The use of Google Maps was another key component of the website, providing an interactive map of the restaurant's location. Users could also use this feature to get directions to the restaurant from their current location. By integrating the Elastic Email API into the contact page, customers could easily send messages to the restaurant with their inquiries, feedback, and suggestions. The API provided a reliable and secure communication channel, ensuring that the messages were delivered promptly and without any issues. Overall, the project demonstrated the importance of technology in the food industry and how it can be used to enhance the customer experience. The project also highlighted the significance of user-friendly design and functionality, particularly in the context of online food ordering and delivery.

COMPONENTS & DEVICES OPTIONS

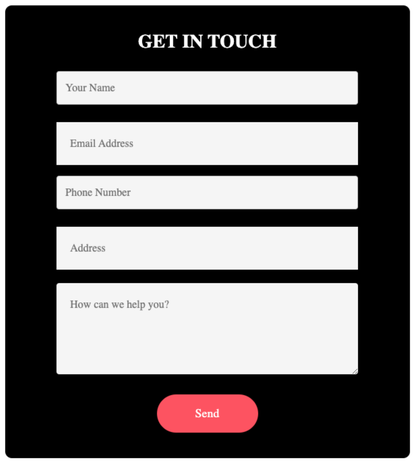
- HTML
- CSS
- JavaScript
- Visual Studio

RESULTS

Samosa

$4.99

1 Add to Cart



ACKNOWLEDGMENT

EMERGING SCHOLARS PROGRAM

Special thanks to Prof. Farrukh Zia

TESTING CODE

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>The Sizzling Spice</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet"
    integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js"
    integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>
    <link rel="stylesheet" href="css styles/styles.css">
    <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.0.7/css/all.css">

</head>
```

```
<body class="contact-body">

    <nav class="navbar navbar-expand-lg navbar-dark bg-dark">
        <img class="logo" src="The Sizzling Spice.png" alt="logo">
        <!--<a class="navbar-brand" href="">The Sizzling Spice</a>-->
        <button class="navbar-toggler ms-auto" type="button" data-bs-toggle="
            <span class="navbar-toggler-icon"></span>
        </button>
        <a href="index.html" class="logo">
            <img src="images/logo new.png" alt="logo">
        </a>
        <div class="collapse navbar-collapse" id="navbarSupportedContent">
            <ul class="navbar-nav ms-auto">
                <li class="nav-item">
                    <a class="nav-link" href="index.html">HOME</a>
                </li>
                <li class="nav-item">
                    <a class="nav-link" href="about.html">ABOUT US</a>
                </li>
                <li class="nav-item">
                    <a class="nav-link" href="gallery.html">GALLERY</a>
                </li>
```

CONCLUSION & FUTURE WORK

In conclusion, the development of a restaurant website has allowed us to explore the ways in which technology can enhance the customer experience in the food industry. The incorporation of various features such as a dynamic menu, shopping cart, and interactive maps has made it possible for users to easily access information, place orders, and navigate their way to the restaurant. Overall, the project has demonstrated the importance of user-friendly design and functionality in creating a positive customer experience.

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Do cosmic filaments protect galaxies from gas stripping in observed clusters?

Group Members: Daniel Gallego, Lianys Feliciano, Ena Chia **Mentor**: Dr.Charlotte Welker
NYC College of Technology

Overview

Background

The Cosmic Web and Quenching

The cosmic web structures the Universe on large scales. It contains dense gas which forms interconnecting streams called filaments. These connect into clusters of galaxies. As galaxies approach filaments from low-density areas they typically go through quenching, a process where the galaxies lose their supply of cold gas and cease to form new stars. However, *Kotecha [2022]* found through simulations that galaxies already in clusters flowing along filaments towards very high-density nodes experience a shielding effect from quenching by the cluster itself and remain star-forming for longer.

Objectives

- Develop an algorithm to calculate distance of galaxies to their closest filaments
- Use DisPerSE to create our own skeleton for filaments
- Compare observational results to simulated results by *Kotecha [2022]*
- Learn more about the relationship between filaments and galaxies
- Learn about the properties of galaxy clusters such as age and mass as they relate to cosmic filaments

Data

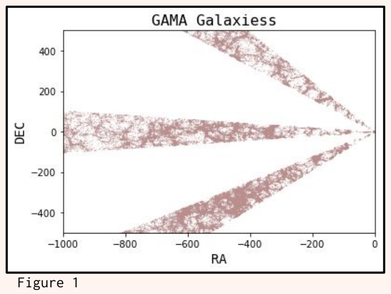


Figure 1

For this investigation our group will use data from the GAMA and SAMI surveys. The graph above illustrates a catalog of GAMA galaxies in cartesian coordinates.

Analysis

Methods

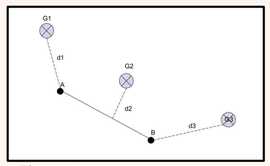


Figure 2

Sketch of 3 possible cases for the distance of a galaxy to its filament

Currently we are utilizing observational data from the GAMA survey to analyze the relationship between galaxies and their relative distance to filaments by using their filament finder tool. We do so by looking at parameters such as the age, mass, and morphology. We also look aim to see whether more galaxies are present closer to filaments as expected.

We also developed an algorithm to assign, catalog and calculate the distances of galaxies to their nearest filament. This algorithm will replace the filament finding tool we are currently using so that we can use filaments we will construct with DisPerSE. The importance distinction between these tools is that we will focus on the spine of the filaments and on different scales of filaments using DiSperSE.

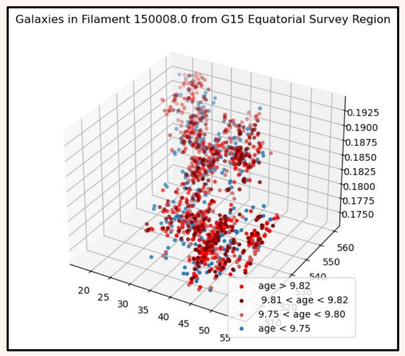
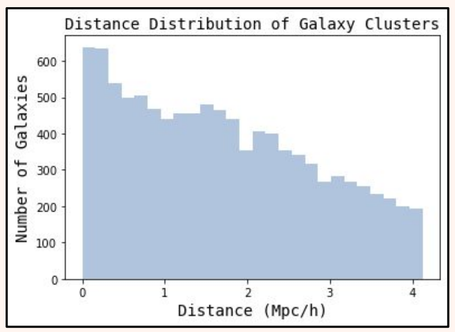


Figure 3a

Results

3D map of GAMA galaxies around a filament colored by age. Where the brighted red are the oldest galaxies and blue are the youngest. Outside clusters, galaxies with the oldest stars are at the spine.

Figure 3b



This histogram displays the distance to filament distribution of galaxies.The greatest number of galaxies reside within 1 Mpc from the filament.

Figure 3c

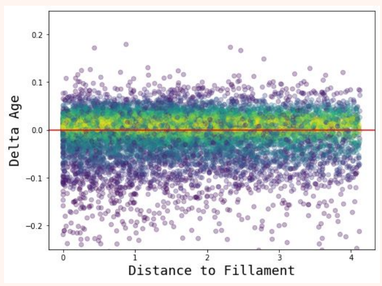


Figure 3c depicts the relationship between the age of a galaxy and its respective orthogonal distance to the closest filament. Outside of clusters, galaxies closest to a filament are typically older.But it's also simply because they tend to be more massive near filaments.

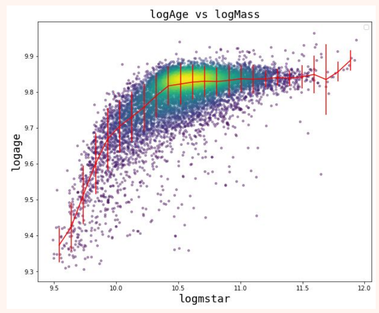


Figure 3d depicts the relationship between the galaxies' age and their stellar mass. We will measure the median evolution of age with mass. This way we can know whether a galaxy is older or younger than other galaxies with similar mass. We will analyse how this difference in (observed age - expected age) varies with distance to filaments in and out of clusters. This will tell us if, at fixed mass, galaxies contain older or younger stars close to filaments

Figure 3d

Next Steps

Discussion

From these results we observes several relationships between galaxies and filaments. From the histogram we learned that that galaxies tend to move toward filaments as most are within 1Mpc of the filament. Then Figure 3a and 3b demonstrated that younger galaxies are closer to the filaments and that age increase with stellar mass. Lastly in figure 3c we learned that many older galaxies reside near the spine of filaments whereas younger galaxies are further away from filaments, but it may just be because they are less massive. Moving forward we look forward to creating our own filaments with DisPerSE and calculated the distance between the filaments and galaxies with our algorithm.

Next Steps

- Use DISPERSE to create our own filaments
- Create new parameters to identify filaments like length and thickness
- Apply our distance algorithm
- Annalyse how observational data compares to simulated data

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Drug Delivery Tests for PDMS Based Scaffolds

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Abstract

Drug delivery plays an important role in cell growth within the engineered scaffolds used in tissue regeneration. In this project, PDMS based scaffolds with interior hollow channels are designed and fabricated by micro-printing at SET Research Laboratory at the department of Mechanical Engineering Technology. The engineered scaffolds are then squeezed in between two glass slides to perform drug delivery tests. Our preliminary test results show that, without a leakage problem, scaffolds can be tested for the drug delivery pathways for bio-reactor applications.

Introduction

Tissue engineering is an associative field in which different methods of engineering and biology are used to restore, preserve and improve the function of cells during tissue recovery. The basic idea of this concept is to regenerate cells to form natural new tissue that will reinforce a damaged or diseased organ.

Throughout the last two decades, tissue engineering has been evolving while putting together different components such as the combination of cells, scaffold engineering, for cell proliferation and differentiation, and bioactive agents along with growth factors to re-create functional new tissue.

Method, Process & Materials

Growth factors supply oxygen and nutrients required for the survival of the cells that will be transplanted during tissue regeneration, therefore, a drug delivery system is essential in tissue engineering to enable the growth factors that will efficiently apply the needed biological effects to make cell regeneration more effective.

Synthetic polymers are used for tissue growth scaffold fabrication. In this project, PDMS (Polydimethylsiloxane), which is a silicon – based organic polymer, is used to manufacture a well – designed, three – dimensional scaffold, with a delivery system design that will be used for drug delivery tests.

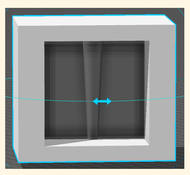


Fig. 1 3D drawing of scaffold design on inventor

Fig. 2 3D scaffold mold printed on MakerBot printer

Fig. 3 PDMS Solution - Sylgard 182 silicone elastomer base

Fig. 4 Over used at average 50°C to dry PDMS

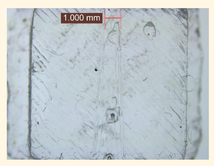


Fig. 5 PDMS sample. With 10x10 (mm) dimensions & 1mm to .5mm channel.

Method: In order to create a hollow channel that will allow fluids to have a constant flow, avoid leakage & concentration of fluid in one spot of the sample, a cone like cylinder gap is designed. Starting from a narrow end of 0.50 mm expanding its way down to 1.00 mm, the channel is expected to create a push that allows the fluid to flow towards the wider end.

Literature Review

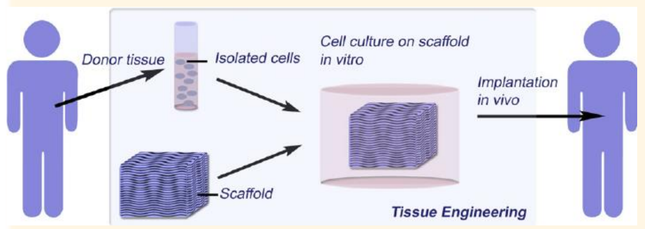


Fig. 6 Basic process for tissue engineering

Controlled drug-delivery strategies have made a dramatic impact in medicine. In general, controlled-release polymer systems deliver drugs in the optimum dosage for long periods, thus increasing the efficacy of the drug, maximizing patient compliance and enhancing the ability to use highly toxic, poorly soluble or relatively unstable drugs.

These vehicles can be engineered to recognize biophysical characteristics that are unique to the target cells and therefore minimize drug loss and toxicity associated with delivery to non-desired tissues.

Results

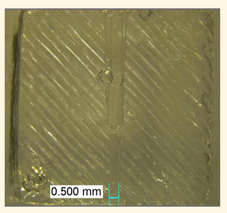


Fig. 7a PDMS Sample 1

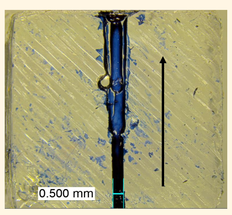


Fig. 7b PDMS Sample 1 with ink

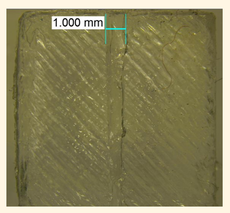


Fig. 8a PDMS Sample 2

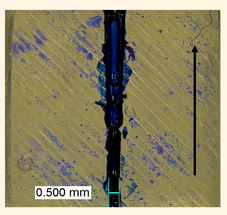


Fig. 8b PDMS Sample 2 with ink

Fig. 9a PDMS Sample 3

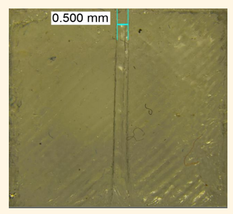
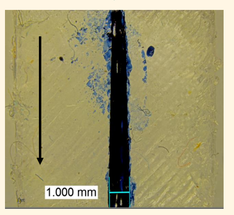


Fig. 9b PDMS Sample 3 with ink



Three PDMS (Polydimethylsiloxane) samples were prepared. Ink was inserted and observed to move down the channel with minimum leakage and constant flow. Arrows are used to show the flow of the ink as it enters the channel through the narrow side (0.5mm) and leaves through the wider end (1.00mm).

Conclusion

A drug delivery system is a major component which along with a well – design, 3D and degradable scaffold, cells will be able to obtain the basic nutrients in order to regenerate and make tissue engineering successful. During the first part of this research, a scaffold was designed with a channel that without any leakage will be able to transport drugs and fluids. Ink was used to show the flow of fluid through the channel which was successful.

Acknowledgement

Acknowledgement to the Mechanical Engineering of Technology department and SET-CUNY for funds, equipment and guidance.

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Military Invasion of the Ukraine and World's Perspective

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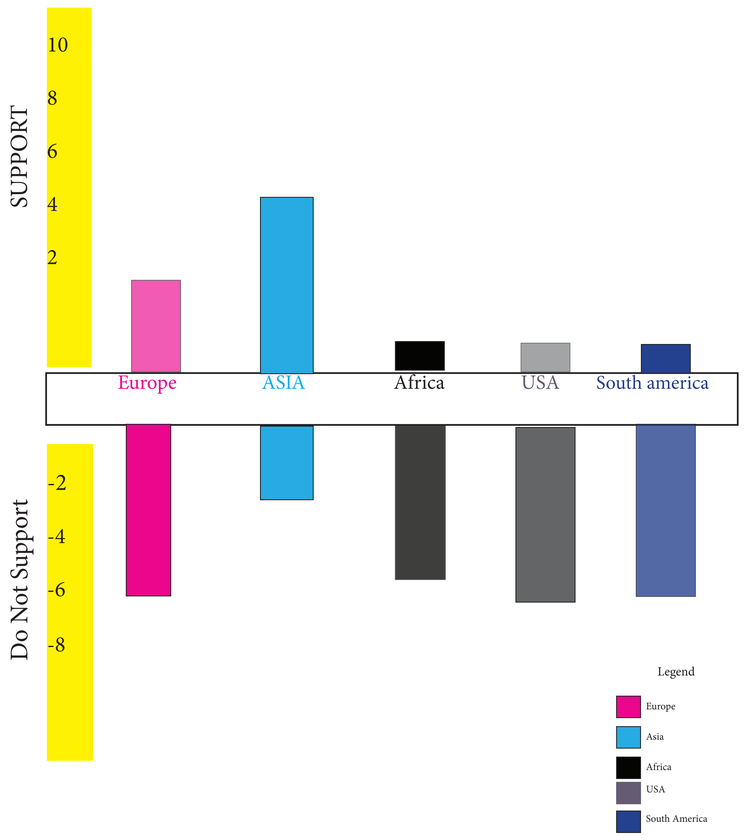
New York City College of Technology

ABSTRACT:
The military invasion by the Russian government is a significant event that became public over a year ago. This brought many furies from many people around the world towards Russia. And much support from many countries to Ukraine. The United States and the United Kingdom are key countries providing Ukraine with military aid and support. This military invasion has resulted in many countries retracting and ending any relationship they have had with Russia. Many people from different countries who are watching this through the media and news sources have stated through interviews that they want a solution fast and that they want this invasion to end as soon as possible. This has now become a situation that has killed many innocent Ukrainian people as well as the eviction of people to go to other countries. The Russian military is known to have powerful weapons making the Ukrainian military struggle against them.My purpose in this Research project was to interview people from the United States that are from different countries and of different ages to see if the differences in age brings a different response perspective. Respondents to the survey were asked how they feel about the ongoing invasion.

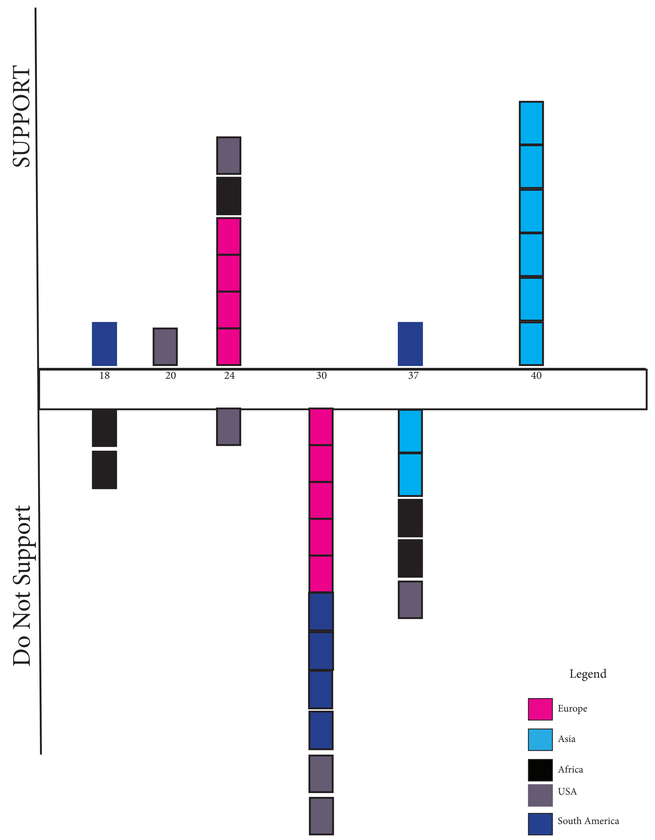
OBJECTIVE:

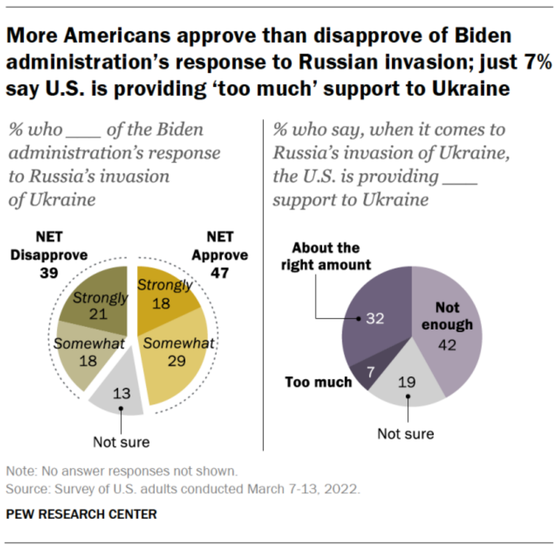
The objective of this project was to perform research about the invasion of the russian military forces and research different Points of view of different countries to try to understand their attitudes towards the war. I gather information from different online sources on different countires that spoke about this topic. I also interviewed people from different nationalities to gather information based on personal interviews done in tourist places based in New York. The amount of people interviewed were 36 people in total. The places I went to interview these people were, Union square 14th street, Times Square, Chinatown, and 5th Avenue 59th street. The days i decided to go were on the days people had spring break which was april 14-16. I knew that a lot of people on that break like to travel to tourist areas of NYC.

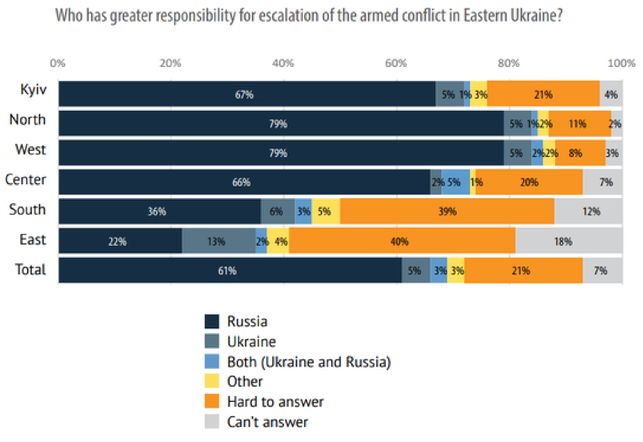
Number of people that support or Do Not Support the military invasion of ukraine



Age of Respondents







CONCLUSION:

Based on the first bar graph which is based on the continents of where people are from, it was brought to my attention that most continets on the west side of the world supports ukraine and are opposed to the military invassion Russia has made. With just a few continents mention in the graph we can see that ASIA is the continent that supports military invasion. My theory being that since Russia is considered part of asia and it's next to a few asia countries it can be because they want to support a country that is part of the area they are from.

On the other hand when taking a look at the age bar graph I can see that most of the people from asia that support military invasion are 37 year's of age. While the rest of the respondents that support the military invasion are young some in their early 20s. For the people that don't support the military invasion we can see that three continents are in their mid 20s, while the the rest of the continents are in there 30s, and some in the 18-20 years old range.

This has also brought to my attention that the content of origin and age both appear to be linked to whether a person supports the invasion of Ukraine.

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Can We Correct Diffusion MRI Data for Alzheimer's Using Magnetic Susceptibility of Geriatric Brain Iron

ABSTRACT

Alzheimer's disease (AD) is a chronic neurodegenerative disease presumably characterized by the presence of two neuropathological protein markers: amyloid beta (Aβ) and intracellular neurofibrillary tangles in the gray matter regions of the brain leading to cognitive dysfunction. We hypothesize, exposure to high metal concentrations, such as iron, could influence protein aggregation and oxidative stress levels, leading to neuronal loss in the AD brain. It is suspected that abnormally high iron levels could contribute to cell death and cognitive deficits. Magnetic resonance imaging techniques have suggested correlation between cognitive dysfunction and iron deposition mostly in the hippocampus, cortical areas, and basal ganglia. Diffusion MRI data and magnetic susceptibility measurements provide complementary information and composition, and both seem to be affected in AD. Our work puts forward a hypothesis that changes in the brain iron levels can explain magnetic susceptibility changes and diffusion tract abnormalities in MRI. Magnetic susceptibility is a measure of how a material responds to a magnetic field, and it can be influenced by the concentration and distribution of iron in the brain. MRI can also detect abnormal iron accumulation in the regions of the brain for additional neurodegenerative disorders such as Parkinson's Disease and Multiple Sclerosis. Our work using Alzheimer's Disease Neuroimaging Initiative database is ongoing to validate the above hypothesis.
Keywords: Alzheimer's Disease, Mean Diffusivity, Fractional Anisotropy, Iron, White Matter

INTRODUCTION

- MRI measurements of whole brain and hippocampus volume changes are mostly focused on imaging techniques for AD progression.[(1)]
- Brain capacity In the elderly declines while cerebrospinal fluid volume grows.[(1)]
- The entorhinal cortex and hippocampus play a significant role in the early stages.[(2)]
- AD is a complex illness resulting from inherited and environmental factors[(3)]
- Metal ions are essential for cell structure, gene expression, antioxidant defense, and neurotransmission.[(3)]

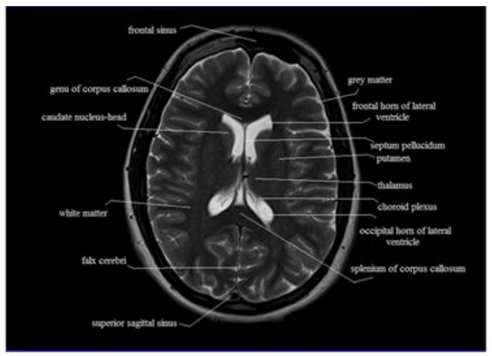

Figure 1: The glymphatic system clears amyloid-ß (Aß), which is the main component of Alzheimer's disease brain plaques. Blocking glymphatic transport causes Aß to accumulate, And deleting the aquaphorin-4 gene impairs clearance of soluble Aß. [5][6]

METHOD

- We were able to utilize research-based projects from meta-analysis acquisitions.
- We compared V11 and V31 using cleaned Mean and Fractional Diffusion date from twelve columns including ALIC, ACR GGC, GCH FX, and GCC (left and right) for the first and second year.[(5)]
- Mean, Standard Deviation, and Cov% were calculated.[(5)]

DISCUSSION

- The Fornix areas bilaterally suffer most for AD patients due to FA loss.[(5)]
- Covariance significantly increases in the third year, suggesting heterogeneity of FA values among survivors.[(5)]
- MD increases in brain regions during AD, particularly in the bilateral Fornix, needing more study and modeling.[(5)]
- COV% decreases in most regions, except Cingulum of Hippocampus, showing varied aging effects among patients in this region.[(5)]
- Survivors with high COV% show uneven FA decreases, while MD increases (with decreasing COV%) independent of progression severity, mainly in the Fornix area.[(5)]
- COV trend is crucial in our research, identifying AD markers as patients age.[(5)]
- We believe it is the Fornix area that characterizes and defines AD progression, with its FA and MD patterns.[(5)]

Table V11 - Fractional Anisotropy

Potential Biomarkers	FA_Anterior limb of internal (ALIC)_Left	FA_Anterior limb of internal (ALIC)_Right	FA_Anterior corona radiata (ACR) Left	FA_Anterior corona radiata (ACR) Right	FA_Cingulum (CGC) Left	FA_Cingulum (CGC) _Right	FA_Cingulum (hippocampus) _GCH_Left	FA_Cingulum (hippocampus) _CGH_Right	FA_Fornix (FX)_Left	FA_Fornix (FX)_Right	FA_Genu of corpus callosum (GCC)_Left	FA_Genu of corpus callosum (GCC)_Right
1st Yr. Mean	0.355	0.373	0.275	0.284	0.269	0.258	0.223	0.256	**0.264322**	**0.354942**	**0.373**	**0.275**
1st Yr. Std Dev. (SD)	0.036	0.038	0.035	0.038	0.028	0.03	0.03	0.033	**0.0435**	**0.0402**	**0.064**	**0.064**
1st Yr. Cov%= SD/Mean *100	**10.1**	**10.1**	**12.8**	**13.3**	**10.4**	**11.2**	**13**	**12.7**	**16.5**	**15.3**	**15.2**	**15**

Table V31 - Fractional Anisotropy

Potential Biomarkers	FA_Anterior limb of internal (ALIC)_Left	FA_Anterior limb of internal (ALIC)_Right	FA_Anterior corona radiata (ACR) Left	FA_Anterior corona radiata (ACR) Right	FA_Cingulum (CGC) Left	FA_FA_ Cingulum (CGC) _Right	FA_Cingulum (hippocampus) _GCH_Left	FA_Cingulum (hippocampus) _CGH_Right	FA_Fornix (FX)_Left	FA_Fornix (FX)_Right	FA_Genu of corpus callosum (GCC)_Left	FA_Genu of corpus callosum (GCC)_Right
3rd Yr. Mean	0.352	0.368	0.269	0.274	0.261	0.255	0.219	0.251	**0.164242**	**0.211685**	0.413	0.414
3rd Yr. Std Dev (SD)	0.037	0.038	0.032	0.035	0.025	0.03	0.03	0.032	**0.0515**	**0.044**	0.049	0.053
3rd Yr. Cov%= SD/Mean *100	**10.6**	**10.3**	**12**	**12.9**	**9.6**	**11.4**	**13.4**	**12.7**	**31.4**	**20.7**	**11.9**	**12.7**

Table V11 - Mean Diffusion

Potential Biomarkers	MD_Anterior limb of internal (ALIC)_Left	MD_Anterior limb of internal (ALIC)_Right	MD_Anterior corona radiata (ACR) Left	MD_Anterior corona radiata (ACR) Right	MD_Cingulum (CGC) Left	MD_Cingulum (CGC) _Right	MD_Cingulum (hippocampus) _GCH_Left	MD_Cingulum (hippocampus) _CGH_Right	MD_Fornix (FX)_Left	MD_Fornix (FX)_Right	MD_Genu of corpus callosum (GCC)_Left	MD_Genu of corpus callosum (GCC)_Right
1st Yr. Mean	0.001	0.001	0.001	0.001	0.001	0.001	**0.000968**	**0.000946**	**0.00135**	**0.001303**	0.001	0.001
1st Yr. Std Dev. (SD)	0.001	0.000	0.000	0.000	0.000	0.000	**0.0001**	**0.0001**	**0.000297**	**0.000273**	0.000	0.000
1st Yr. Cov%= SD/Mean *100	**11.9**	**9.8**	**10.9**	**11.7**	**11.6**	**10.4**	**13.2**	**11.3**	**22**	**20.9**	**13.7**	**13.7**

Table V31 - Mean Diffusion

Potential Biomarkers	MD_Anterior limb of internal (ALIC)_Left	MD_Anterior limb of internal (ALIC)_Right	MD_Anterior corona radiata (ACR) Left	MD_Anterior corona radiata (ACR) Right	MD_Cingulum (CGC) Left	MD_Cingulum (CGC) _Right	MD_Cingulum (hippocampus) _GCH_Left	MD_Cingulum (hippocampus) _CGH_Right	MD_Fornix (FX)_Left	MD_Fornix (FX)_Right	MD_Genu of corpus callosum (GCC)_Left	MD_Genu of corpus callosum (GCC)_Right
3rd Yr. Mean	0.001	0.001	0.001	0.001	0.001	0.001	**0.001006**	**0.000979**	**0.002563**	**0.002253**	0.001	0.001
3rd Yr. Std Dev (SD)	0.000	0.000	0.000	0.000	0.000	0.000	**0.000160**	**0.000130**	**0.00043**	**0.00031**	0.000	0.000
3rd Yr. Cov%= SD/Mean *100	**10.7**	**11.3**	**8**	**9.2**	**7.5**	**6**	**15.9**	**13.3**	**16.8**	**13.3**	**10.6**	**11.4**

RESULTS

- Metals are vital in the body such as enzyme cofactors and for neuronal communication.[(3)]
- The body regulates metal transit and reactivity with a protein network.[(3)]
- Chronic metal exposure from anthropogenic activity is increasing.[(3)]

ACKNOWLEDGEMENTS

- We express our gratitude for The Emerging Scholars Program and Analia Basilicata who have been extremely valuable in providing us with guidance in this project.

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Exact Solvable Two-Body Problem in Two-Dimensional Quantum Mechanics

Jianning Luo, Claudio Malvino, Roman Kezerashvili

New York City College of Technology

Abstract

Over hundreds of years, people believe all matters exist with 3-dimensional form in the world until the discovery of 2-dimensional material graphene in 2004. It is totally formed with 1 layer of carbon atoms, the width of graphene is the width of a carbon atom, thus the study of 2-dimensional material will be the study of 2-dimensional quantum mechanics.

The objective of this research is the following: Consider two particles problem in 3-dimensional (3D) coordinates space that are exactly solvable for a given central two particle interaction V(r) and find the analytical solution with the same potential in 2-Dimensional space. This should be done by solving the stationary two-particles Schrodinger equation in 2D. We would use Nikiforov-Uvarov method to determine what kind of variation of parameter we should use. We would expect the solution of wavefunction to be written in terms of special functions such as confluent hypergeometric function or Laguerre polynomials.

Frame of reference of relative motion

It is not easy to work in inertial frame of reference because 2 particles will have 4 coordinates need to be determined. Instead, we can study the relative motion between 2 particle so that we need to determine 2 variables only.

The angular wave function is:

$$\Phi(\theta) = e^{im\theta} \tag{1}$$

The radial Schrodinger equation can be written as the following:

$$(\frac{d^2}{dr^2} + \frac{1}{r}\frac{d}{dr} - \frac{m^2}{r^2})\phi(r) + [\frac{2\mu}{\hbar^2}(E - V_{12})]\phi(r) = 0 \tag{2}$$

Coulomb potential

Consider the Coulomb potential as following:

$$V(r) = -k\frac{e^2}{r} \tag{3}$$

By several substitution, the wave function of the two interacting particle via the Coulomb potential in 2D space is:

$$\psi(r,\theta) = \sqrt{\frac{(n-|m|)!}{(2n+1)(n+|m|)!}(2\beta)^{2(|m|+1)}} \cdot r^{|m|}e^{-\beta r}L^{2|m|}_{n-|m|}(2\beta r) \cdot e^{im\theta} \tag{4}$$

We also obtain the eigen-engergy in terms of principle quantum number n:

$$E_n = -\frac{k^2e^4\mu}{2\hbar^2}\frac{1}{(n+\frac{1}{2})^2} \qquad n = 0, 1, 2, ... \tag{5}$$

Modified Kratzer potential

Consider the modified Kratzer potential as following:

$$V(r) = -\frac{e^2}{4\pi r_0}(\frac{a}{r} - g^2\frac{a^2}{r^2}) \tag{6}$$

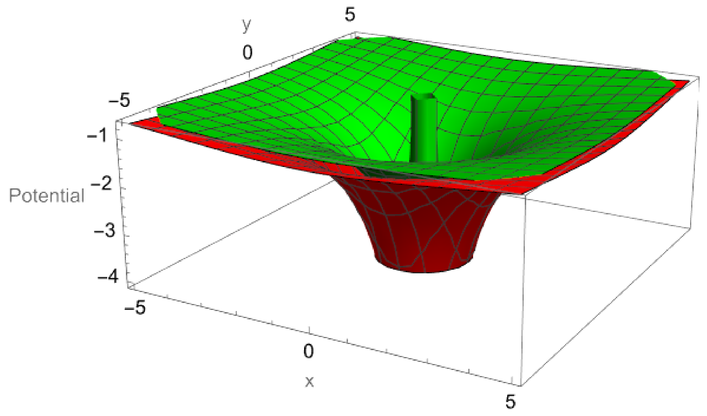
We obtained the wave function as the following:

$$\Psi(r,\theta) = C(\frac{r}{a})^{\lambda}e^{-\frac{k}{a}r}\ {}_1F_1(\frac{1}{2} - \frac{\gamma^2}{k} + \lambda, 1 + 2\lambda, 2k\frac{r}{a})e^{im\theta} \tag{7}$$

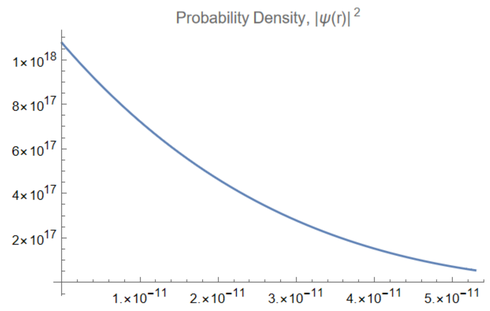
Meanwhile, the eigen-energy is:

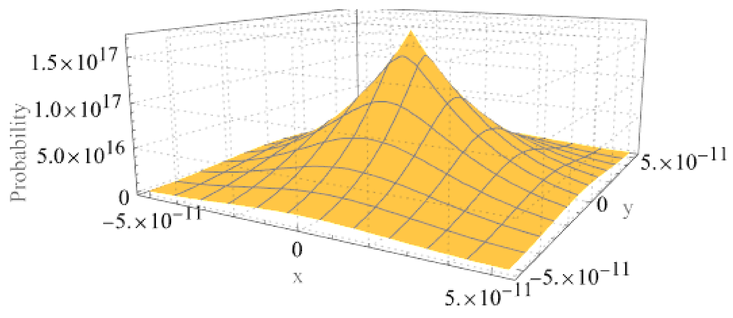
$$E = -\frac{k^2e^4\mu}{2\hbar^2}\frac{1}{(n+\frac{1}{2}+\sqrt{2g^2\frac{\mu a^2}{\hbar^2}\frac{e^2}{4\pi r_0} + m^2})^2} \tag{8}$$

Figures of Coulomb potential (red), Kratzer potential (green)



Probability for Coulomb potential





Nikiforov-Uvarov method

Nikiforov-Uvarov method is used to solve Schrodinger equation. We used it to check if a Schrodinger equation with the particular potential energy has analytical solution.

Nikiforov-Uvarov method starts from a differential equation of the form:

$$\frac{d^2\phi(r)}{dr^2} + \frac{\tilde{\tau}(r)}{\sigma(r)}\frac{d\phi(r)}{dr} + \frac{\tilde{\sigma}(r)}{\sigma^2(r)}\phi(r) = 0 \tag{9}$$

Using change of variable $\phi(r) = \chi(r)u(r)$, we can simplify the differential equation in the form:

$$\sigma(r)\frac{d^2u(r)}{dr^2} + \tau(r)\frac{du(r)}{dr} + \lambda u(r) \tag{10}$$

where $\sigma(r)$ and $\tilde{\sigma}(r)$ are polynomials at most of second degrees, $\tilde{\tau}(r)$ is a polynomial at most of first degree, $\tau(r)$ is a polynomial of at most first degree and λ is a constant. Choose $\chi(r)$ so that:

$$\frac{\chi''(r)}{\chi(r)} = \frac{p(r)}{\sigma(r)}; \quad p(r) = \frac{\tau(r) - \tilde{\tau}(r)}{2} \tag{11}$$

$p(r)$ should make $\bar{\sigma}$ to be divisible by $\sigma(r)$:

$$\bar{\sigma}(r) = \tilde{\sigma}(r) + p^2(r) + p(r)[\tilde{\tau}(r) - \sigma'(r)] + p'(r)\sigma(r) \tag{12}$$

$$\bar{\sigma} = \lambda\sigma \tag{13}$$

If equation (11) and (13) satisfied, equation (10) has an analytical solution.

Conclusion

We derived the radial Schrodinger equation in 2 dimensional space. For Coulomb potential, we noticed that the eigen-energy is inversely proportional to $(n+\frac{1}{2})^2$ while eigen-energy is inversely proportional to n^2 in 3 dimensional space. For Harmonic oscillator potential, we obtained that the eigen-energy relates to a factor that contains constant 1 while the eigen-energy relates to a factor that contains constant $\frac{3}{2}$ in 3 dimensional space.

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Delusional Types in Forensic Psychiatric Patients

Johnsely Felix, Alyssa Ramsawak, Margarita Aleshka, & Daniel Capruso, PhD

May 3rd, 2023

Abstract

Aim: The project was to determine if there is delusional content that is characteristic of forensic psychiatric patients.

Subjects: Patient were male (n=9) and female (n=1) psychiatric patients involuntarily committed to Kirby Forensic Psychiatric Center (Wards Island, NY) under NYS CPL § 330.20 as having a "dangerous mental disorder."

Method: Brief case histories of the instant offense drawn from the medical record of each patient were reviewed.

Results: Frequencies of delusional types in this sample were as follows: 40% had delusions of external control, 40% had religious delusions concerned with God, the Devil, or sin; and 30% had delusions with sexual content. In addition, 40% of the patients were described as experiencing auditory hallucinations at the time of the instant offense, with half having command hallucinations, and the other half having hallucinations with persecutory content.

Discussion: Exploring the delusional types in forensic psychiatric patients who commit homicides, assaults, and sex crimes may help in determining which type of disturbed beliefs may signal an urgent need to prevent violent acts. This study contains no control group of delusional patients who have *not* engaged in violence, so a statistical analysis could not be performed that might have had predictive or discriminative value. As a first step, the results provide preliminary indication that delusions of external control or with religious content may warrant urgent intervention to determine if an increased risk of violent behavior is present.

Background

In NYS, persons who commit a serious crime may assert an "insanity defense" of psychiatric, developmental, or other illness which caused them to not understand the nature or consequences of their actions. Once adjudicated, such persons are involuntarily committed to NYS forensic psychiatric hospitals under Criminal Procedure Law (CPL) § 330.20 until they are deemed by the Court to no longer have a "dangerous mental disorder."

A "delusion" is a false or pathological belief which a person holds despite facts or evidence that the belief is not true. We sought to determine the frequency of various types of delusions in these patients.

Figure 1

Kirby Forensic Psychiatric Center

Figure 2

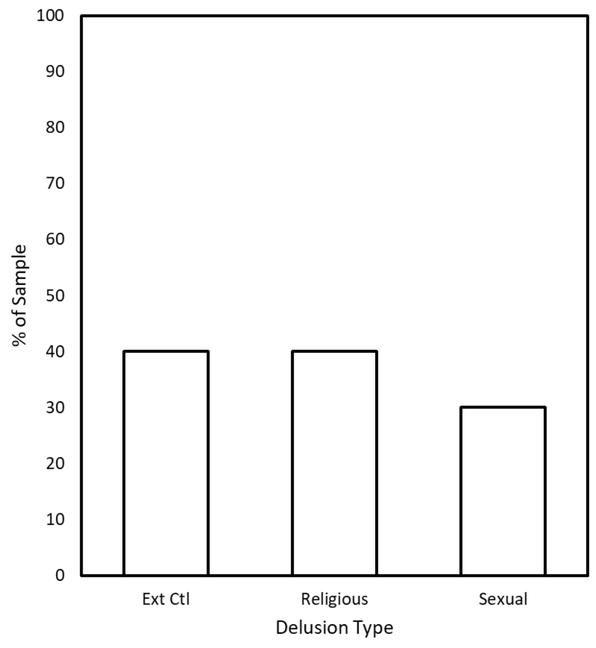


Table 1

Demographic, clinical, and victim characteristics

	Male	Female			
Sex	9	1			
	White	Black	Hispanic	Asian	Indigenous
Race	4	4	1	1	0
	Schizophrenia	Bipolar	Schizoaffective		
Diagnosis	6	2	2		
	Homicide	Assault			
Crime	4	5			
	Firearm	Sharp	Blunt	Motor Vehicle	
Weapon	1	6	2	1	
	Family	Friend/Acquaintance	Stranger	Mental Health worker	Multiple Other
Relationship	3	2	3	1	1

Method

The data consisted of case summaries (n=33) of patients committed as not responsible by reason of mental disease or defect (insanity) under CPL § 330.20 at Kirby Forensic Psychiatric Center on Ward's Island, NY (See Figure 1).

Results

As shown in Table 1, the sample was disproportionately male, as males have much higher rates of violence and incarceration when compared to females. The crimes were homicides and serious assaults. Most cases involved stabbings. The victims included family members, friends, acquaintances, strangers, and a mental health worker.

Of principal interest was that all ten (10) patients were "psychotic" in that they had lost contact with reality when they committed the instant offense. Their delusional types are shown in Figure 2 and Table 2. In addition to delusions, patients also had frequently had auditory hallucinations, either in the form of commands, or with persecutory content.

Table 2

Common delusional types in forensic patients.

	(f)*	
External Control	40%	Belief that one's mind, body, or behavior are under the power of another person or entity
Religious	40%	False beliefs whose content primarily involves God, the Devil, demons, or other supernatural entities that are recognized in that person's culture
Sexual	30%	False beliefs that are focused on the genitalia, or carnal matters and desires
		*Delusional types may overlap, therefore the (f) of delusional types may total > 100%.

Conclusion

The absence of a control group of delusional patients who have not committed acts of extreme violence limits conclusions about causality.

The data suggest that patient with delusions of external control, or with delusions containing religious content, may warrant cautious intervention to determine if violent behavior is imminent. Auditory command hallucinations, or hallucinations with persecutory content also appear frequently in these psychotic patients, and should also be considered as risk factors for violence.

Control of the VEX Robots with Image Processing

Justin Bartholomew
Mentor: Dr. Lili Ma
Department of Computer Engineering Technology

Abstract

Why would we control a VEX robot using Raspberry PI? By doing so, we are able to integrate a camera (the PI camera) on top of the VEX mobile base. Using the OpenCV libraries, image sequences captured by the PI camera can be processed onboard. The extracted information from the image sequence is used to control the motion of the robot, realizing vision-based control tasks such as visual serving/tracking and vision-based localization.

We have successfully integrated VEX mobile base, Raspberry PI plus its camera module, and OpenCV, by controlling the robot to follow a color target. Motors' rotating directions and speeds are adjusted based on the visual clues. The robot's functionalities are significantly improved to tackle real-work problems. This project produces a prototype of a smart device that uses visual information to made decisions and take actions.

What is OpenCV

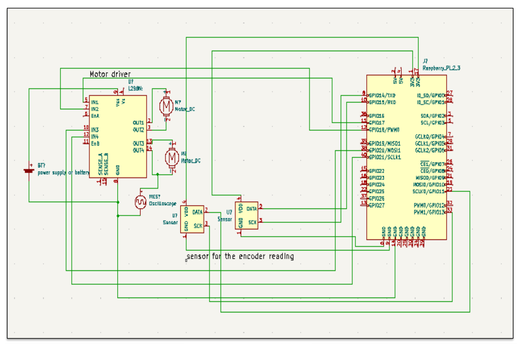
- OpenCV (Open Source Computer Vision Library) is an open source that can be use for computer vision, image processing and machine learning. It can be used with C/C++, Python, Java and MATLAB with the support with an operating system such as Windows, Linux or Mac OS.
- OpenCV libraries help to build real time application and complex projects that includes artificial intelligence, embedded system, IOT (Internet of Things), and robotics
- Since Raspberry PI 3 Model B supports Linux, we can install OpenCV libraries. This allows us to build complex embedded system that involves computer vision and image processing.

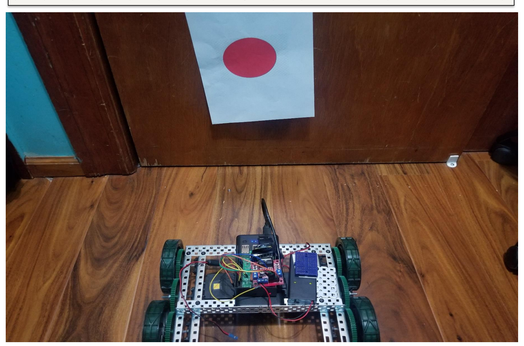
Acknowledgments

- Thanks to my mentor, Dr. Lili Ma, for supervising and supporting this project. I learned how to use image processing to program and control the VEX Robot on a Raspberry PI.

- Contact: Justin.Bartholomew1@mail.citytech.cuny.edu

Hardware design





Schematic diagram:

The software that I use to build the is from KiCad. KiCad is a schematic capture that can be used to design electronic hardware such as PCB. The wiring diagram show how I build robot with a motor driver with two dc motors.

Vex Robot:

This picture show the VEX robot that is targeting the red color object using its onboard PI camera.

Materials & Components

- VEX Robot with 2 VEX 393 motors
- Motor driver board: L298N
- Power supply module or Batteries with a holder: 9V – 12V
- Raspberry PI 3 Model B
- Portable Charger Power Bank 26800mah
- PI Camera

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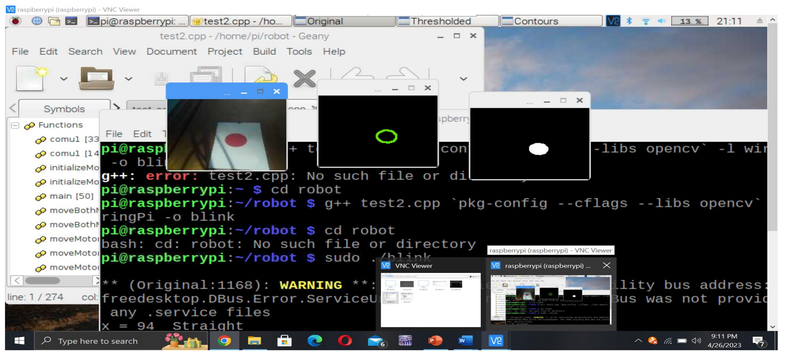
Results



- When controlling the VEX Robot with the help with image processing, C++ and Python are the two commonly-used languages on the Raspberry PI. In this project we used C++ that requires the Wiring Pi library. This allows us to use the GPIO pin to develop low-level motion control
- With the help of OpenCV libraries, the color target is extracted on the image plane using color space conversions, color-based extraction, noise filtering, and detection of contours.
- By applying different and appropriate thresholds in filtering the color(s) in consideration, the VEX robot can be controlled to track targets of different colors, mainly based on the HUE channel.

Conclusion

This project is to build an autonomous mobile robot capable of performing vision-based control tasks. This prototype merges existing commercially available robotic kits, electronic components, and embedded systems to yield an integrated and enhanced robotic platform.

Future Plans

Our Raspberry PI-controlled VEX robot allows exploration and investigation of many tasks of both educational and research flavors. Our next step is to install Robot Operating System (ROS) on the PI to explore the functionalities provided by the ROS. We may also install a virtual machine to communicate with the physical robot.

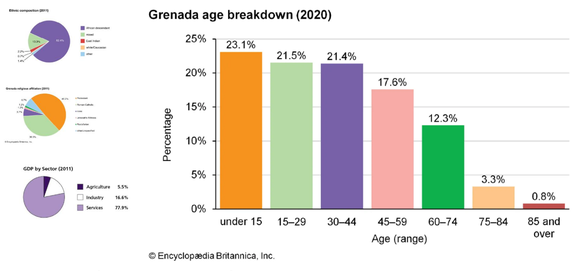
Grenada Mental Restorative Space

Kada Clyne

Phillip Anzalone Ross, Michael Duddy

Abstract

The mind is an intricately powerful tool, however, sustainability of its health and development is often trivialized, especially within smaller developing countries, like Grenada. A holistic-care approach is necessary to deal with underlying causative agents of mental health challenges. The objective of this project is to highlight how architecture can act as a restorative tool within nature, to enhance the mental wellbeing of individuals within a community. In tandem with the revision of scholastic case studies, architectural precedents of mental health facilities were also analyzed. The research conducted helped determine the state and contributory factors of mental health systems in the Caribbean, particularly Grenada. Furthermore, there remains a need for additional research on mental health, regarding the influence of underlying stressors, lack of resources and the abundance of under qualified/under-quantified professionals. In this context, I propose architecturally altering an expansive site, catering to spaces of mental health and development through symptomatic treatment and facilitating societal adjustments, within the natural landscape of Grenada.



Grenada Demographics

Background

Demographics, culture, age groups and existing healthcare of the site (Grenada) were studied to determine similar characteristics and patterns that emerge in research on other small- island developing countries. Understanding the factors that affect mental health like family history, stress, brain injury, health problems, hormones, drug abuse and addiction, and imbalance of chemical messengers in the brain (Nucleus Medical Media, 2:30-3:00). Mental health in black communities (Grenada has an 80% African descendant make-up) as a topic, remains a niche area of research. There are so many underlying traumas that go undealt and ignored, especially within Caribbean islands who's mixed black and indigenous cultures have both endured gruesome histories. These generational traumas have been recycled countless times; to cease this there needs to be permanent resources put in place to specifically target these areas. The negative connotations with verbiage surrounding mental health remains evident in the contexts that it is often used.

Discussion

The International Journal of Mental Health Systems' analysis produced insight on the prevalence of mental health stigmas in Small Island Developing States (SIDS) and the effects of addictive disorders to disease burden, which was used to further analyze data from the 2018 PAHO report on Grenada. (Walker et al. 2) The report revealed that Mental, Neurological, Substance use disorders and Suicide (MNSS) accounted for the largest burden (¼ of the total disease burden between 10 and 40 years) of all disease groups, highlighting its predominant affect on the community. Additionally, global events like COVID-19 impact public mental health more vigorously in these smaller countries (PAHO 1).

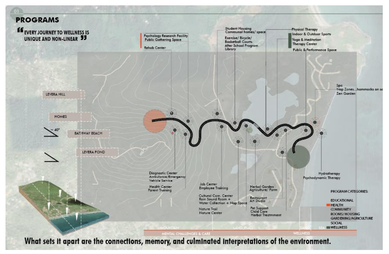
Men		Women	
Disorder	DALYs per 100 000	Disorder	DALYs per 100 000
MNSS (all)	4845	MNSS (all)	4309
Alcohol use disorders	858	Headache disorders	994
Headache disorders	552	Depressive disorders	654
Self-harm and suicide	537	Anxiety disorders	502
Depressive disorders	445	Somatic symptom disorder with prominent pain	469
Somatic symptom disorder with prominent pain	399	Alzheimer's disease and other dementias	379

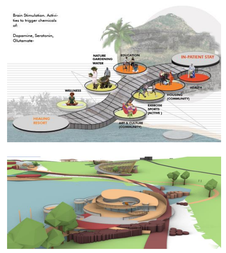
In an effort to combat the lack of research and global interventions specifically targeting mental health within smaller countries (like Grenada) the World Health Organization (WHO) developed an Action Plan (2013-2030) which seeks to prioritize mental health concerns.

This shows the understanding for the need for systems on mental wellbeing and though there are facilities in place they do not address a large enough range to cater to specific mental challenges, but rather rely on services that are hospital-based. Grenada has an 80-bed psychiatric center, the 'Pink House", yet it lacks the adequate personnel and resources. Existing facilities should be improved to a welcoming status, whilst resources should expand to create room for newer options as developments in research on mental health occur.

Architectural concept/ proposal

The architectural proposal developed from the history of Grenada and finding the Taino people described as peaceful in nature. Their living arrangements, which were usually circular individual huts, or villages arranged circularly, their use of natural medicine, farming and agriculture for food rather than hunting and their general respect for nature/ the environment were core elements taken to determine programs of the buildings.





The brain's overall intricate process of retrieving and outputting information helped determine the circulation and layout of the programs and buildings. Simplifying the general concept of the neuron; the idea of connectivity between two axons(major nodes), and smaller signals (minor nodes) being passed along that journey. The major nodes signify the journey from two intensities (treatment versus wellness) . The smaller nodes addressed program activities that stimulate the brain and trigger certain chemicals linked to mental health issues like Dopamine, serotonin and Glutamate. It shows the journey to wellness along a path intertwined within the natural landscape; travelling down the 758ft elevated Levera Hill to more leveled land and then along the shores of Bathway beach. The beach is the overall destination signifying wellness.

Conclusion

Culture that resists, ignores, or poorly addresses the signsof mental challenges is a common denominator for deteriorating mental health in small island developing countries. Architecture can be used as a medium to format spaces catering to programs and advancing building techniques that improve mental health, or further the conversations surrounding mental health. By implementing more systems that aid and prevent disease burdens (mental health), healthier communities can be developed.

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Global Radiological Technologist Licensing Requirements

Author: Katelyn Lopez
Mentor: Professor Patrick Slattery

ABSTRACT

By examining the global radiological technologist licensing requirements, the research aims to provide valuable insights into the work field of licensed radiology professionals and propose recommendations to address the future outcomes of this field. The study will contribute to a better understanding of the global landscape of radiological technology and help inform strategies for ensuring a sufficient supply of highly skilled professionals in this essential healthcare discipline.

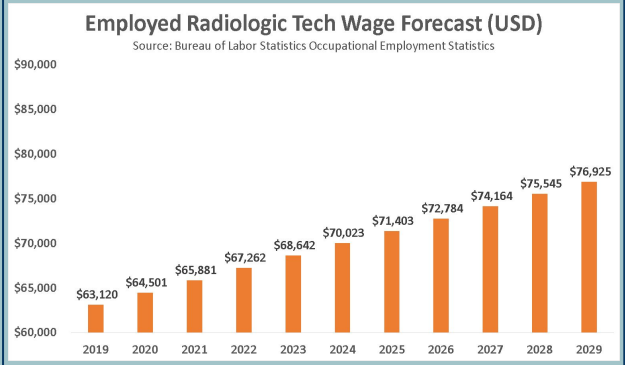
INTRODUCTION

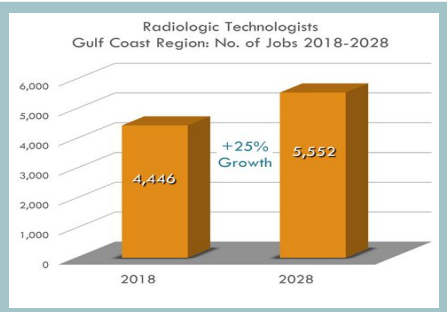
To be in the Radiologist Technology field one has to obtain many licensing requirements. Radiologists specialize in using various high-tech equipment that help diagnose and treat injuries and diseases. Tests that help diagnose these issues are X-rays, MRI's, CT Scans, PET Scans, and ultrasounds. With the increase in technology there is more advancement in society and in helping diagnose and help fix problems which is extremely beneficial in this health care field. Although there is some risks in this field such as the risk of radiation, with the proper training and schooling individuals would be able to become highly skilled radiological technologists.

RESEARCH

This research project aims to examine the licensing requirements for radiological technologists across various regions of the world, with the goal of understanding the advancement of technology in the radiology technology field. The study will answer various questions such as: (1) What is the highest and lowest radiologist paying country? (2) What strategies can be implemented to address the global technological advancements in the field of radiological technology?

DIAGRAMS





ACKNOWLEDGEMENTS

- Emerging Scholars Program 2023 Spring

CONCLUSION

In conclusion with the research that was done it is proven that with the advance that has been happening recently in technology the radiology technology health care field will advance expediently in the following years to come. With the US being the highest paying radiologist profession compared to Portugal's lowest there is always room for growth and improvement.

FUTURE WORK

With new advances in technology such as AI can be a beneficial factor for the radiology healthcare field. By being able to better diagnose and find and help fix issues that individuals have with the advancement of technology would lead to hopefully more cures in society. Technology can be a positive reinforcement to continue in the field of radiology since there would be more growth in this workforce.

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Augmented Reality (AR) Research with membit.co

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Mentor
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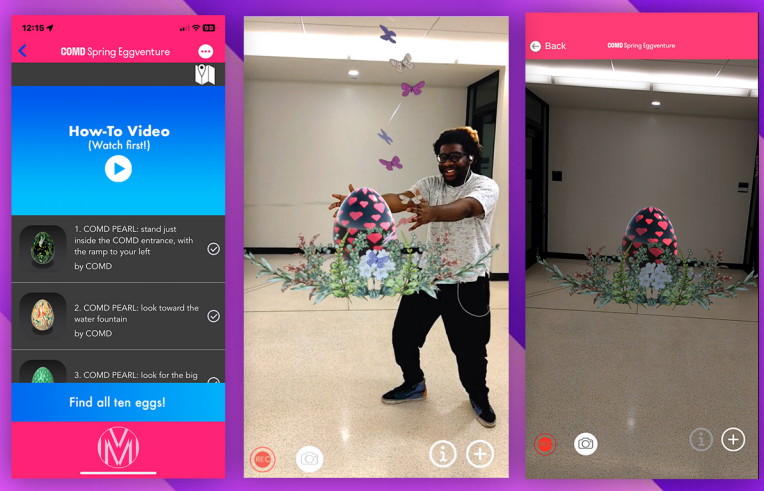
COMD Futures Collaboratory



Abstract

Augmented Reality (AR) is an emerging medium that superimposes digital content over a user's view of the real world. In our research, we explore the user experience, focusing on how AR interactions can connect people through collaboration and community building. Utilizing the AR application Membit™, "a geolocative augmented reality (AR) storytelling platform," developed and co-founded by Jay Van Buren, we are helping to identify interface and usability issues, providing outreach support, and developing AR experiences.

Introduction

This semester researchers developed an AR treasure hunt using Membit. The **COMD Spring Eggventure** gives students and visitors a fun way to explore the COMD Department. The user downloads the app, selects the Eggventure channel, and reads the clues to discover the ten virtual eggs hidden along the COMD Hallway. The research team added 3D assets to each site along the hallway, tested the user experience, and created an instructional video to guide users through the steps of how to participate in the egg hunt. We also started working in Adobe Aero (AR) and Vectary (3D), creating 3D objects to use in our future AR exhibit of alumni and student work.

Future Plans

We are creating an AR exhibit to showcase COMD Alumni work and inspire other students at City Tech. The first exhibit we are working on is a virtual showcase of projects from the class of Spring 2020 because, due to the start of the pandemic, they didn't have the same opportunity in past years to present their final Senior Projects. Our team is also working on a freeform collaborative exhibit that will allow everyone to add their own images or videos to give them more exposure and foster a feeling of community in the COMD Department. We will use the AR program Adobe Aero (AR) and the 3D application Vectary to build the augmented experience. Viewers will be able to walk through the virtual exhibitions on-site and offsite using the free apps.

Methods & Materials

We tested the user experience of the Membit app and explored ways of making the app more user-friendly. We also experimented with Adobe Aero to compare the user experience between both apps.

- iPhone and Android phones with camera
- Apple App store / Google Play store
- Adobe Photoshop (Image Editing) Ps
- Adobe XD (Experience Design) Xd
- Vectary (3D)
- Adobe Aero (AR Experience) Ar

Discovery

Our research outcomes were made possible by repeatedly testing how 3D objects appear on the Membit app. The team initially conducted usability and user experience tests while planning the AR Alumni Senior Projects exhibit. We then shifted gears and started working on the COMD Spring Eggventure project and realized that users enjoy the 3D objects in Augmented Reality more than 2D images. Based on the tests, we adjusted the exhibit display to include 3D objects for a better user experience. The team also created a mock-up of a new user interface to help make the Membit app represent the company's message of storytelling and fun.

Types of Cyber Attacks and Incident Response

ESP Researcher: Kaung Myat Thu(Computer System)

Mentor: Professor Patrick J Slattery (CST)

Abstract:

In today's digital age, cyber attacks are a growing threat to individuals, organizations, and governments. Effective incident response is essential to minimize the damage caused by attacks. This research project explores incident response strategies, including preparation, identification, detection and analysis, containment, eradication and recovery, and post-incident activities. The project also examines common types of cyber attacks, such as malware, phishing, ransomware, DDoS attacks, and social engineering, and how incident response can mitigate their impact.

Understanding the various types of cyber attacks is crucial for protecting against them. Common types of attacks include malware, phishing, ransomware, DDoS attacks, and social engineering. Malware is malicious software that can cause damage to or steal sensitive information from computer systems, networks, or devices. Phishing attacks aim to trick users into revealing personal information, such as usernames and passwords. Ransomware encrypts data and demands payment in exchange for a decryption key. DDoS attacks disrupt online services by overwhelming them with traffic. Social engineering attacks exploit human psychology to trick users into revealing sensitive information.

Incident Response Steps:

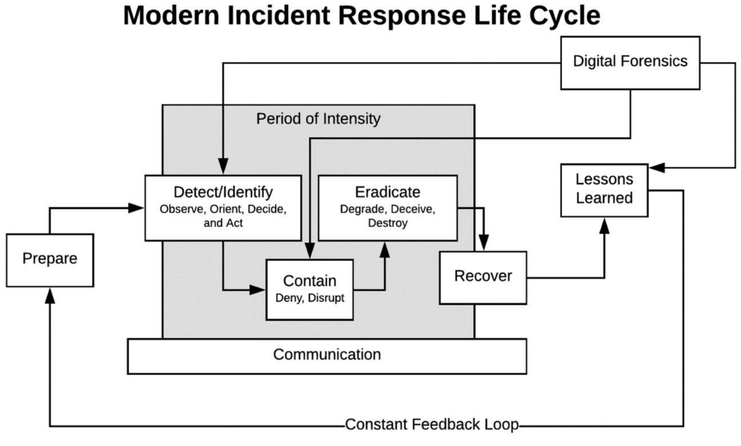
When a cyber attack occurs, it's important to have an incident response plan in place to minimize the damage and restore normal operations as quickly as possible. Incident response involves a series of steps, including:

1. Preparation
2. Identification
3. Detection and Analysis
4. Containment
5. Eradication and Recovery
6. Post-Incident Activity

1. Preparation:

This phase involves preparing for potential incidents before they occur. This includes:

- Creating an incident response plan
- Establishing communication protocols
- Identifying critical assets
- Establishing training and testing procedures
- Setting up tools and infrastructure to assist in incident response.



2. Identification:

This phase involves identifying potential security incidents through various means. This Include:

- Monitoring System Logs: For Incident Response Team to review logs and identify any abnormal activity, such as unauthorized access to sensitive data.
- Network Traffic Analysis: To find out any suspicious network activity, such as unusual traffic patterns, port scans, or network connections.
- User Behavior Analysis: To detect unusual behavior made by a user, such as unauthorized access attempts, data exfiltration, or use of privileged access.
- User Reports: Users may report suspicious activity or incidents to the Incident Response Team. Organizations should have clear procedures in place for users to report incidents or security concerns.

Reliable event identification is critical to information asset protection.

3. Detection and Analysis:

This phase involves to verify whether an attack is occurring and forensic evidence (clues and facts) to determine the nature of the incident and any potential impacts. This Include:

- Verifying Potential Threat: Incident Response Team reviews the suspicious activity to identify during the identification phase to confirm whether a security incident is occurring.
- Collecting Data: Collecting data or forensic evidence to determine the incident and any impacts such as network logs, memory dumps, or network captures.
- Assessing the Scope of the Incident: The team analyzes how many systems or users are affected, what type of data is compromised, and amount of damage to the organization.

4. Containment:

During the containment phase, IR Team focuses on preventing further damage to critical systems to minimize impact and stopping the spread of the security incident. This may involve isolating affected systems or network segments, disabling compromised user accounts, or shutting down affected services.

- Isolating Infected Systems: IR team Isolates infected systems or devices from the network to prevent the spread of malware or other malicious activity. Examples such as: disconnecting network cables or disabling network access.
- Blocking Malicious Traffic: IR team blocks or filters malicious traffic, such as traffic associated with a known malware infection or DDoS attack.
- Removing Malware: Removes malware or other malicious software from affected systems. This may involve using antivirus software, deleting files or registry entries, or restoring system backups.
- Implementing Access Controls: Implement access controls to prevent unauthorized users or devices from accessing critical systems or data. Examples such as: changing passwords or revoking access privileges.
- Deploying Countermeasures: This includes updating antivirus software, applying security patches, or reconfiguring network devices.
- Verifying Success: IR team verifies everything to make sure that containment has been successful, and the incident has been contaminated. Example such as: conducting scans or tests to confirm that malware and other malicious activity has been removed or blocked. Preventing further damage is an important milestone.

5. Eradication and Recovery:

This phase is to restore affected systems to a safe and functional state. This include:

- Removing Malware and Threats to affected systems and networks to ensure that all malware, backdoors, or other malicious code have been eliminated. Establishing a reliable environment is critical.
- Applying Security Patches and updates to software, firmware, and hardware to ensure that all known vulnerabilities are patched and that the systems are secure. New versions of software can limit exposure.
- Restoring Data and Services to their normal state, verifies data integrity, and ensures that backups are up-to-date and functioning correctly.
- Testing and Validating systems and networks to ensure that they are operating as expected and that there are no lingering issues or vulnerabilities. The organization needs to know that everything works.
- Documenting the Incident, the entire incident response process, including lessons learned and recommendations for future improvements. To be effective in the future, documentation is key.

6. Post-Incident Activity:

This phase is to evaluate the response effort and identify areas for improvement. Example such as conducting a mortem analysis, updating incident response plans, and implementing additional security measures to prevent similar incidents from occurring in the future. This include:

- Updating Policies and Procedures: The team updates incident response policies and procedures based on the findings of the lessons learned review.
- Training Staff: The team provides training to staff to ensure that they are prepared to respond to future incidents.
- Conducting Tabletop Exercises: The team conducts tabletop exercises to test and refine incident response plans and procedures.
- Maintaining Incident Response Capability: The team maintains incident response capability by conducting regular assessments of the security environment, identifying potential threats, and ensuring that the incident response plan is up-to-date and relevant.

In conclusion, cyber attacks pose an increasing threat in today's digital age. To protect against them, organizations must be prepared to respond effectively. Understanding common types of attacks, such as malware, phishing, ransomware, DDoS attacks, and social engineering, is essential. Incident response involves several steps, including preparation, identification, detection and analysis, containment, eradication and recovery, and post-incident activity. By following these steps, organizations can minimize the damage caused by an attack and restore normal operations quickly. Post-incident activities, such as updating policies and procedures, training staff, and conducting exercises, are also essential for improving incident response. Overall, having a complete incident response plan is critical for protecting against cyber attacks and minimizing their impact.

NYCHA + CITYTECH ARCscholars

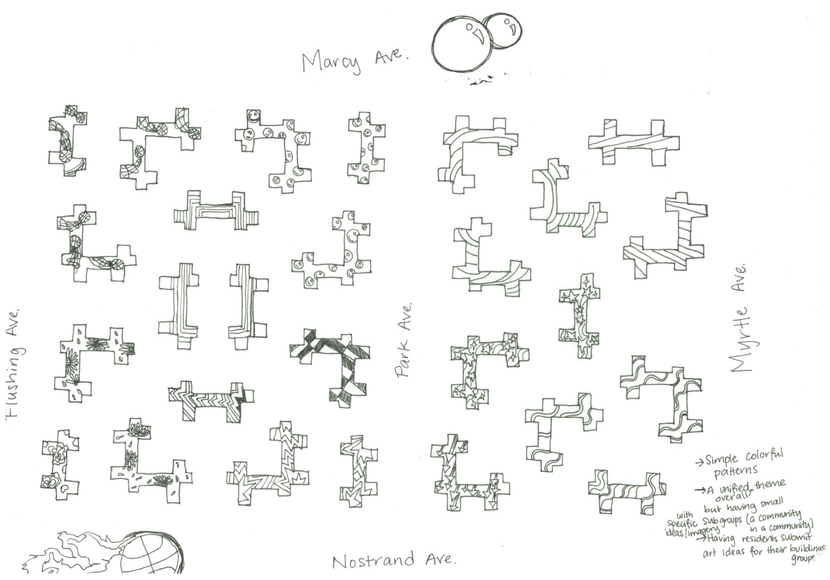
The Marcy Houses: Roof Design

Naomi Langer | Nicole Vlado | Vincent Zheng | Kaylynn Daoud
Kismel Bermeo | Jeanette Flores | Malia Vazquez | Jason Bhimani | Janier Joyner | Destiny Walker

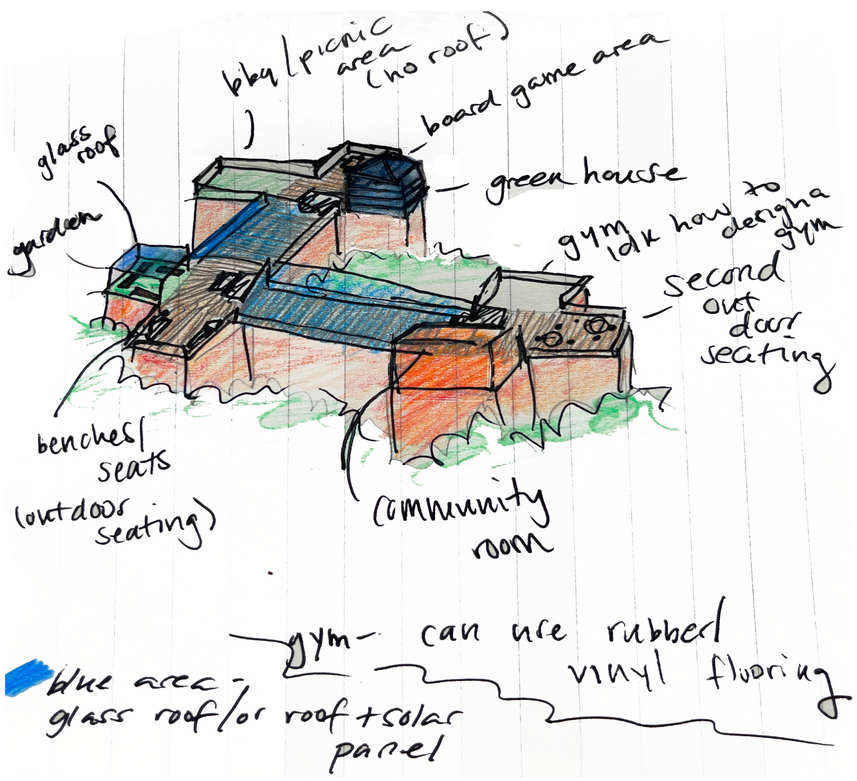
OUR TEAM GOAL:

The goal of the roof design team is to transform the roof into a secure and inviting place for Marcy residents. After collaborating with our group members, we noticed a lack of gathering space for teens and young adults. Depending on which building roof it is meant for, the new roof organization will include the construction of spaces to rest and meet. According to our research, 57 percent of the people residing in Marcy are between the ages of 18 and 61, and 17% are 62 and older; so each roof will cater to particular age groups. We believe the roof has the potential to become a place that unifies the community by offering possibilities for recreation and general health development for people of every demographic and ability levels.
Some rooftops will have garden areas for the elderly who enjoy gardening, as well as fixed seats, tables, and benches for study and relaxation. further rooftops will have board games, and checker tables for young adults and teens. while other roof's will have na fitness center. The design will focus on creating a feeling of safety with the addition of overhangs to cover people from the sun. The roof will be transformed into a usable area with both interior and exterior spaces.

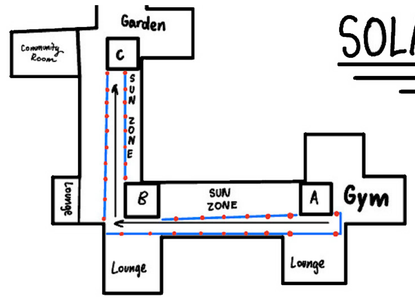
CAMPUS



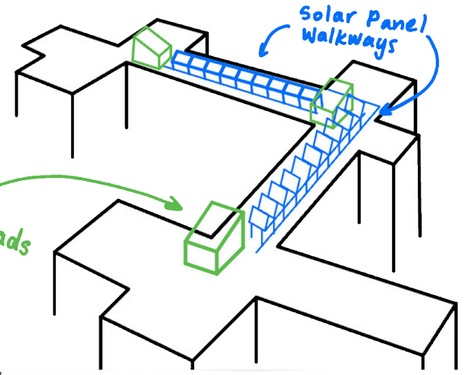
BUILDING



INDIVIDUAL SPACES



SOLAR PANEL WALKWAYS

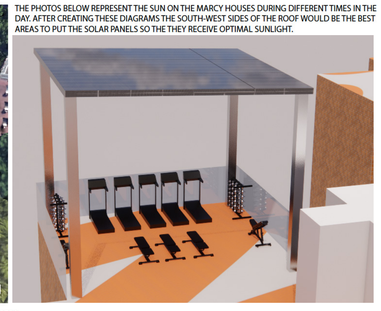


8pm at night me & friends want to go outside for a peace of mind so we go outside & sit on the roof its nice view with seats and tables

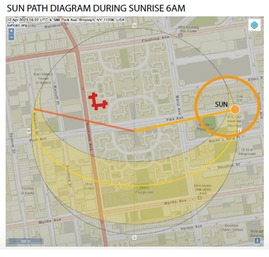
SUN DIAGRAM

MARCY HOUSES SUN RENDERING 04/2023

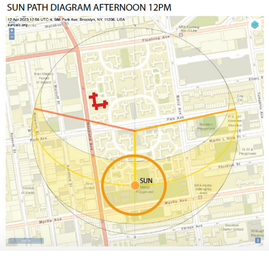
THE PHOTOS BELOW REPRESENT THE SUN ON THE MARCY HOUSES DURING DIFFERENT TIMES IN THE DAY. AFTER CREATING THESE DIAGRAMS THE SOUTH-WEST SIDES OF THE ROOF WOULD BE THE BEST AREAS TO PUT THE SOLAR PANELS SO THE THEY RECEIVE OPTIMAL SUNLIGHT.



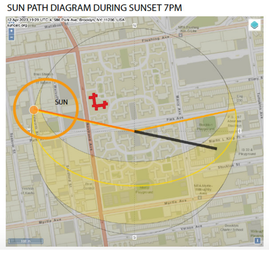
SUN PATH DIAGRAM DURING SUNRISE 6AM

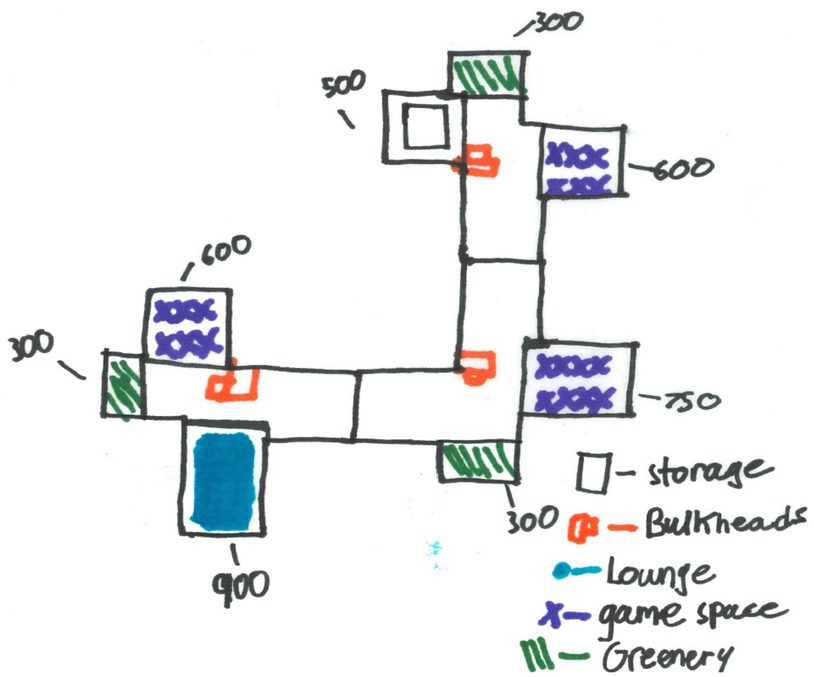


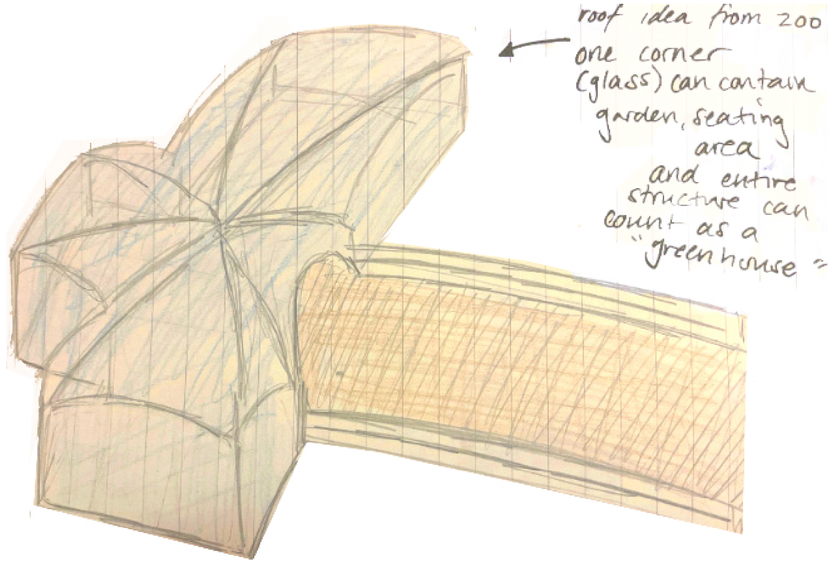
SUN PATH DIAGRAM AFTERNOON 12PM



SUN PATH DIAGRAM DURING SUNSET 7PM







ARCScholars - NYCHA

Kevin Valencia, Catherine Valenzuela,
Sofia Bilbao, Justin Cole, Mi-Luv Holley, Gisselle Nunez,
Driannye Nunez
Vaidehi Mody (NYCHA), Stephen Sheng (HANDEL ARCHITECTS),
Danai Metoyer (LEROY STREET STUDIO)

Project Abstract:

Who are we?
We are a diverse group of scholars ranging in age, gender, and background from all over New York City. We share a common interest in solving our urban challenges through studying and proposing improvements to the built environment. From professors at CUNY CITY TECH to NYCHA Design & Implementation specialists and NYCHA residents, we encompass a group of scholars united by this common purpose.

What are we here to accomplish?
This team of ARCscholars is working collaboratively, sharing lived experiences, creatively thinking & planning, and applying our research discoveries to the proposed design interventions. We seek to address and combat critical issues to foster a measurable improvement in community health, understanding, and relationships. Through enhancing the community at large via housing equity, durability, and beauty, we hope the proposed design improvements will have a direct, indirect, and long-lasting positive effect on the NYCHA communities.

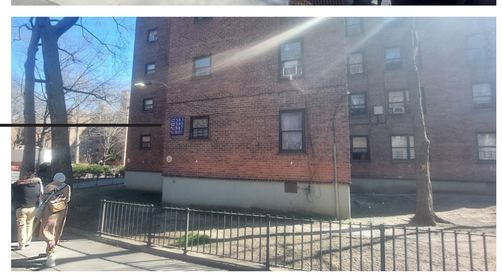
How are we doing it?
To address several of the concerns of NYCHA residents, the ARCscholars team will divide into sub-teams that will focus on one of the following categories; Placemaking, Roof Design, and Active Neighborhoods. The scope of work within each category covers a multitude of concerns for the residents. Placemaking in particular will primarily focus on the need for proper physical/ visual orientation within the site for visitors and residents themselves. This includes the implementation of follies, signage, material color/ texture, lighting, and more.

What have we found?
After interviewing several residents, the aspect of a lack of a sense of direction on the Marcy Houses site was brought up recurrently. Residents developed an unofficial naming system to identify specific areas on the site that over time became part of the neighborhood vernacular. This includes spots like “Blueberry Hill’’ and “The Living Room”. Interviews and photographs taken during a site survey indicate a lack of proper signage. Signs are placed out of eye level, out of view, or in nondescript places. Materiality among buildings, walkways, and green areas is the same throughout the site. All these issues create a sense of getting lost. Residents themselves get disoriented and visitors are encouraged to meet off-site.

SITE PHOTOS

EMPTY SPACES, SIMILAR MATERIALS, NO DIFFERENTIATION

SIGNAGE OUT OF EYELINE, CONFUSING, DISORIENTING



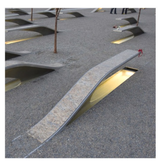
PRECEDENT AND SOLUTIONS

Proposal: Wayfinding, Branding and Identity

Based on some of the issues we have identified from interviews and the site visit, we have developed solutions that address the wayfinding, branding, and site identity of the Marcy Houses. We propose design solutions that differentiate neighborhood elements for wayfinding purposes and in turn can also help with community spirit, incentivizing residents to take care of the neighborhood. This includes the implementation of architectural follies which serve as landmarks that can help visitors and residents find their place within the site, the addition of color/ textures to existing materials, and the implementation of lighting for signs and pathways. Below are some precedent examples for each category.

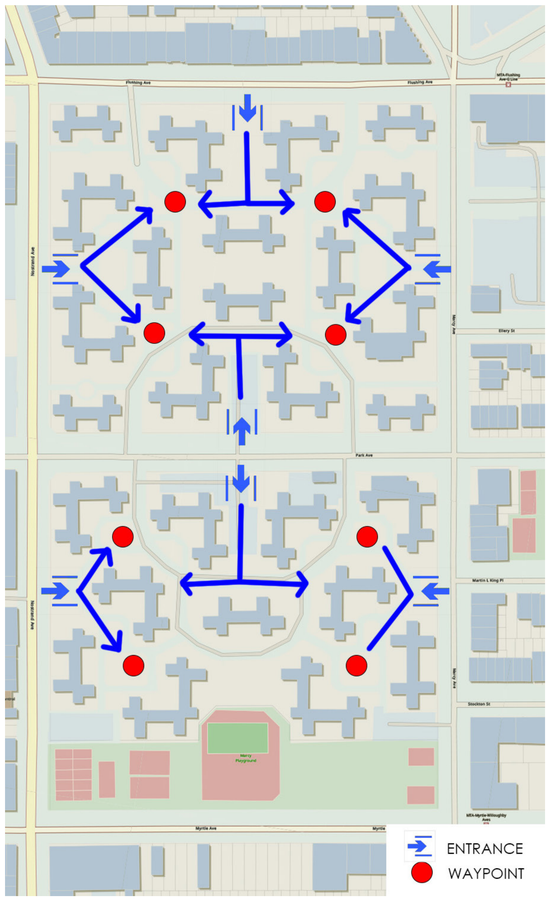
FOLLIES

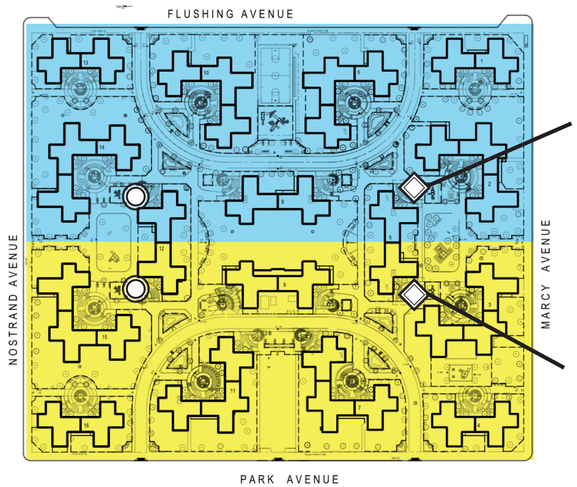
COLORS/ TEXTURES IN MATERIALITY

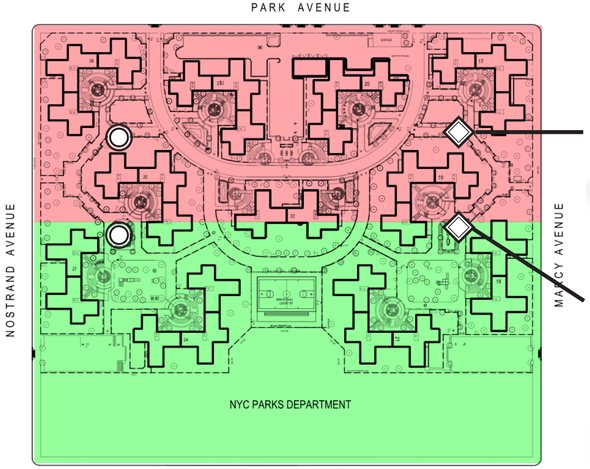


LIGHTING/ SIGNAGE

FOLLY/ COLOR DISTRICTS STUDY

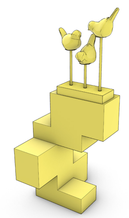




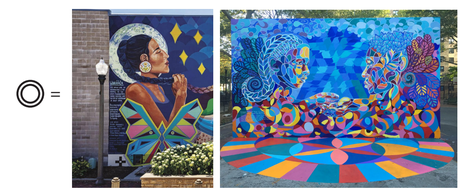


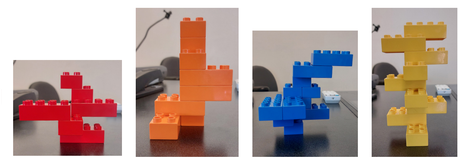
THE CONCEPT: COLOR

Entrance points were strategically identified where visitors and residents would most likely enter Marcy Houses. From here, right or left ***pathways*** differentiated by ***colors/ textures*** and guided by ***lighting/ signage*** based on ***color district*** would lead to a **folly** based off of a color district and one of fours animals.

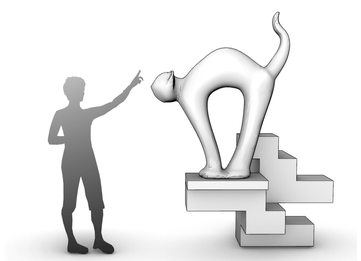


For contrast the follies located on the side of Nostrand Avenue are proposed to be artist canvases for local artists to place their work.





PHYSICAL MODELS



HUMAN SCALE

ARTIFICIAL TURF AND HEALTH HAZARDS

Student: Le Van La—Mentor: Prof. Vishwas Joshi, MS., PhD./
Department of Chemistry
New York City College of Technology (CUNY)

CHEMICAL COMPOSITION AND IDENTIFICATION IN ARTIFICIAL TURF

Figure 1. Layers of artificial turf, including plastic fibers (1), crumb rubbers (2), a plastic carpet (3), an anti-weed barrier (4), a shock-absorbing pad (5), broken concrete (6), and lastly natural soil (7).

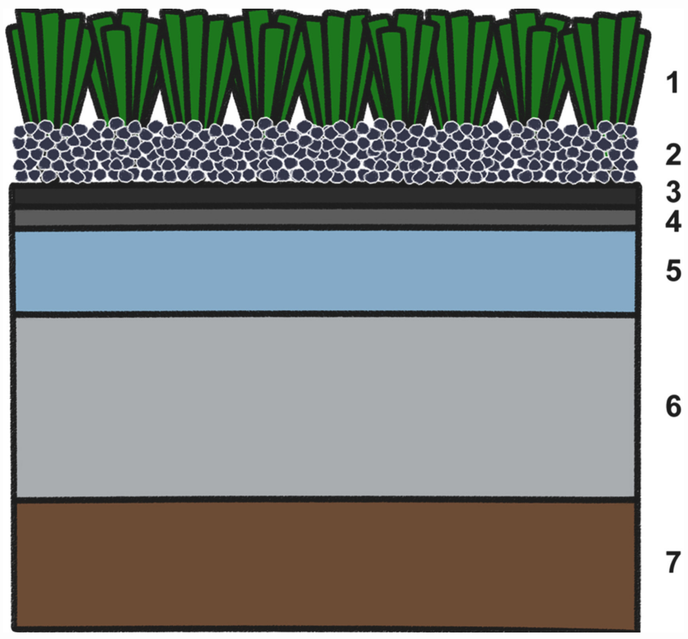


Figure 1 depicts the general structure of layers in artificial turf. These layers could be made of nylon, polypropylene, polyethylene, polyurethane, synthetic rubber, and other polymers. The least popular options include thermoplastic elastomers, used athletic shoes, acrylic coated sand, coconut fibers, cork, and sand (Massey et al., 2020). Due to the cost-effectiveness, the most popular infill is crumb rubber manufactured from virgin rubber or car recycled tires.

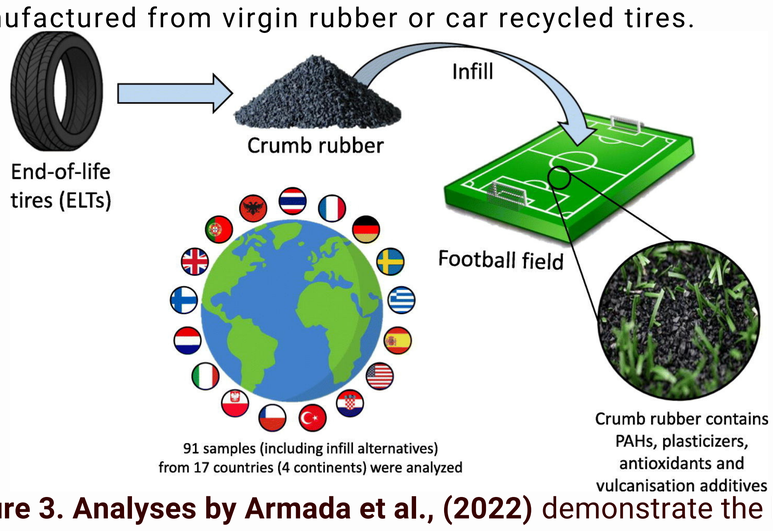


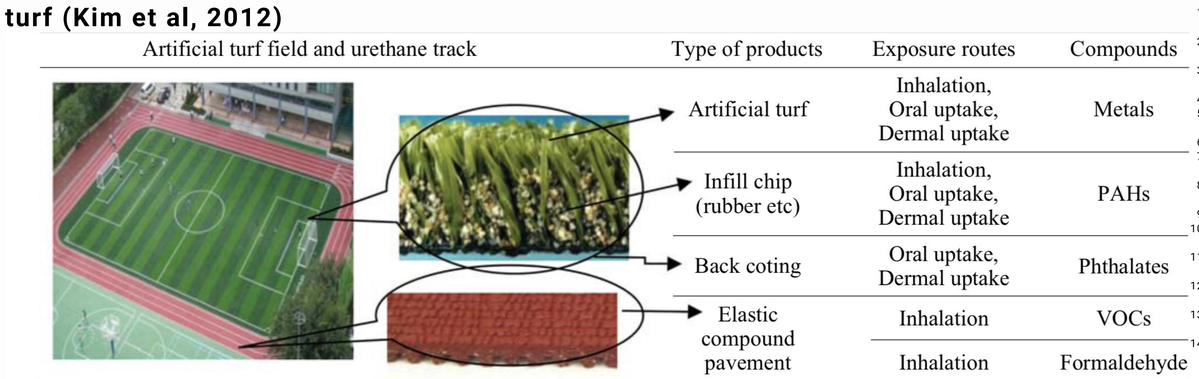
Figure 3. Analyses by Armada et al., (2022) demonstrate the lists of chemical risks associated with the recycled tire crumb rubber used on synthetic football fields around the world.

STUDIES ON THE HUMAN HEALTH IMPACTS OF ARTIFICIAL TURF

Hundreds of compounds, including recognized carcinogens, neurotoxicants, and endocrine disruptors, have been found in recent chemical tests of crumb rubber and other artificial turf components (Massey et al., 2020). Besides the chemicals in crumb rubber, recent studies of whole artificial turf and non-crumb rubber components have revealed polyfluoroalkyl substances (PFAS) as an emerging class of contaminants to be taken into account alongside well-known rubber chemicals, highlighting the importance of studying other turf components. (Naim, 2020).

According to Bleyer and Keegan (2018), there was no discernible correlation between the number of turf fields and cancer occurrences in the counties of California. According to Tarafdar et al.'s (2020) estimation of the cancer risk in children from PAH exposure from rubber playground surfaces in 2022, the risk is ten times higher than it is from soil surfaces. Other endpoints besides cancer have not been examined in any human epidemiological studies on artificial turf or crumb rubber.

Figure 5. Some possible human exposure routes to hazardous chemical from artificial turf (Kim et al, 2012)



WHAT MADE CRUMB RUBBER BECOME THE MAIN SUSPECT FOR HEALTH AND ENVIRONMENTAL HAZARDS?

Reason 1: Crumb rubber is made from used auto tires

Tens of millions of tires have been used in playground surfaces and artificial grass fields in the US (Watterson, 2017). Since crumb rubber is known as a recycled material and a substitute for common tire disposal strategies (e.g burning or illegal dumping), crumb rubber has been marketed as a sustainable way to reduce wastes and save energy (Gomes et al., 2021).

According to Watterson (2017) and Brandsma et al. (2019), a single professional-size sports field needs between 20,000 and 40,000 tires worth of crumb rubber to be installed, and as the granules move around during use, the field will need to be refilled with new crumb rubbers over time.

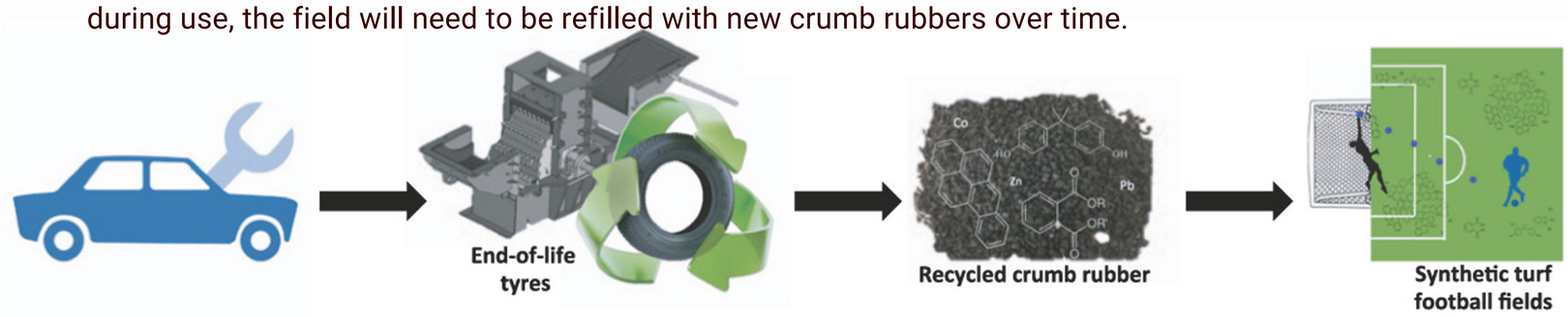


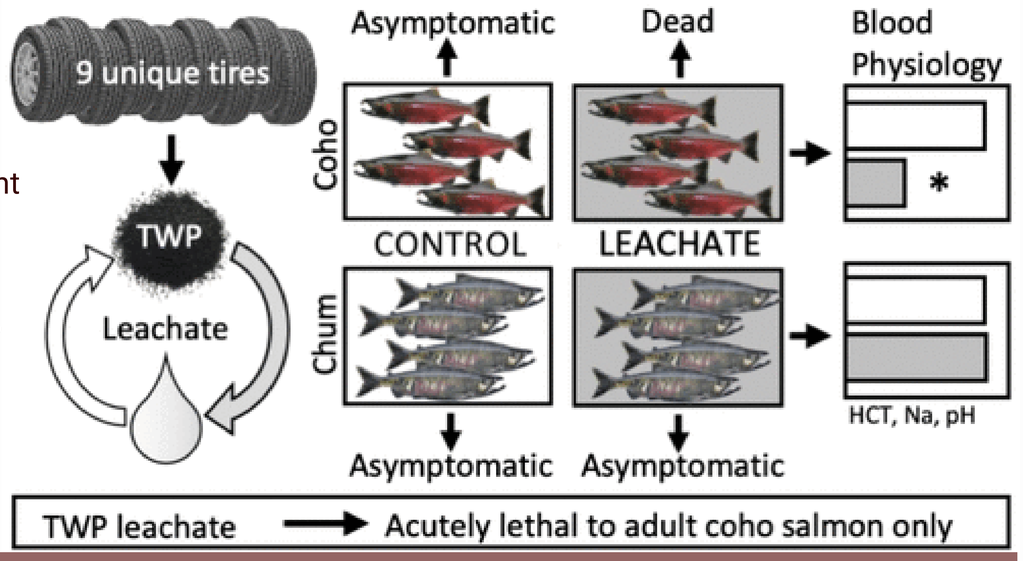
Figure 2. An overview about how recycled crumb rubber made from end-of-life tires become a part of the synthetic turf football fields (Gomes et al., 2021).

Reason 2: The ecotoxicity of several chemicals found in tires and crumb rubbers

Many toxic chemicals have been found in tires and rubber leachate, the extensive usage of crumb rubber in the environment is particularly problematic. Tire rubber is made up of natural and synthetic rubber polymers, reinforcing agents, aromatic extender oils, vulcanization additives, antioxidants, and processing aids. It has been widely demonstrated that the tire rubber contains hazardous chemicals that include volatile and semi-volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), heavy metals, phthalates, vulcanization agents, and antioxidants (Gomes et al., 2021; Armada et al., 2022).

For instance, the rubber antioxidant N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) has been demonstrated to produce acute low dose toxicity in juvenile coho salmon exposed by road runoff (McIntyre et al., 2021; Tian et al., 2021; Tian et al., 2022). This is because 6PPD, a common tire chemical that exists in artificial turf fields, most likely leaches from crumb rubber and transforms into the highly ecotoxic 6PPD-quinone.

Figure 4. The summary result for an experiment conducted by McIntyre et al., 2021. When present at environmentally relevant amounts, tire wear particle (TWP) leachate causes acute death in adult coho salmon only. However, the chum salmon fish is not affected.



CONCLUSIONS

Artificial turf is available in a variety of brands and from different producers, each with their own layers and structure that could contain exclusive elements. Samples from significant businesses in all global markets should be used in studies. Contrary to many discovered compounds in crumb rubber and other artificial turf components, as well as leachate, there are very few health and toxicity investigations on artificial grass. Although nearly every nation recognizes the potential health risks posed by heavy metals, microplastics, PAHs, and PFAS chemicals, only a small number of nations have implemented artificial turf and crumb rubber infill regulations or established sufficient surveillance measures to protect those frequently exposed to the fields (Zuccaro et al, 2022). This suggests that more studies should be conducted to address any current challenges and health issues, and implement appropriate regulations.

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OPPORTUNITIES IN SUSTAINABLE ARCHITECTURE

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Emerging Scholars Program
New York City College of Technology

ABSTRACT

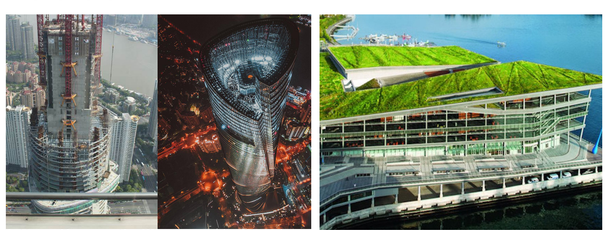
Sustainability was first defined as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Sustainability is important to maintaining our quality of life. It is the practice that can improve water and air quality, reduce landfills, and [fig.2] increase the availability of renewable energy. And understanding of how-to re-use materials and how to choose more sustainable products will guarantee cleaner and healthier living conditions for all people, especially those in lower income communities.

The objective driving this study is how can we as inspired Architects, Builders, and Engineers start designing more sustainable buildings to contribute to the changes of our living conditions. In this study I research alternative materials[fig.1] that can be used to replace the ones that are less sustainable. I search for strategies that provide better opportunities in sustainable architecture. To find these alternative options I read about sustainable architecture in books and online using the library research page. I interview an Architecture professors on sustainability.

SUSTAINABLE BUILDINGS

Shanghai Tower
. One third of the interior is green
. Powered with wind turbines
.Build with high percentages of recycled materials.

Vancouver Convention Center - CANADA
.Green roofs
.Rain water system
.Habitat for fish built into building foundation



https://www.thrillist.com/home/most-sustainable-buildings-around-the-world-best-green-architecture

METHOD

Figure 2
https://www.builderspace.com/how-to-make-existing-buildings-sustainable-8-ways

IMPROVEMENTS

1- Use low impact buildings material
  a- Recycled material
  b- Cellulose insulation
2- Add cool roofs
  a- Use light colored or reflective material
3- Install renewable energy systems
  a- Solar, wind and geothermal system
4-Add a rainwater harvesting system
  a-The barrel structure
5- Engage in modular construction practice
6- Install smart appliances

https://www.construction21.org/articles/h/6-ways-to-improve-sustainability-in-architecture.html

NON- SUSTAINABILITY RESULT

1- Increase in respiratory diseases
2- Harsher weather
3- Declining soil quality
4- Fewer green spaces
5- Rising sea levels

https://www.inspirecleanenergy.com/blog/sustainable-living/what-is-sustainability

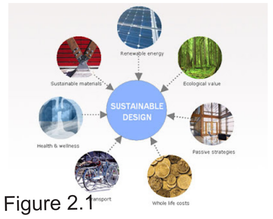


Figure 2.1

SUSTAINABLE MATERIALS

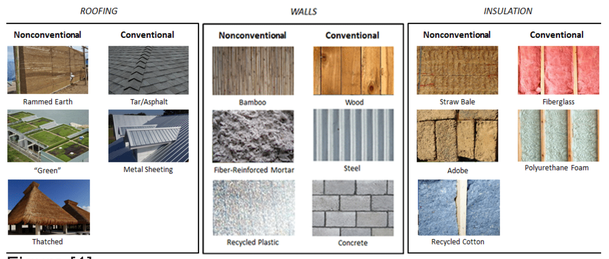


Figure [1]
https://www.engineeringforchange.org/wp-content/uploads/2016/10/building-materials-24.png

RESULT

Application of the method will lead to:

A- Provide healthier environment for creatures that lives on earth and in waters
B- Ensuring better quality of air
C- Reducing poverty and world hunger
D- Economic growth
E- Reduce climate change , -137 =kgC0,e/m3 released during building contruction
F- Enviromental development - Green areas takes over, no polution
G- Enviromental protection - Protection against polluted air, sea rise, sudden changes in climate
H-Longer lasting buildings

https://www.inspirecleanenergy.com/blog/sustainable-living/what-is-sustainability

CONCLUSION

In conclusion sustainable building will be a huge help to a sustainable environment and it will benefit everyone that is why it is not just one group’s problem but everyone’s problem. This research will reform architects’ thinking on how to build, considering not just the design but ways in which the design can contribute to a healthy lifestyle.

ACKNOWLEDGMENTS

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Professor Benjamin Posel
Place-Based Sustainability edited version by Jason Montgomery

Investigating the Taste Quality of Hydroponic Vegetables in Culinary Applications for Year-Round Availability

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Abstract

This study aims to investigate the taste quality of hydroponic vegetables in comparison with conventionally grown vegetables produced in peak season. The guiding research question for this study is whether hydroponic growing can create vegetables that taste just as good as conventionally grown vegetables produced in peak season; thus, eliminating the need for seasonality.

- The significance of this study
  - Has the potential to inform the development of sustainable and efficient methods of vegetable production
  - Could reduce the impact of seasonal limitations on the supply chain
  - Would be beneficial in urban areas where space is premium
  - Could raise awareness of ethical environmental stewardship in the culinary and restaurant industry

Comparative Life Cycle Assessment
Florida Winter Field Grown –vs- Local Hydroponic Tomatoes

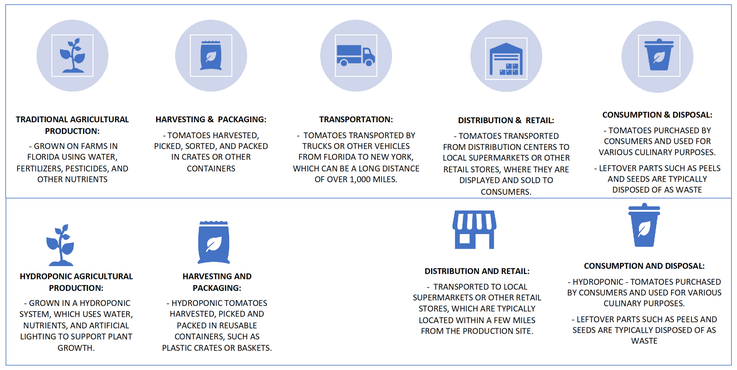

Figure 1: A Life Cycle Assessment comparison between Florida Winter Field Grown tomatoes and local hydroponically grown tomatoes.

Figure 2: Red Robin variety at week 2 (left) and week 4 (right)

Figure 3: The hydroponic system at Week 8

Methodology

Phase I:

- Two varieties of tomatoes, the Tiny Tim and Dwarf Red Robin, were germinated and grown in a hydroponic setting.
  - Approximately Seven days for seeds to sprout
- Experimented with germinating the seeds directly in the hydroponic system, as well as covered on a tray in the windowsill.
  - Both yielded the same results
- Staggered the growth of seeds to monitor each stage of growth.
- Kept record of a variety of variables, including:
  - pH
  - Temperature
  - Nutrient levels (EC)
- During our study we made alterations to the system to ensure consistency of product
  - Water temperature too high
    - Moved system away from the windows and radiator
    - Added ice to the water tank
  - Nutrient Levels and pH too low
    - Added nutrients and pH balancers
  - Added reflective materials to focus more light on the plants

Phase II: (to come)

- We will conduct a comparative sensory analysis by a trained panel of assessors to evaluate the following:
  - Appearance, aroma, texture, and flavor

Results

- The system and our plants have yielded positive results and will continue to be cared for until they fruit and provide tomatoes
- Our plants have just reached the flowering stage, therefore the gastronomic analysis of our tomatoes will be forthcoming

We have found that the optimal conditions for the hydroponic atmosphere are

- PH Level = 5.5 – 6.0
- Water Temperature = 70 F
- Nutrient Level (EC) = 2.0

Lights- 10 hours
Water- 16 hours

Conclusion

- We are pleased with the results thus far and have found that hydroponic farming could be a viable source for vegetable production that yields high quality products.
  - This is specifically true for the tomato varieties that were used in our research.
- Our research is currently in phase one and the comparative evaluation will be conducted in the future.

We conclude that this is very valuable research , and we are confident that our findings thus far are a solid basis to build upon for further investigation.

Figure 4: The root structure developed at Week 7

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Acknowledgements

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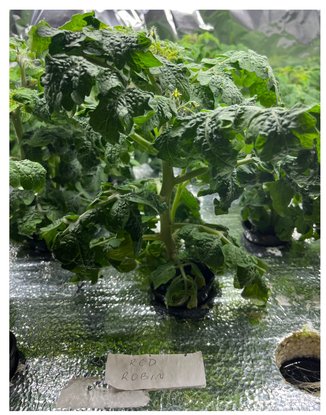


Figure 3: Red Robin variety at week 6 (left) and week 8 (right)

Understanding Data Mining and Its Relation to Information Systems

Author Malak Alammari

Mentor – Professor Patrick Slattery

Abstract

This research project aims to enrich an Open Educational Resource (OER) textbook on Introduction to Information Systems/Technology with a focus on data mining and its relation to hardware and software components of information systems. The study will address the following research questions: (1) What is data mining? and (2) How does data relate to the hardware and software components of information systems?
To answer these questions, the researcher will conduct research to ascertain the current state of data mining and its relevance in the field of information systems/technology. The results of the research will be incorporated into an existing OER textbook, modernizing or updating its content. The researcher will collaborate with the project team to develop a plan for incorporating new content into the OER textbook and communicate findings and progress to ensure the project's overall success.

Introduction

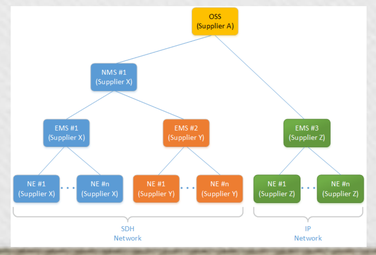
Data mining is a process of finding patterns and trends by extracting from large data sets using machine learning and statistical analysis techniques. The idea of data mining has been with us since 1763 when Thomas Bayes published a paper about the Bayes' theorem. Which theorem for relating the current probability to prior probabilities. It isn't the 1990s when the term "data mining" started to appear and become as we know it now.

Algorithm

The algorithm first analyzes the data you provide, and it looks for specific types of patterns. It uses the results of analysis over many iterations to find the optimal parameters for creating the mining model. The model can have many different outcomes based on the data you provide. The model can be predicter of the outcome, mathematical model and it can be set of clusters that describes the case in the dataset. When choosing an algorithm is important to choose the right one for the task because each algorithm produces a different result. The are five types of Classification algorithms, Regression algorithms, Segmentation algorithms, Association algorithms and Sequence analysis algorithm.

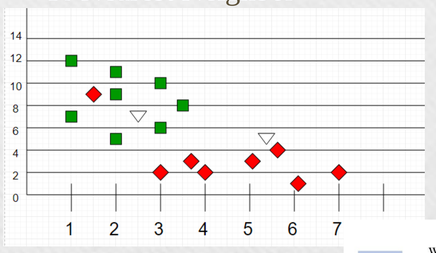
The different type of data mining algorithm

K-Nearest Neighbor -It is one of the most basic yet essential classification algorithms in Machine Learning. The way it works is by storing all the available cases and classifies the new data or case based on a similarity measure.
For example, if you see the graph is has red Dimond shapes and green square. Both are classified but the white triangle is not. We can assign it to a group by observing what group its nearest Neighbors belong to. This means a point close to a cluster of points classified as 'Red' has a higher probability of getting classified as 'Red'.
Neural Network. It performs tasks by being exposed to various datasets and examples without any task-specific rules. It is based on computational models for threshold logic. Neural has three basic sequences of learning. It first is simulated to new environments then the free parameter is going to change. The neural responds in a new way because of the new environment. There are seven types of Neural Networks, an example is Multilayer Perceptron.
Deciding Tree Algorithms- Deciding Tree is the best now for it accurately predicting the outcome and the most popular tool classification. A Decision tree is designed like the roots of tree. It works by node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node holds a class label.
They are many more different Algorithm

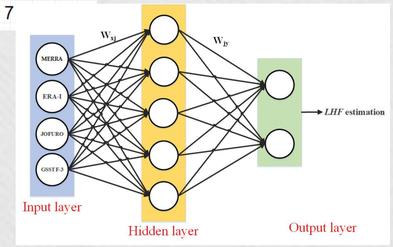


Deciding Tree

K-Nearest Neighbor

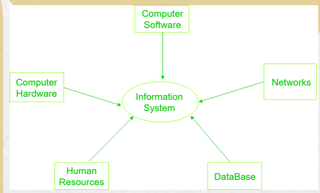


Neural network



Components Of Information System

It is the combination of hardware and software that work together to collect and distribute useful data. The database is software that runs on hardware. Hardware job is to store data and software processing data. Information systems were in the middle and everything else is connected to it like Computer Hardware, Computer Software, Databases, Network and Human Resources. Its objective is to provide information, gather the data, process the data and communicate information to the user. Computer Hardware used for input, output and processing. Computer Software is used to control and coordinate the hardware. components and it has three types of classified System Software, Application Software and Procedure. Databases are data that is raw facts. The are unorganized and later processed to generate information . Networks include communication media, and Network Support. Human Resources It requires the user to anage the system.



Conclusion / Discussion

Data mining is very significant because it can help with product Development because companies can use data to analyze which audience would be the best for the product. It can also help with manufacturing data mining. It can help companies to calculate the raw materials that the product needs, its cost and what would be the best option, that cost the least.

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New Gender Identity In The Fashion Global Workforce

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Introduction

In the new global workplace, there is an estimation of at least 40% of employees do not identify as either male or female but rather transgender meaning non-binary, not identify as either male or female (Inclusion, 2023). While there is some acceptance of non-binary employees in the workplace, there are still challenges these individuals face from other LGBTQ employees. It is important that inclusion and diversity are among the human resources practices for all genders. In the United States, the EEOC (Equal Employment Opportunity Commission) was created as part of the 1964 Civil Rights Act, which as an effort to address racial discrimination in voting, education, and other aspects of daily life, including discriminatory hiring and workplace practices (Inclusion, 2023). Gender, social inclusion, and diversity policies are important to business organizations to create an enabling environment for impartiality, progress towards diversity goals, and support organizations to develop a business case for gender equality.

Purpose of Research

To investigate how companies in the fashion business view gender diversity. It is estimated that at least 40% of workers do not identify as either male or female, but rather as transsexual, which means non-binary. While there is some recognition of non-binary employees in the workplace, these people still face challenges from other LGBTQ employees. Previous research has focused on prejudices from the viewpoint of LGBTQIA+ workers. This was investigated in relation to diffusion theory. Employers in the United States' fashion business were questioned for this research, and open-ended queries about gender variety in the workplace were used. A qualitative examination of the findings from 25 employers is being conducted to identify themes that will be addressed.

Theoretical Framework

Everett Rogers' Diffusion of innovation theory describes the trends in the distribution of innovation among a population. Innovation describes brand-new concepts, items, functions, or behaviors. New concepts or goods diffuse through time through a process called diffusion. The theory proposes five groups at the beginning to the end of the adoption process: (1). Innovators; (2). Early adopters; (3). Majority; (4). Late majority; (5). Laggards. The new idea/product (innovation) has to be perceived as having particular characteristics for successful adoption: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1983). Findings demonstrate that adoption of gender specific policies is early in the adoption process. Gender inclusion/diversity has been fully adopted conceptually, but in comparison, adoption of related policy is earlier in the adoption process. The participants indicated that young populations are more familiar with the concept of gender diversity. Targeting these groups as early adopters might help facilitate the adoption of policies.

Methods

To further studies a divided survey featuring open-ended questions related to workplace policies along with demographics was send to individuals working in the fashion industry in the United States most specifically in urban settings. Participants of this survey ranged from ages 24 to 25 five were Hispanic, five were Black/African American, five where white, three were Asian, and one was Native American in total 25 people participated hailing from the northeastern region of the U.S. which are New York, New Jersey ,Rhode Island, Vermont, Delaware and Pennsylvania. The portion of the instrument included questions such as:

- Have you ever witnessed an employee questioning an individual of a non-binary gender? Discuss the circumstance
- Does your company have a policy related to gender expression?
- Does your company have a policy related to gender identity?
- Have you ever had to discuss the dress with an employee? Was the dress related to his/her gender?
- What types of training on gender diversity is needed for students/new employees? Explain).
- How do employers propose to educate employees about gender diversity?
- To what extent are dress cues accurate in conveying gender identity? Provide examples where applicable and explain.

The second half of the instrument dealt with the participants demographics. Question about the participants household income, political orientation, ethnicity, highest level of education

Literature Review

Moya and Moya-Garófano (2019) investigated discrimination within the workplace of those who identify within the LGBTQ+ community and have reported facing discrimination due to their sexual orientation. This resulted in employees having a higher prevalence of job stress, mental illnesses, and depression. Persistence of job discrimination and its negative implications underscore the need for initiatives to eliminate prejudice against LGBTI people in the workplace. The study found identical results in two independent indicators of psychological well-being: (1) mental diseases and (2) depression. With a study conducted with 377 participants answering questions pertaining to their sexuality and the workplace. Answers revealed some participants felt that their sexual orientation has posed a problem or had caused difficulty in serval elements of their career. Most participants expressed their sexuality has become a negative factor when applying for a job, while in the workplace one's sexual orientation has hampered the ability to advance to positions of responsibility in their career shifting the focus from work to the individuals sexual becoming a topic of discussion or a joke creating harassment. Due to discrimination in the workplace one can be overwhelmed by excessive amount of stress can elevating one's blood pressure causing fatigue along with mental disorders such as memory/concentration problems, experiencing symptoms of insomnia and irritability. Spain appears to have the world's lowest rate of discrimination along with prejudice against LGBTQ individuals.

Ozeren (2014) investigated how companies discriminate towards employees who identify within the gay, lesbian, bisexual, transgender (GLBT) community. Specifically, how employees of the LGBT community are hired for a job and only later experience discrimination resulting in wage inequality and a lack of inclusiveness. Specifically, how employees face discrimination in the workplace such as wage inequality, the concept of wage differences among gay, lesbian, bisexual, transgender (GLBT) and heterosexual employees that can lead to termination, searching for new employment resulting. In addition, workplace discrimination can create an unhealthy environment which includes inappropriate jokes, inequitable hiring practices, and promotional discrimination which all can be detrimental to the company's reputation.

Anouk and Lorena (2016) investigated the concept of sexuality and the diverse expansion as related to employees who have come out in society, sexually identifying as something different from what has been defined as the norm in society, as in male or female gendered. Current LGBT workplace policies that are established by companies have been able to reduce sexual discrimination and increase LGBT employees' overall health. Relationships of employees/employer need to be examined once an individual choose to "come out" in public, including workplace relationships. This examination of relationships can document any unfair treatment by governments or business. A quantitative study indicated how LGBT are affected by employment policies. The study revealed gendered employees identify with race, age, and cultural background. In addition, diversity management positively improved LGBT employees by lowering prejudice and improving overall well-being at work, however, LGBT psychological health may not have indicated the same outcome.

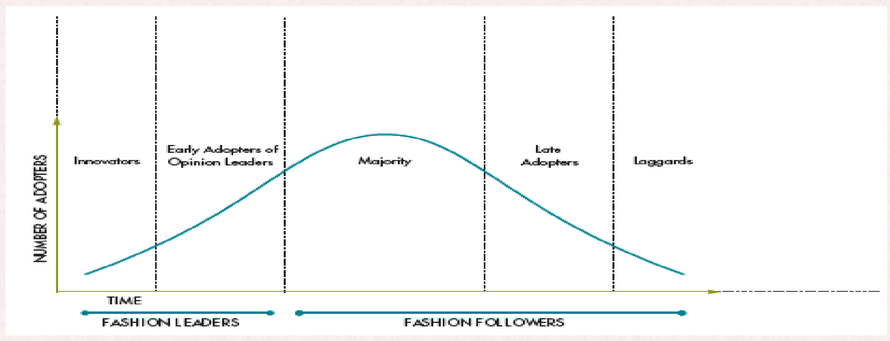

Table1. Roger's 1964 Diffusion on Innovation Curve

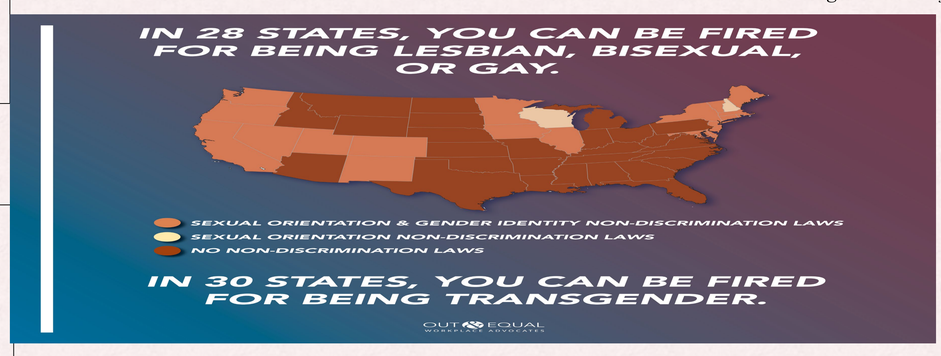

Table2. Out & Equal Workplace Fact sheet

Conclusion

Companies have difficulties accommodating employees who identify within the GLBT communities. When applying to a job one may fear of being rejected due to sexual orientation or sexual identity. Those who were successful at land the job found themselves the butt of office jokes centered around their sexuality, being misgendered on purpose by colleagues resulting in harassment which can cause a stressful environment due to the lack of inclusivity, attacking one's mental state.

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Exploring Methods for Recycling Filament Waste in 3D Printing

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Department of Mechanical Engineering Technology

Abstract

The goal of the current study is to investigate cutting-edge techniques for recycling filament waste from 3D printing procedures. Appropriate waste management techniques are required to reduce this trash's harmful environmental consequences. The goal of the project is to look at new methods for recycling filament waste in order to minimize disposal and encourage reuse. To acquire data from pertinent papers and research, a thorough literature review methodology was used. The findings show that this issue may be resolved utilizing a variety of recycling techniques, including shredding, melting, and re-extrusion. The type of filament waste and the intended goal will determine which approach is best to use. Overall, the study promotes sustainable behaviors, reduces the environmental impact of filament waste, and helps create appropriate waste management solutions for 3D printing.

Introduction

Additive manufacturing, sometimes referred to as 3D printing, is a process for producing three-dimensional items layer by layer out of materials like plastic, metal, or ceramic using a digital model as a guide. This ground-breaking technology has acquired enormous appeal in recent years because it makes it feasible to quickly and affordably produce intricate forms and patterns that were previously challenging or impossible to produce using conventional manufacturing techniques. Its ability to produce personalized goods, prototypes, and even replacement components on demand has made 3D printing a game-changer in industries as diverse as medical, engineering, architecture, and fashion.

During the past ten years, the 3D printing sector has experienced rapid expansion, which has also led to an increase in the quantity of plastic waste produced by rejected or unsuccessful prints. In response, scientists have investigated a range of filament waste recycling processes, including additive manufacturing, chemical recycling, and mechanical recycling. These techniques have the potential to cut the price of 3D printing materials while also reducing waste. In order to better understand the various methods for recycling filament waste in 3D printing, their advantages and disadvantages were taken in consideration for review.

Methods

In order to collect and evaluate data from pertinent scholarly articles and journals, we used a literature review technique in this work. The goal was to collect and compile the current information on 3D printer filament recycling techniques. We used a variety of internet resources, including Google Scholar, ScienceDirect, and ResearchGate, among others, to perform an extensive search to do this. To make sure we found pertinent material on the subject, we used a mix of keywords like "3D printing waste management," "recycle filament waste," and "reuse filament waste.“

We restricted our search to include only research and articles that were published within the previous ten years in order to ensure that we received up-to-date information. To ensure uniformity and understanding in language usage, we also limited our search to research that were written in English. These inclusion criteria helped us identify pertinent research and exclude those that weren’t.

Then, in order to discover the many techniques that have been suggested for recycling filament waste in 3D printing, we analyzed the papers that had been chosen. We analyzed each method's advantages and disadvantages as well as its likelihood of being widely adopted in the sector. We were able to consolidate the data and present an overview of the current body of knowledge on the subject, indicating areas that need more research, due to the review process.

Discussion/Conclusion

There are various solutions being investigated for the rising problem of filament waste in 3D printing. Some solutions to this issue include the use of novel materials, chemical recycling, grinding, and melting. To reduce waste and boost efficiency, a mix of these techniques can be required, thus it's vital to remember that. It will need further investigation and development to simplify the processes and increase user accessibility. Through ongoing development, we can make 3D printing a more ecologically responsible and sustainable technology.

Results

Waste filament may be recycled using a variety of techniques and used for 3D printing. These include:

1. Chemical Recycling:

Is the process of dissolving discarded plastic into its individual molecules so that they can be combined to make new goods or materials. Chemical recycling is helpful in the context of 3D printing for recycling filament waste, which might be complicated owing to various types of plastic or additives. Chemical recycling offers a technique to manufacture fresh, high-quality filament from waste, lowering the environmental effect of 3D printing by disassembling discarded filament into its fundamental building elements, such as PLA or ABS.

2. Shredding

With a device called a shredder, shredding is the act of breaking down big items or materials into smaller, easier-to-handle pieces or particles. Shredders usually shred materials, which might range from paper and cardboard to plastic and metal, using sharp blades or other cutting devices. Waste management frequently involves shredding because it lowers the volume of garbage and makes it simpler to transport and dispose of. Also, since they are smaller in size, shredded materials may be processed more readily during recycling.

3. Melting

Entails burning the discarded filament until it melts and becomes liquid by heating it to a high temperature. The impurities and pollutants are readily eliminated once they are in a liquid form. The molten substance is then given time to cool and solidify, creating a fresh filament suitable for 3D printing. As melting doesn't change the plastic's quality and may be used repeatedly without changing its characteristics, it is a useful technique for recycling used filament. The environmental effect of 3D printing may be lessened, and precious resources can be preserved by melting filament waste.

4. Re-extrusion:

Is a method used to recycle spent filament in 3D printing. In this procedure, the shredded filament waste is melted and turned into fresh filament. After melting, the filament is sent through a die to create a brand-new, consistent filament shape. Re-extrusion assists in turning waste materials into high-quality, useable filament, lowering the demand for fresh filament manufacturing and the negative effects of 3D printing on the environment.

5. Grinding

Is a method used to recycle spent filament in 3D printing. This procedure entails utilizing a grinding machine to reduce the spent filament to tiny particles. The ground filament can then be utilized as a raw material to make fresh filament or for other tasks like injection molding or 3D printing using recycled materials. For the purpose of manufacturing high-quality recycled filament, grinding helps to make the filament particles more uniform in size and consistency.

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A Deep Learning Approach to Diagnostic Classification of Prostate Cancer Using MR images

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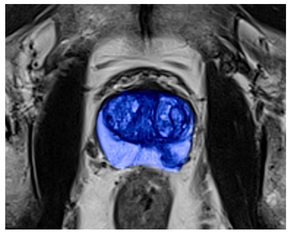


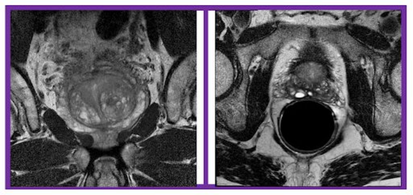
Purpose/Hypothesis

The second most prevalent and sixth most aggressive malignancy in men globally is prostate cancer. Prostate cancer is distinguished by uncontrolled (malignant) cell proliferation in the prostate gland. It is crucial to distinguish between patients with high-risk and low-risk prostate cancer because early detection of high-risk prostate cancer increases survival rates and accurate diagnosis prevents unnecessary treatments.

The objective of this research is to combine magnetic resonance imaging (MRI) data with pathology assessments from 679 patients with probable prostate cancer in order to construct an artificial intelligence (AI)-based model for early detection of prostate cancer. The MR images were labeled with prostate biopsy and a deep-learning model will be developed. We hypothesize that a DL model can distinguish between high-risk and low-risk cases accurately.

Method

Our dataset was derived from an open access database of medical images for cancer research called the Cancer Imaging Archive (TCIA), which supplies the medical research community with de-identified clinical images of cancer. Image acquisition entails acquiring high-quality MRI images of the prostate gland, utilizing specialized MRI sequences such as T2-weighted imaging or diffusion-weighted imaging. TCIA gathers, de-identifies, curates, and manages large amounts of oncology datasets



Aggressive Tumor Non-Aggressive Tumor

We present a CNN framework to analyze MRI images and to distinguish:

- High-risk tumor from Low- risk tumor

PyTorch and Google Colab are known to be popular tools for deep learning research and development. It was utilized in our study as it's a deep learning framework that provides a flexible and efficient platform for building, training, and deploying deep neural networks.

Figure 1. Method flowchart

This flowchart depicts our framework, which comprises (from left to right):

- Data extraction (From TCIA database) with available prostate MR images and their corresponding biopsy results, converting DICOM images to png using a python script/ training
- Evaluating a convolutional neural network (CNN) based model that predicts the risk level for each patient
- Receiver operating characteristic curves (ROCs) were used to assess the diagnostic performance of the model based on individual patient.

The images are divided into two groups (high risk and low-risk), and the CNN algorithm is trained for these two classes. Images are divided into three categories for each class: training, validation, and test groups. For this purpose, 552 of all images are allocated to the training group, and 127 images are devoted to validation and 112 for test sets, respectively.

In deep learning research, an 80/10/10 split of the dataset into training, validation, and test sets is usually known as the optimal ratio for data splitting, which sometimes varies based on the size and complexity of the dataset.

Results and Discussions

The parameters involved are the number of convolution layers, convolution kernels, pooling layers, the fully connected layer and the optimizer.(Figure 2)

We trained our model with a learning rate = 0.001, optimizer = Adam, and weight_decay = 0.0001, the best model was obtained after 20 iterations.

```
from torchsummary import summary
model=model.cpu()
summary(model, (3,150,150))
```

```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Conv2d-1          [-1, 12, 150, 150]             336
       BatchNorm2d-2          [-1, 12, 150, 150]              24
              ReLU-3          [-1, 12, 150, 150]               0
         MaxPool2d-4            [-1, 12, 75, 75]               0
            Conv2d-5            [-1, 20, 75, 75]           2,180
              ReLU-6            [-1, 20, 75, 75]               0
            Conv2d-7            [-1, 32, 75, 75]           5,792
       BatchNorm2d-8            [-1, 32, 75, 75]              64
              ReLU-9            [-1, 32, 75, 75]               0
           Linear-10                     [-1, 2]         360,002
================================================================
Total params: 368,398
Trainable params: 368,398
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.26
Forward/backward pass size (MB): 12.53
Params size (MB): 1.41
Estimated Total Size (MB): 14.19
----------------------------------------------------------------
```

Figure 2. The three layered CNN architecture.

The CNN algorithm developed comprises three layers with different parameters that work together to build the basic architecture. The primary layer is called the 2D Convolution Layer (Conv2D), and it creates a convolution kernel that convolves with the input layers to produce a tensor of outputs. In our model three Conv2D layers were used in order to increase the amount of features in each layer.

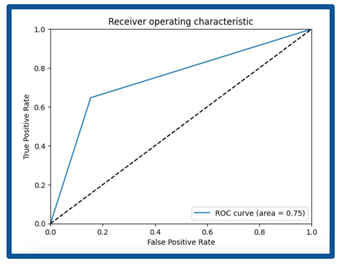


Figure 3. The ROC curve depicts the trained model's performance.

An AUC of 0.5 typically implies no discrimination (the ability to classify patients with and without the disease or condition based on the test), whereas an AUC of 0.7 to 0.8 is considered good. We can claim our model is good because the ROC (AUC) on our plot was 0.75 (Figure 6). Because of the fairly good ROC/AUC curve score, we may conclude that our predictions will be rather accurate. Our result displayed that the accuracy of the model for the blind test is 75%.

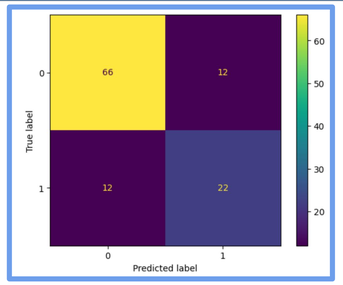


Figure 4. The confusion matrix (2 dimensional array) comparing predicted category labels to the true label.

The results were also displayed in a confusion matrix. This table provides a visual summary of how well the classification algorithm performed. While the algorithm can effectively categorize negative and positive classes (66 true negative instances and 22 true positive cases), a deeper look at the confusion matrix information and related photos revealed that our model has misclassified 24 cases.

Conclusion

In this study, we demonstrate the power of deep learning approaches for classification of Prostate Cancer utilizing MR images. We proposed an automated DL model that provided a data-driven and reproducible way to assess cancer risk from MR images and a personalized strategy to potentially reduce the number of unnecessary biopsies. By improving the parameters there can be improvements to the CNN model. The trained model and its associated data is made accessible in Google Colaboratory format (.https://colab.research.google.com/drive/1I-N9w2HkRyxLUtrxWS1cpiL4WH1XpCWi#scrollTo=xXJmaaRoT_nq)

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Number Theoretic Arithmetic Functions and Dirichlet Series

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Abstract

In this study, we will study number theoretic functions and their associated Dirichlet series. This study lay the foundation for deep research that has applications in cryptography and theoretical studies. Our work will expand known results and venture into the complex plane.

Introduction

The Dirichlet series are a certain kind of an infinite series that often arise in analytic number theory, and are important to analysing functions such as the Riemann zeta and Dirichlet L-functions. The Dirichlet series can be expressed as an infinite sum of an abstract function $f : \mathbb{N} \to \mathbb{C}$ multiplied by n^{-s}, where s is the exponentiated argument of the series.

$$\mathrm{D}_f(s) = \sum_{n=1}^{\infty} f(n)n^{-s} = f(1)+f(2)2^{-s}+f(3)3^{-s}+f(4)4^{-s}+\dots \quad (1)$$

This series has several very interesting and elegant properties that we will explore throughout the following exercises in greater depth.

Properties of Dirichlet Series

0.1 Convolution

The first interesting property that arises from Dirichlet series is their product $\mathrm{D}_f(s) \cdot \mathrm{D}_g(s)$. The Cauchy product

$$\left(\sum_{n=0}^{\infty} a_n\right) \cdot \left(\sum_{k=0}^{\infty} b_k\right) = \sum_{i=0}^{\infty}\sum_{k=0}^{i} a_k b_{i-k} \quad (2)$$

conveniently allows us to express our product as a sum of discrete convolutions,

$$\left(\sum_{n=1}^{\infty} f(n)n^{-s}\right) \cdot \left(\sum_{k=1}^{\infty} g(k)k^{-s}\right) = \sum_{i=1}^{\infty}\sum_{k=1}^{i} f(k)g(i-k+1)(k(i-k+1))^{-s}. \quad (3)$$

However, because this is quite a bulky representation of what we want to express, we want to perform a change of indices. Noting that k and $i-k+1$ are divisors of $k(i-k+1)$, setting them to d and $\frac{n}{d}$ respectively allows us to reformulate our equation as a sum over the divisors d of n

$$\mathrm{D}_f(s) \cdot \mathrm{D}_g(s) = \sum_{n=1}^{\infty} \sum_{d|n,\, d>0} f(d)g\left(\frac{n}{d}\right) n^{-s}, \quad (4)$$

where

$$\boxed{(f*g)(n) = \sum_{d|n,\, d>0} f(d)g\left(\frac{n}{d}\right)} \quad (5)$$

is the Dirichlet convolution.

0.2 Functions Within a Dirichlet Convolution

Studying various properties that come from taking Dirichlet convolutions of certain functions yields very interesting results. For instance taking the convolution of f with the Kronecker delta identity function $\iota(d) = \delta_{d1}$ returns f – hence the name "identity function",

$$\sum_{d|n,\, d>0} \iota(d) f\left(\frac{n}{d}\right) = f(n). \quad (6)$$

If we consider a function $P_k(n) = n^k$, it trivially follows that

$$\tau(n) = P_0(n) * P_0(n) = \sum_{d|n,\, d>0} 1, \quad (7)$$

which gives us the divisor counting function $\tau(n)$.

Let us define another function, σ_k, which will be called the divisor function, as

$$\sigma_k(n) = P_k(n) * P_0(n) = \sum_{d|n,\, d>0} P_k(d)P_0\left(\frac{n}{d}\right) = \sum_{d|n,\, d>0} d^k. \quad (8)$$

This divisor function adds all the divisors of n raised to an abstract power k. However, we can convert it into a product of prime powers. Because every number n can be expressed as a unique product of prime powers $\prod_{i=1}^{t} p_i^{e_i}$, its divisors are of the form $d := \left\{\prod_{i=1}^{t} p_i^{e_i-a_i} \mid a_i \in \mathbb{N}_0,\, e_i \geq a_i\right\}$. Thus, $\sigma_k(n)$ is simply the sum

$$\sigma_k(n) = \sum_{P\left(a_i \in \mathbb{N}_{[0,e_i]}\right)} \prod_{i=1}^{t} p_i^{(e_i-a_i)k} = \sum_{P\left(s \in \mathbb{N}_{[0,e_i]}\right)} \prod_{i=1}^{t} p_i^{sk}, \quad (9)$$

where $P(s)$ denotes possible permutations. Utilising a property of products nested within summations,

$$\prod_{i=1}^{t}\sum_{n=1}^{k} a_{i,n} = \sum_{P(n\in A)} \prod_{i=1}^{t} n, \quad \{a_{i,n} \in A\}, \quad (10)$$

our divisor function becomes

$$\sigma_k(n) = \prod_{i=1}^{t}\sum_{s=0}^{e^i} p_i^{sk}. \quad (11)$$

Noting that the nested summation is a finite geometric series allows to be $\sigma_k(n)$ to be expressed as the product

$$\sigma_k(n) = \prod_{i=1}^{t} \frac{1-p_i^{k(1+e_i)}}{1-p_i^k}. \quad (12)$$

Notable Dirichlet Series

0.3 The Riemann Zeta Function

Perhaps the most famous Dirichlet series is the Riemann zeta function,

$$\zeta(s) = \sum_{n=1}^{\infty} n^{-s}, \quad \Re(s) > 1, \quad (13)$$

which is similarly expressible as

$$\zeta(s) = \sum_{n=1}^{\infty}\prod_{i=1}^{\infty} p_i^{-se_{i,n}}. \quad (14)$$

Equation (10) allows us to switch the product and summation operators as shown,

$$\zeta(s) = \prod_{i=1}^{\infty}\sum_{n=0}^{\infty} p_i^{-sn} = \prod_{p\,\text{prime}}\sum_{n=0}^{\infty} p^{-sn}. \quad (15)$$

Since the inner sum is a geometric series, it follows that

$$\zeta(s) = \prod_{p\,\text{prime}} \frac{1}{1-p^{-s}}. \quad (16)$$

This also acts as the proof of the existence of infinitely many primes, as the original Dirichlet series famously diverges if $\Re(s) = 1$.

By identical means, it can be shown that for a multiplicative function f,

$$\boxed{\mathrm{D}_f(s) = \prod_{p\,\text{prime}} \frac{1}{1-f(p)p^{-s}}.} \quad (17)$$

0.3.1 The Möbius Function

If we take the reciprocal of the Riemann zeta function, $\frac{1}{\zeta(s)} = \prod_{p\,\text{prime}}\left(1-p^{-s}\right)$, its Dirichlet series can be found by expanding this product as

$$\frac{1}{\zeta(s)} = 1 - p_1^{-s} - p_2^{-s} - \dots + p_1^{-s}p_2^{-s} + p_2^{-s}p_3^{-s} + p_1^{-s}p_3^{-s} + \dots$$
$$- p_1^{-s}p_2^{-s}p_3^{-s} - p_2^{-s}p_3^{-s}p_4^{-s} - \dots = 1 + \sum_{k=1}^{\infty}(-1)^k \prod_{P(i\in\mathbb{N},|i|=k)} p_i^{-s}, \quad (18)$$

where i is never duplicated in a permutation. This directly implies that $\frac{1}{\zeta(s)} = \sum_{n=1}^{\infty}\mu(n)n^{-s}$, where $\mu(n)$ is the Möbius function, defined as

$$\mu(n) = \begin{cases} 0 & \text{if } n \text{ is divisible by a squared prime factor} \\ 1 & \text{if } n \text{ is a square-free positive integer} \\ & \text{with an even number of prime factors} \\ -1 & \text{if } n \text{ is a square-free positive integer} \\ & \text{with an odd number of prime factors} \end{cases}. \quad (19)$$

0.3.2 Euler's Totient Function

Another interesting arithmetic function is Euler's totient function, which counts the number of integers less than n that are coprime to it. The most natural way to formulate such function is to subtract the number of integers that are multiples of each unique prime divisor of n, and that is done by the equation

$$\varphi(n) = n \prod_{d|n,\, d>0}\left(1-\frac{1}{p}\right). \quad (20)$$

Multiplying this out yields $1 - \frac{1}{p_1} - \frac{1}{p_2} - \dots + \frac{1}{p_1p_2} + \frac{1}{p_2p_3} + \dots$, which leads to the formulation $\varphi(n) = \sum_{d|n,\, d>0}\frac{\mu(d)}{d}$. An elegant property of this function due to Gauss is that

$$\sum_{d|n,\, d>0}\varphi(d) = n. \quad (21)$$

To show why it is true, consider a set $S_d = \{1 \leq k \leq n \mid \gcd(k,n) = d\}$. For each divisor d, there will be exactly $\varphi\left(\frac{n}{d}\right)$ elements in S_d. Because each element appears exactly once in some S_d, it is true that $\sum_{d|n,\, d>0}|S_d| = \sum_{d|n,\, d>0}\varphi\left(\frac{n}{d}\right) = n$, which proves the theorem.

0.4 The Dirichlet Eta Function

Another notable Dirichlet series is very closely related to the Riemann zeta function, namely – the Dirichlet eta function,

$$\eta(s) = \sum_{n=1}^{\infty}(-1)^{n-1}n^{-s}, \quad \Re(s) > 0. \quad (22)$$

We may actually show this close relationship by observing that

$$\sum_{n=1}^{\infty}(-1)^{n-1}n^{-s} + \sum_{n=1}^{\infty}2(2n)^{-s} = \sum_{n=1}^{\infty}n^{-s}$$
$$\Rightarrow \eta(s) = \left(1-2^{1-s}\right)\zeta(s), \quad (23)$$

Extending Dirichlet Series to the Complex Plane

Making use of Euler's formula $e^{i\theta} = \cos\theta + i\sin\theta$, we can decompose a Dirichlet series into its real and imaginary parts,

$$\mathrm{D}_f(\sigma+bi) = \sum_{n=1}^{\infty} f(n)\cos(b\ln n)n^{-\sigma} + i\sum_{n=1}^{\infty} f(n)\sin(b\ln n)n^{-\sigma}. \quad (24)$$

This allows us to analyse these parts separately, as seen in this graph of the real and imaginary parts of the Riemann zeta function of $\frac{1}{2}+bi$ approximated by the first 10,000 terms of the series,

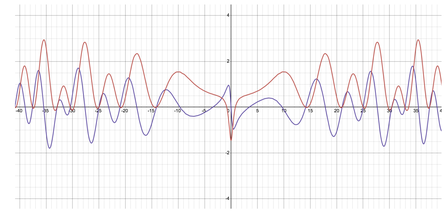

Figure 1: $\Re\left[\zeta\left(\frac{1}{2}+bi\right)\right], \Im\left[\zeta\left(\frac{1}{2}+bi\right)\right]$

As can be seen, the real and imaginary parts intersect each other at 0 throughout the graph. The question of whether this only happens at $\sigma = \frac{1}{2}$ for $\Re(s) > 0$ is an unsolved conjecture in mathematics first proposed in 1859 known as the Riemann hypothesis.

Acknowledgements

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FABRICATION OF MONOLAYERED TMX MATERIALS FOR QUANTUM CONNECTORS

Pedro Sotomayor

Prof. Vitaliy Dogoran

Abstract

Quantum computers are the next big thing. They use information stored as qubits to perform exceedingly complex calculations that normal computers can't, in a fraction of the time. They use the principle of quantum mechanics to model a superposition of states, going even further than a traditional 0 and 1.

However, even with their edge over normal computers, they still face similar drawbacks. They are still limited by the size of the information they can process. With normal computers, you can compensate by making a super-computer. But unlike with conventional computers, you can't just hook quantum computers together to make a quantum super-computer. Different quantum computers use different physical principles to function. One could use low-temperature superconductors, while another could use optics. The usage of different principles renders the computers incompatible with each other and presents a hurdle for upscaling and tackling more advanced computations.

In response to this, we propose to make a quantum connector, capable of receiving electrical input from one quantum computer and subsequently converting it to an optical signal that can be read by another quantum computer.

The device will use TMX semiconductors, specifically the materials WS_2 and $MoSe_2$. After exfoliating each of the materials in a careful process using special scotch tape, we will deposit them onto a silicon chip and subsequently fabricate contacts to the flakes using electron-beam lithography. We will be using TMX materials specifically for their ability not only to operate at low temperatures but up to room temperature as well.

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Methods

- Materials and supplies are gathered.
- The exfoliation process is optimized. Initial samples are produced.
- The series of good-quality samples with WS2 and MoSe2 monolayers are produced.
- The chips are coated with resist and the electron-beam lithography is used to write the electrical contacts to the TMX flakes followed by the metal deposition.
- The electrical and optical measurements are conducted on the samples.

Where we are now

At this point in time, we are currently engaged with the exfoliation method in order to produce our samples of WS_2 and $MoSe_2$.

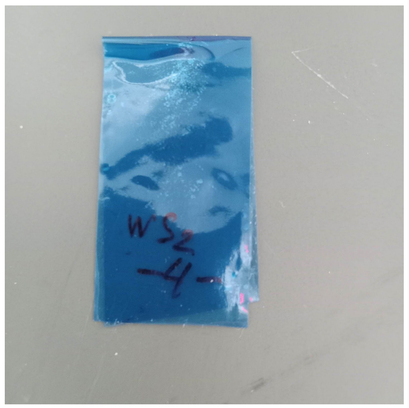
The exfoliation process can be described as following:

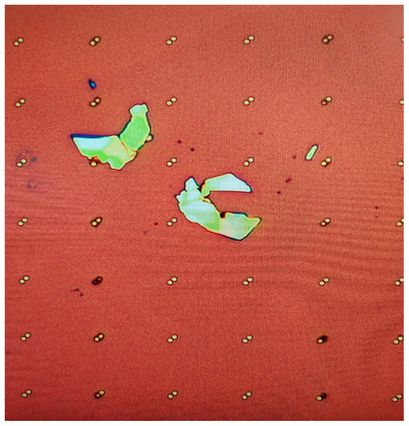
- TMX material is placed between two ribbons of specialized scotch tape.
- The two pieces of scotch tape are pulled apart.
- A new scotch tape is placed on top of the remaining TMX and the process is repeated, thus reducing the number of layers down to a single monolayer.
- Double-sided PDMS film is attached to a glass slide. A scotch tape with a monolayer of the TMX is pressed to the PDMS film.
- The TMX flake should stick to the PDMS and the scotch tape is then removed.
- The glass slide is flipped and fixed at a small angle (we did approximately 1˚) to the horizontal. Then, it is lowered carefully to bring the PDMS film in contact with the silicon chip.
- The silicon chip is heated to a temperature between 80˚C and 100˚C. We chose 90˚C.
- The glass slide is kept pressed to the chip for one to three minutes.
- The glass slide is slowly lifted away from the silicon chip. The TMX is subsequently left behind on the chip.

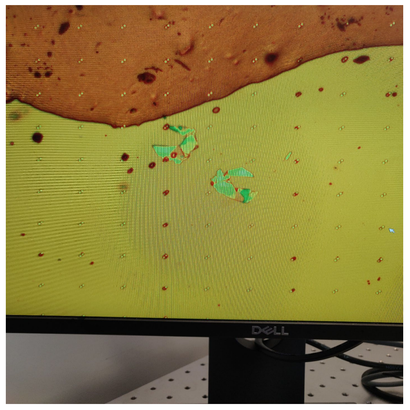
Currently we managed to procure two fine samples of TMX material and managed to deposit them onto a single chip.

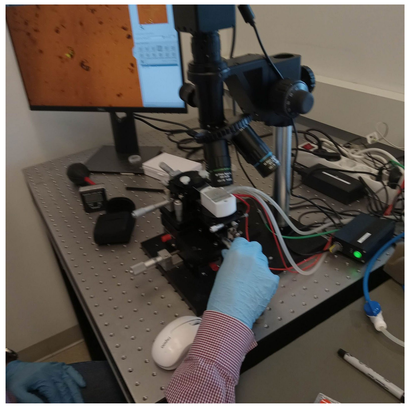
Going Forward

After we have acquired a number of satisfactory samples, we then move on to coating and electron beam lithography to write the electrical contacts. One difficulty we've run into is the integrity of our samples. Treating the chips in the coating, we've found that there is a small chance that the TMX material can be lost in the process, as there may have been organic residue left on the chip. We will going forward be using plasma cleaning, in an effort to clean the chip better before exfoliation.









Acknowledgments

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Special thanks to Prof Vitaliy for his guidance, and Lianys Feliciano for pushing me into this.

Investigation of Degradation Rates of Poly(ethyleneglycol) diacrylate (PEGDA) for Engineered Scaffolds

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Abstract

Tissue Engineering has been studied to develop tissues as an alternative approach to the organ regeneration. Successful artificial tissue growth in regenerative medicine depends on the precise scaffold fabrication as well as the cell-cell and cell-scaffold interaction. Scaffolds are extracellular matrices that guide cells to grow in 3 dimensions to enable the tissue to grow or hold a certain desired shape while promoting cell growth. Cell-seeded scaffolds must be implanted to the damaged tissues to enable tissue regeneration. Scaffolds' mechanical properties and porosities are the two main scaffold fabrication parameters as the scaffolds must be able to hold the pressure due to the surrounding tissues after the implantation process. In this research, scaffolds are fabricated by photolithography and different concentrations of Poly(ethylene glycol) Diacrylate (PEGDA) which is a biocompatible and biodegradable material is used as a fabrication material. This material is typically in the form of a hydrogel. After the scaffolds are fabricated, they are placed in the stir plate, and they are weighted every hour to see the degradation rate. This preliminary research showcases that degradation rate of the PEGDA-based photopolymerized scaffolds can be altered with PEGDA concentration.

Introduction

There are 2 classes of plastics that exist, first we have the thermosets which are plastics that burn when a heating element is introduced to them. The second type of plastics are thermoplastics which are plastic that liquefy when a heating element is introduced, and they can be recycled. The goal is to find out if we can speed up the degradation of both classes of plastics or to at least be able reshape the thermosets using the curing agent that solidifies PEGDA.

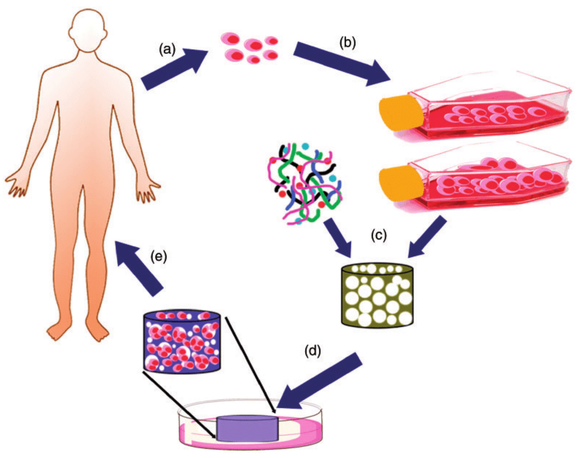


Fig 1. Tissue Engineering Scaffold Fabrication and Cell Culture

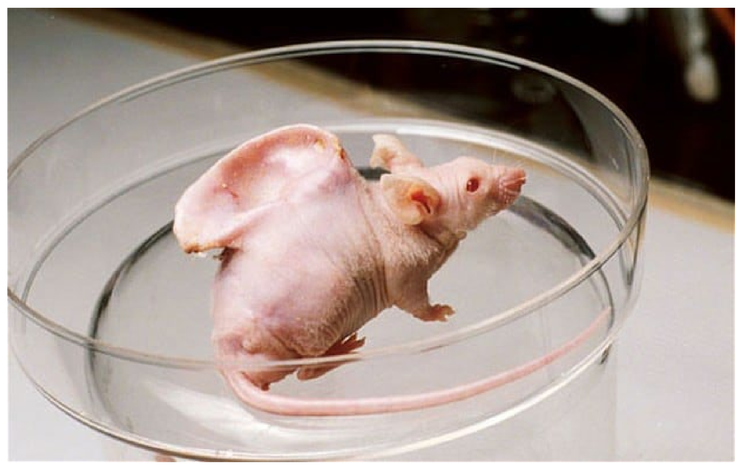


Fig 2. Tissue Engineering Application

Methods

Mold Design and Fabrication

To make the PEGDA samples first we make some mold so that the solution can take a certain shape as it solidifies, and that shape is a cylinder so that we can use it for future testing. Another problem that needs to be dealt with is the need for a strong blacklight for the solution to solidify. That means that the mold had to have some visibility to allow light to go through and for that another biodegradable material known as PDMS was used.



Fig 3. 3D printed Negative Mold and Fabrication Materials

Results

Making PEGDA

To make a PEGDA scaffold we make 2 separate solutions and combine them. The first is the PEGDA which is mixed with water to change the durability and hardness of the final solution. We then use 2.5mL for the solution. For the second part combine 1mL of 1-Vinyl-2-Pyrrolidone and 0.1 g of 2-Dimethoxy-2-phenylacetophenone. To combine both solutions we use the entirety of the first solution and mix it with 0.3 mL of the second soliton. With that the solution is ready for the black light. As shown in fig 3.


Fig 4. 3D Photopolymerized PEGDA before and after the compression test

Conclusion

If this method works, then we can recycle the number of thermosets that burn when they are heated and remold then using the catalyst used in the solidification process of the PEGDA.

Acknowledgement

The author acknowledge the research support from Dean's office, Research Scholars' funds and SET-CUNY.

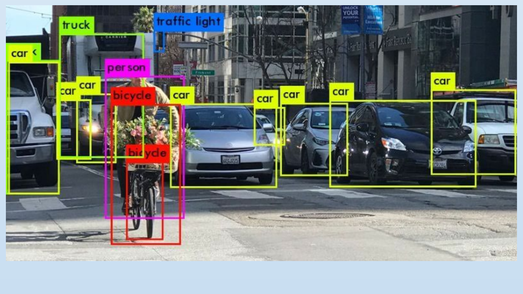
Image Recognition

Zhenghua Li

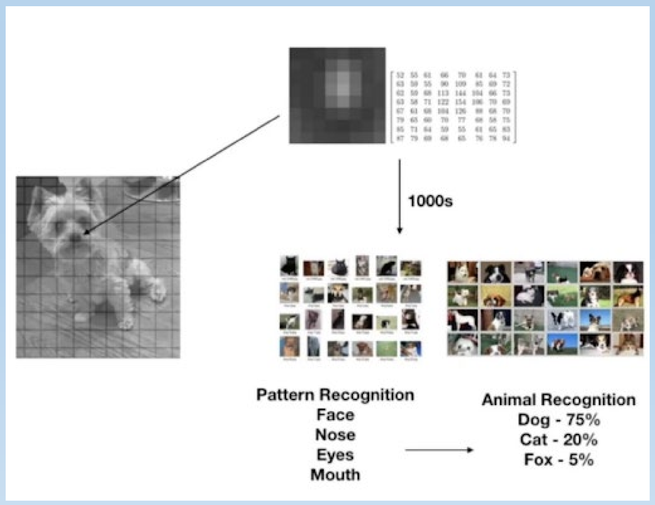
Mentor: Marcos Pinto

Abstract

This project consists of building an Android app which can recognize images which means if you show the image of dog it is going to tell you the breed of dog and if you show any fruit is it going to tell you which fruit it is. Similarly, it can predict 1000 categories. It also show how to deploy deep learning model on the android app by using android studio. Specifically, the app makes use of TensorFlow Lite models.



The difficulty of this project is how to make the computer understand the 3d world base on 2d image. Base on our perception, human can only see the 2D image in the 3D world. Same to android cell phone, we need to use code and train the model to let the model understand the 2D image of the object represent in the 3D world. Therefore, extra information for the object is require. Other than the shape, which is the easiest element that computer can detect, color, texture, and more also become crucial elements for our android program to recognized the object.



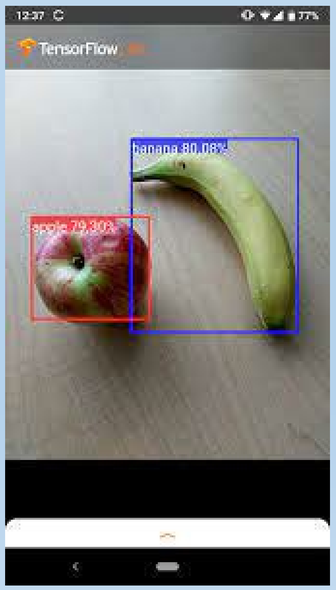
Materials

To make the android program recognize the object correctly, the TensorFlow Lite Models need to be downloaded, and a personal computer that installed TensorFlow Lite and android studio with java package.

TensorFlow Lite

Methodology

The project use TensorFlow Lite model to classify the object through android studio. Since TensorFlow Lite have pre-trained, which the project only need to deploy the model in to our program so it can run smoothly in android studio program.



Result

After the testing, the program shows the accuracy around 75% with total 1,145 images with various objects, which fall into the similar accuracy of TensorFlow Lite have tested.

Conclusion

Unlike other models have higher accuracy, even though TensorFlow Lite have lower accuracy, since we need to deploy it on the mobile applications, power efficiency is critical. A better model means more power consumption. After balance, the accuracy, and power efficiency for android, TensorFlow Lite is good options for mobile application developer, if they want image recognition features.

Acknowledgements

I would like to thank my mentor provide me such excited project to have a hand on the new tech, and also thanks to ESP for the great opportunity to encourage me to explore new area.

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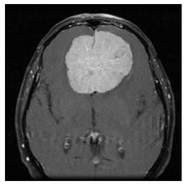
Brain Tumor Detection and Classification from MRI using Convolutional Neural Network



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Hypothesis

Brain tumors are the abnormal growth of cells within the brain or surrounding areas. Brain tumors are the second leading cause of cancer death. Biomedical applications led to new advances that allow doctors to diagnose patients accurately and effectively; MRI images are used to help to create diagnoses or treatment plans for patients based on the findings of these images. The application of deep neural networks has been changing the world of biomedical sciences.

The goal of this project is to create a dataset that will classify brain tumor images: non-tumor vs brain tumor. By creating a CNN, the model will classify if the patient has a tumor or not based on the MRI images. We present a new convolution neural network model (CNN) architecture for brain tumor detection. The developed model is simpler than already-existing pre-trained models, and it will be trained and tested on magnetic resonance images (MRI).

Methods

Using the Kaggle Database, we downloaded public MRI images with normal vs brain tumor MRI. Images were split in 80 train/10 validation/10 test set.

We created a dataset called BRAIN to determine:

- Patient brain status

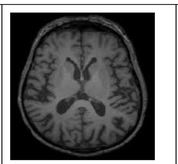
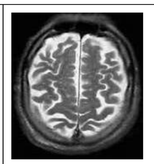
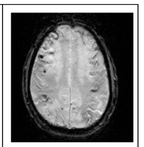
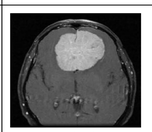
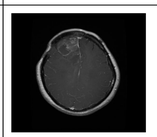
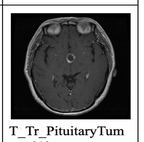
NORMAL MRI	 N_NoTumor10.png	 N_NoTumor93.png	 N_NoTumor76.png
TUMOR MRI	 T_Tr_MeningiomaTumor_2.png	 T_Tr_GliomaTumor_670.png	 T_Tr_PituitaryTumor_640.png

Figure 1. Samples of the dataset used

Public MRI datasets are used for training the proposed CNN model. The first brain tumor dataset is collected from Kaggle. The Kaggle dataset has 963 images that were used in this project; 636 brain tumor MRI and 327 normal MRI.

Number of Images in Dataset

TRAIN- 260 Nontumor MRI/580 Tumor MRI

VALIDATION- 31 Nontumor MRI/ 31 Tumor MRI

TEST- 25 Nontumor/25 Tumor MRI

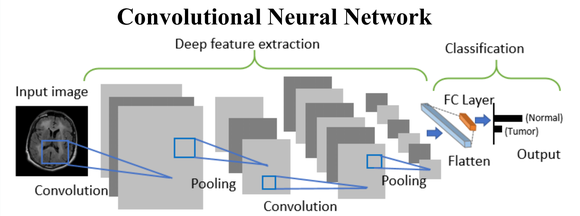


Figure 2: Sample of CNN architecture

CNN architecture works with the hidden layers and features that are involved within the model.

- Input layer- dataset that will be placed within the model to get a classification score of "Normal vs Tumor".
- Pooling layer- algorithm learns the different features of the CNN model, consolidates the features learned.
- Convolution layer- sets filters, different parameters (learning rate, learning optimizers weight decay) process is repeated based on how many layers the algorithm is built with until the images are classified

Image Source: (Kang et al., 2021))

```
#Model training and saving best model

best_accuracy=0.0

for epoch in range(num_epochs):

    #Evaluation and training on training dataset
    model.train()
    train_accuracy=0.0
    train_loss=0.0

    for i, (images,labels) in enumerate(train_loader):
        if torch.cuda.is_available():
            images=Variable(images.cuda())
            labels=Variable(labels.cuda())

        optimizer.zero_grad()

        outputs=model(images)
        loss=loss_function(outputs,labels)
        loss.backward()
        optimizer.step()


        train_loss+= loss.cpu().data*images.size(0)
        _,prediction=torch.max(outputs.data,1)

        train_accuracy+=int(torch.sum(prediction==labels.data))
```

Figure 3: Training the Model

The script [Figure 3] shows:

(a) The model is being trained to use specific parameters and the epoch size of 25, to minimize the train loss and ensure that the train accuracy is increasing as it is repeatedly trained.

(b) By training the model, in each epoch, the dataset produced a train loss, train accuracy and test loss and test accuracy which helps the algorithm validate the data being inputted.

```
#CNN Network

class ConvNet(nn.Module):
    def __init__(self,num_classes=2):
        super(ConvNet,self).__init__()

        #Output size after convolution filter
        #((w-f+2P)/s) +1

        #Input shape= (256,3,150,150)

        self.conv1=nn.Conv2d(in_channels=3,out_channels=12,kernel_size=3,stride=1,padding=1)
        #Shape= (256,12,150,150)
        self.bn1=nn.BatchNorm2d(num_features=12)
        #Shape= (256,12,150,150)
        self.relu1=nn.ReLU()
        #Shape= (256,12,150,150)

        self.pool=nn.MaxPool2d(kernel_size=2)
        #Reduce the image size be factor 2
        #Shape= (256,12,75,75)


        self.conv2=nn.Conv2d(in_channels=12,out_channels=20,kernel_size=3,stride=1,padding=1)
        #Shape= (256,20,75,75)
        self.relu2=nn.ReLU()
        #Shape= (256,20,75,75)
```

Figure 4: CNN Architecture built

[Figure 4]We used the train/validation/test that are not identical and contain different images by putting random images into different folders.

In order to deploy the central architecture, we used:

- Python programming language
- Different hypermeters
- three layered neural network (not pictured)

The script demonstrates:

(a) this script shows the Convolutional Neural Network that was created to define the parameters for the image input. By using specific parameters, the model is being trained to produce the output positive or negative which represents the 2 classes shown in the algorithm.

```
checkpoint=torch.load("best_checkpoint.model")
model=ConvNet(num_classes=2)
model.load_state_dict(checkpoint)
model.eval()
```

```
ConvNet(
  (conv1): Conv2d(3, 12, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn1): BatchNorm2d(12, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (relu1): ReLU()
  (pool): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (conv2): Conv2d(12, 20, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (relu2): ReLU()
  (conv3): Conv2d(20, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (bn3): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
  (relu3): ReLU()
  (fc): Linear(in_features=180000, out_features=2, bias=True)
)
```

Figure 5: CNN Image Conv Net Model Selection

[Figure 5]By running the model, the algorithm was able to select the best model which included 3 Conv2d layers, 2 ReLU activation functions and a pooling layer of MaxPool2d. This worked best based on the class size.

Results and Discussions

```
Epoch: 0 Train Loss: tensor(0.0181) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 1 Train Loss: tensor(0.0166) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 2 Train Loss: tensor(0.0178) Train Accuracy: 0.9988066825775657 Validation Accuracy: 0.9166666666666666
Epoch: 3 Train Loss: tensor(0.0182) Train Accuracy: 0.9988066825775657 Validation Accuracy: 0.9
Epoch: 4 Train Loss: tensor(0.0190) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 5 Train Loss: tensor(0.0172) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 6 Train Loss: tensor(0.0164) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 7 Train Loss: tensor(0.0171) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 8 Train Loss: tensor(0.0177) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 9 Train Loss: tensor(0.0176) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 10 Train Loss: tensor(0.0180) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 11 Train Loss: tensor(0.0169) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 12 Train Loss: tensor(0.0162) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 13 Train Loss: tensor(0.0159) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 14 Train Loss: tensor(0.0179) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 15 Train Loss: tensor(0.0185) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 16 Train Loss: tensor(0.0169) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 17 Train Loss: tensor(0.0188) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 18 Train Loss: tensor(0.0166) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 19 Train Loss: tensor(0.0153) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 20 Train Loss: tensor(0.0170) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 21 Train Loss: tensor(0.0169) Train Accuracy: 1.0 Validation Accuracy: 0.9
Epoch: 22 Train Loss: tensor(0.0163) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 23 Train Loss: tensor(0.0159) Train Accuracy: 1.0 Validation Accuracy: 0.9166666666666666
Epoch: 24 Train Loss: tensor(0.0178) Train Accuracy: 1.0 Validation Accuracy: 0.8833333333333333
```

Figure 6:Training Set Results

The highest results for the training accuracy that was obtained was a 1.0 and the validation accuracy was a 0.91. These are great results that were obtained by the training and validation set throughout the algorithm.

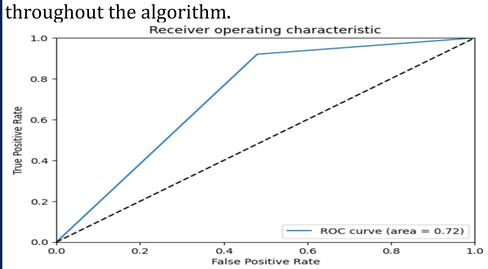


Figure 7: ROC CURVE

Based on the ROC obtained, the model performs with a 72% accuracy. The test set accuracy falls below training accuracy which is expected based on the blind test set.

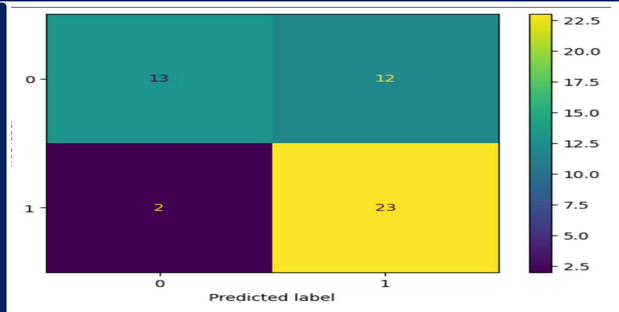


Figure 8: Confusion Matrix for Test Set

Confusion matrix is a table with prediction summary in matrix form. It shows the number of accurately predicted values and inaccurately predicted per class. The matrix can be interrupted as 13 true positive cases and 23 true negative cases. The algorithm misclassified 14 cases, 12 false positive cases and 2 false negative cases.

```
pred_dict
{'N_2_NoTumor_89.png': 'NoTumor',
 'N_NoTumor33.png': 'Tumor',
 'N_2_PituitaryTumor_628.png': 'Tumor',
 'N_Meningiomatumor_2.png': 'Tumor',
 'N_NoTumor_1.png': 'NoTumor',
 'T_YesTumor02.png': 'NoTumor',
 'N_NoTumor34.png': 'NoTumor',
 'N_NoTumor_1.png': 'NoTumor',
 'T_Tr_PituitaryTumor_784.png': 'Tumor',
 'N_NoTumor_2.png': 'NoTumor',
 'T_Tr_PituitaryTumor_795.png': 'Tumor',
 'T_GliomaTumor_8.png': 'Tumor',
 'T_MeningiomaTumor_2.png': 'Tumor',
 'N_2_PituitaryTumor_22.png': 'Tumor',
 'T_YesTumor03.png': 'Tumor',
 'T_Tr_PituitaryTumor_744.png': 'Tumor',
 'N_NoTumor_6.png': 'Tumor',
 'N_NoTumor31.png': 'NoTumor',
 'T_YesTumor01.png': 'Tumor',
 'N_2_NoTumor_71.png': 'NoTumor',
 'N_NoTumor30.png': 'Tumor',
 'N_NoTumor_13.png': 'NoTumor',
 'T_Tr_PituitaryTumor_740.png': 'Tumor',
 'N_NoTumor_3.png': 'NoTumor',
 'T_Tr_PituitaryTumor_783.png': 'Tumor',
 'N_2_PituitaryTumor_164.png': 'Tumor',
 'T_MeningiomaTumor_3.png': 'Tumor',
 'T_GliomaTumor_78.png': 'Tumor',
 'T_YesTumor04.png': 'Tumor',
 'N_2_PituitaryTumor_638.png': 'Tumor',
 'N_NoTumor_2.png': 'NoTumor',
 'N_2_NoTumor_103.png': 'NoTumor',
 'N_NoTumor_4.png': 'Tumor',
 'T_GliomaTumor_24.png': 'Tumor',
 'N_NoTumor_18.png': 'Tumor',
 'T_YesTumor05.png': 'Tumor',
 'T_GliomaTumor_76.png': 'Tumor',
 'N_2_NoTumor_76.png': 'NoTumor',
 'T_GliomaTumor_66.png': 'Tumor',
 'T_MeningiomaTumor_17.png': 'Tumor',
 'N_2_NoTumor_98.png': 'Tumor',
 'T_Tr_PituitaryTumor_795.png': 'Tumor',
 'T_GliomaTumor_20.png': 'Tumor',
 'T_GliomaTumor_75.png': 'Tumor',
 'T_GliomaTumor_3.png': 'Tumor',
 'N_2_PituitaryTumor_21.png': 'Tumor',
 'N_NoTumor32.png': 'Tumor',
 'T_GliomaTumor_18.png': 'NoTumor'}
```

Figure 9: 50 Classified Images

CNN classified these images and this is the data that relates to the confusion matrix. There are 14 images that were classified inaccurately while there are 36 images classified within the correct class.

Conclusions

In this study, it is shown how deep learning algorithms such as CNN can be used to classify brain tumors vs non-tumor MRIs. By improving the parameters such as the learning optimizer, weight loss and learning rate and gathering more normal MRI for the database, there can be improvements to the accuracy of the trained CNN model. This algorithm can be used within the health care or research settings after these parameters are improved for training purposes.

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[4]

Machine Learning Galaxy Morphology

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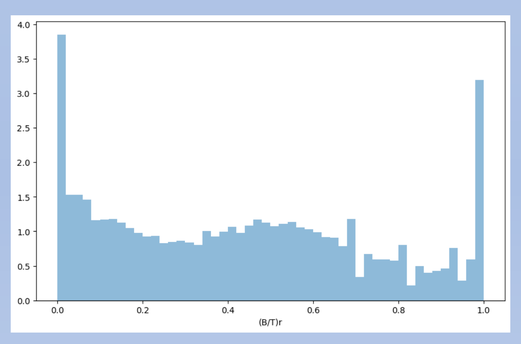
Abstract

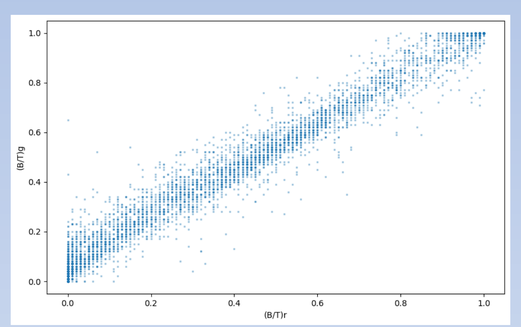
The light profiles of galaxies can be largely fit by an exponential disk and an exponential to the 4th power bulge (galaxies can be 100% one or the other). However, the computational cost of performing such a fit is rather expensive, which has led many scientists to instead perform a single component fit to galaxy light profiles. With a single component fit the exponential is raised to a free parameter. We study the distributions of these fitting parameters and their relationships. We then use machine learning to try and predict the bulge-to-total ratio from the other properties.

Method

When starting the project, we had to ensure that the data file that was being imputed could be read by the panda's library in python. Afterwards we examined what each column meant in relationship to the galaxy and since we are applying machine learning, we had to get rid of any columns containing strings or constants. Our target value was the bulge-to-total ratio in the r band feature which meant that we had to drop any g band features. These two features measure the same thing using different color bands. We attempted to find any strong relationship between the target values and other features by graphing. Lastly, we applied a linear regression model, represented by model(x,y), with the x variable representing an array of 15 features and 4994 instances and our y variable being the target values. Lastly, we cross validated our data to ensure our model can predict “new” data.



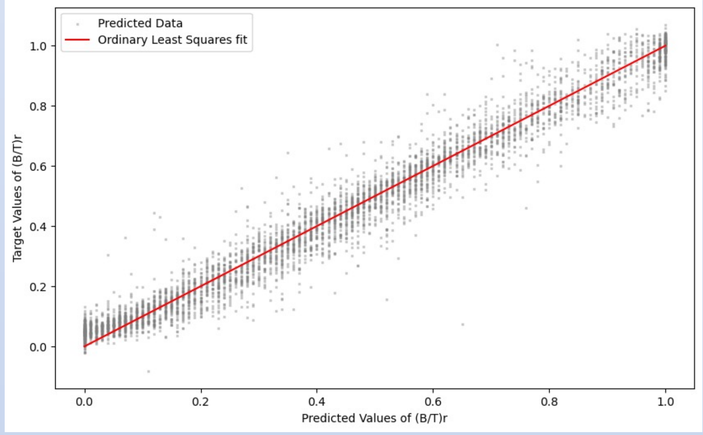
The figure to the left shows the distribution of bulge-to-disk ratios.



The figure to the left shows the strong relationship between the r and g band bulge-to-disk ratio.

Results

Below we have plotted the target values (bulge-to-total ratio of the r band) vs. the predicted values from the linear regression model. After cross validating and splitting our data into 5 groups, our model was able to obtain a coefficient of determination value of 0.966 for the test score with a standard deviation of 0.03. We also obtained a training score of 0.967 with a standard deviation of 0.001.



The figure to the left shows the Target values vs. Predicted values from the model. We can see a strong relationship between the two which is represented by a linear line of slope 1.

Conclusion

We can conclude that with the data frame that we have created and the remaining columns (excluding the g band measurement features), we obtained a linear regression model that can predict the target values with a high coefficient of determination. This means that our goal was successful in creating a model that can inexpensively predict the bulge-to-total ratio from other properties after refining data to suit our model.

Possible Next Steps

Due to time constraints, we were only able to apply one type of machine learning algorithm. One of the possible next steps for this project could include using different metrics such as the mean square error, and the root mean square to compare the different models we have implemented. Another possible route is to include more complex algorithms like Gradient descent and compare it with the linear regression models that we have created. We should take into consideration that this is a supervised machine learning algorithm, which means we could test how this model does when new data is introduced to further test its success.

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DRIVING FORCES BEHIND CHOOSING RADIOLOGICAL TECHNOLOGY AS A CAREER

Mentor : Professor Zoya Vinokur

Created by Peber DeJesus, Tatiana Ryzhakova and Mikhail Kun

Abstract

Healthcare covers a wide range of services. One aspect is medical imaging and all its various modalities, such as radiographic technology, ultrasound, CT/MRI, and mammography. We would like to explore the reasoning behind how people choose radiographic technology as a career. Was it a first choice or a career change? The perfect career is hard to choose. Many people change their careers in mid-age life. Radiology technology is a unique career that has many pathways after completing school and passing the licensing exam. It allows for cross-training into other modalities and administration. The pros and cons will be described on making a career choice where people tend to come from different jobs and degrees to start all over again to apply for a medical imaging modality.

Introduction

People's hardest decision is choosing the career they want. Radiology technology is one of the careers that people find an option to choose from, no matter what other job or major they come from. People from all over choose to become radiology technologist, but what is the driving forces that's making them choose this career? Radiology technologist contains is pros and cons as any other career.

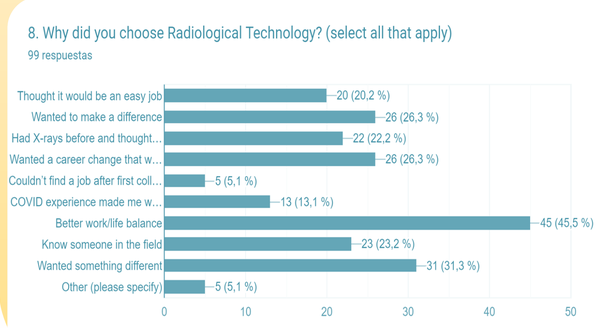
Methodology

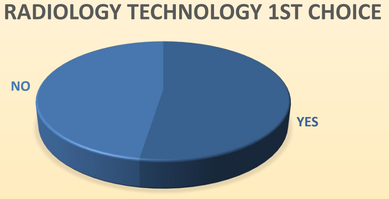
In order to do an analysis of the quantity of people that had come from other jobs or changed their careers to start a degree in medical imaging, Surveys are going to be disseminated. The use of surveys is the most ideal applications for this research studies because of their high reliability. Surveys are going to be widely spread to student in which include graduates in 2023 and 2024.

After Google surveys are disseminated, an analysis will be made by using Excel and to compare data. Data will be represented on charts to be created as graphs. Data will be use in order to be evaluated and compare to encountered final results.

Results

Before becoming a Radiologic Technology, some people already had another career choice on their mind, or their major was another option. 52.5% of the respondents were chosen by people that radiology technology was not their first career choice. Radiologic technology has its pros and cons. The survey that was disseminated included its pros and cons options.





The survey was responded by students answered that they choose radiologic technology primarily because of the better work/life balance (45.5% of responses). One of the main benefits of radiology technology is the work balance that it brings to an individual. When becoming a radiology technology program, people have to work either part-time or full-time. When working in hospitals, some rotations such as the ER include the 12-hour shift if available. Hours are really flexible, and it depends on the employee what time is best for them.

The option in second place chosen by students was wanting something different (or a life change) (31.3% of responses). People look for a life-changing phase of life. No matter what major or job they have had before, they choose to start over again and major as a radiology technologist.

Conclusion

Overall, Career choice must be an accurate decision for an individual because this decision will become part of a person for the rest of their life. Every career has its pros and cons.. Some people called Radiology technologist a basic "Button pusher" but that's is not what makes a radiology technologist. Even though it may look like an easy job, people need to have educational skills background in order to mandate and control ALARA policy on a patient. Driving forces from all over the united states is making them choose becoming radiology technology but all the pros and cons to see if they the right fit.

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DOORFRONT.ORG

Said Naqwe; Mentor: Professor Patrick Slattery

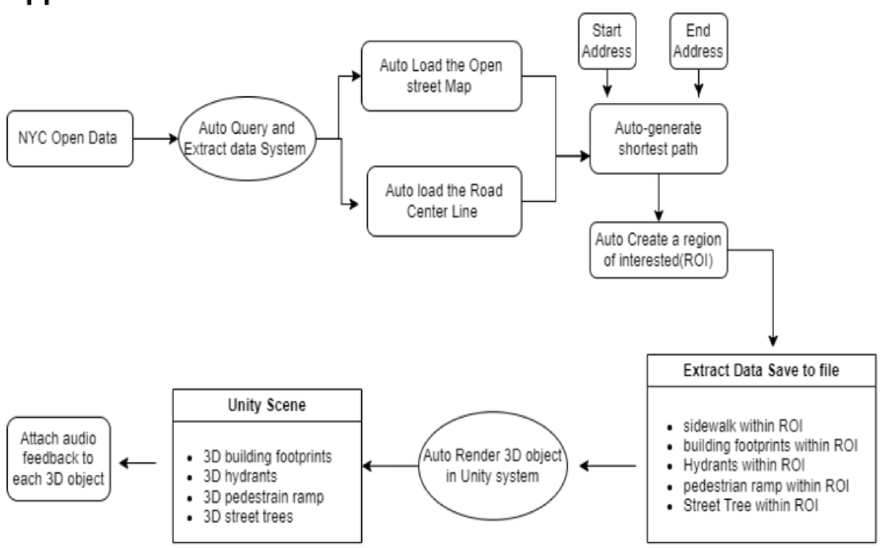
New York City College Of Technology (CST)

Abstract

Approximately one-fifth to one-quarter of American families have a family member with a mobility

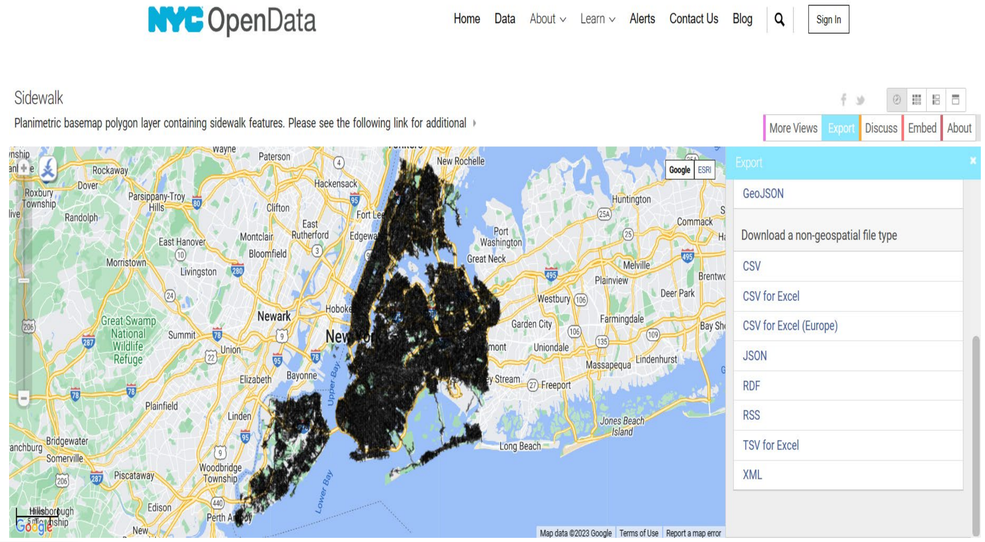
impairment, which poses challenges for many local communities, particularly in New York City Boroughs. To address this issue, Doorfront.org aims to make sidewalks and facilities, such as residential buildings and restaurants, more accessible to disabled residents of New York City. As a research assistant for Doorfront.org, I used NYC Open Data to accumulate data on inaccessible facilities, such as the NYC sidewalk polygons, building footprints, city hydrants, bus shelters, parking meters, street trees, pedestrian ramps, litter baskets, city benches, and newsstands. I downloaded a non-geospatial CSV file of all boroughs of New York from the NYC Open Data portal and researched to become familiar with the dataset's basic latitude and longitude information. Using QGIS and GeoPandas, I organized the data to enable developers to improve the Doorfront.org website. The website allows anyone to report areas that are not accessible to people with disabilities while also collecting data that can be used to fix them. The "Change Street view location" feature of the website enables users to jump to different locations without specifying information.

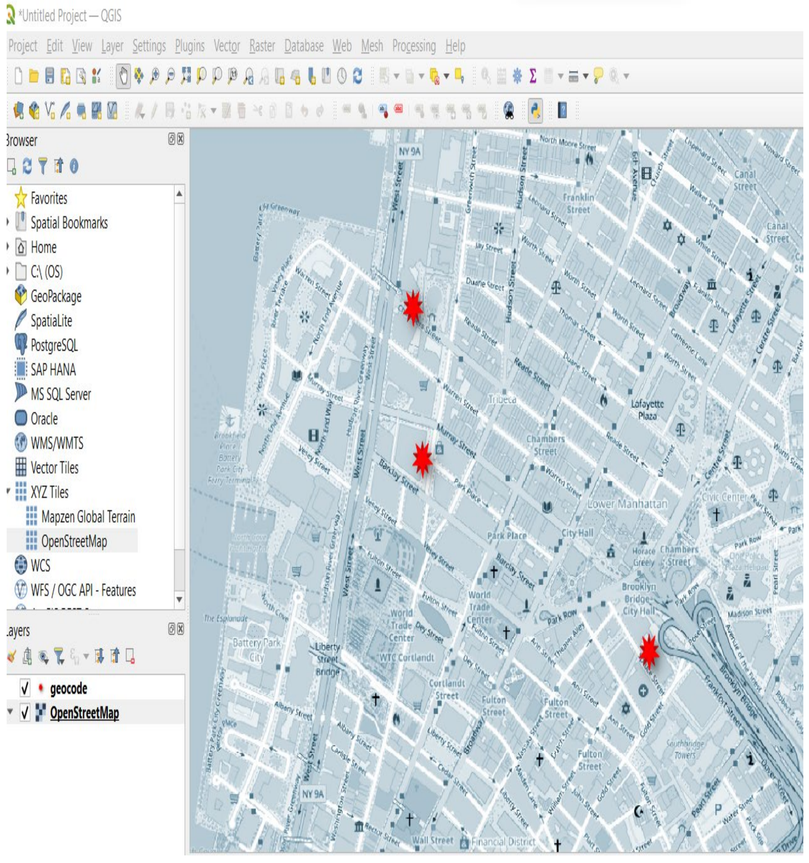
Approach

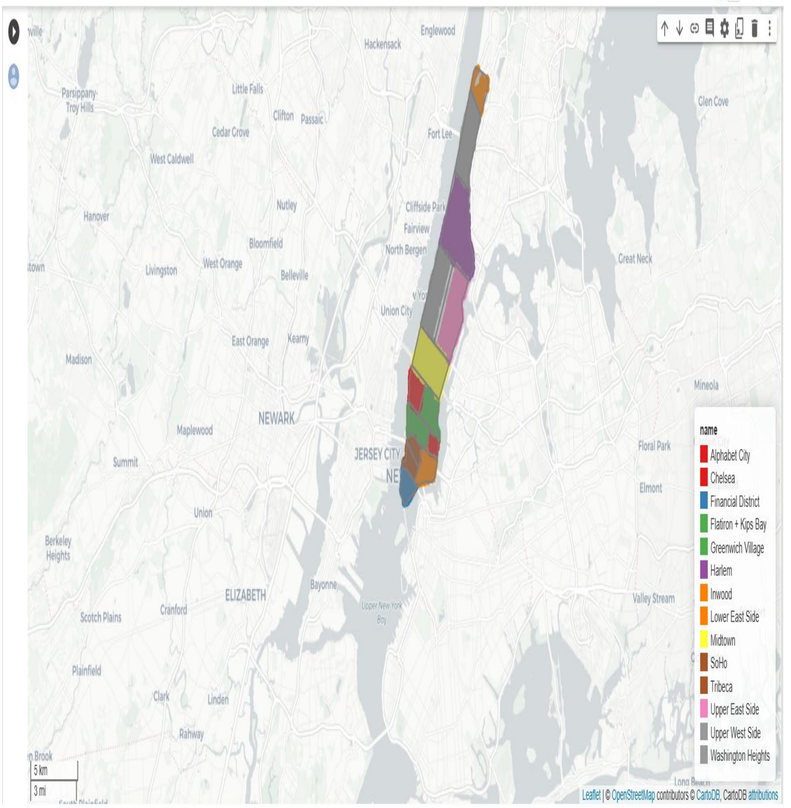


Data Analysis

Using QGIS and GeoPandas, I organized the data to enable developers to improve the Doorfront.org website. The website allows anyone to report areas that are not accessible to people with disabilities while also collecting data that can be used to fix them. The "Change Street view location" feature of the website enables users to jump to different locations without specifying information.







In conclusion, Doorfront.org is a collaborative effort to improve accessibility for people with mobility impairments in New York City. The project utilizes NYC Open Data to accumulate data on inaccessible facilities, which is then used to improve the website and create a more inclusive community.

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Revitalizing Education: Modernizing Textbook Chapters with ChatGPT

Shaquan Larose, Professor Patrick Slattery

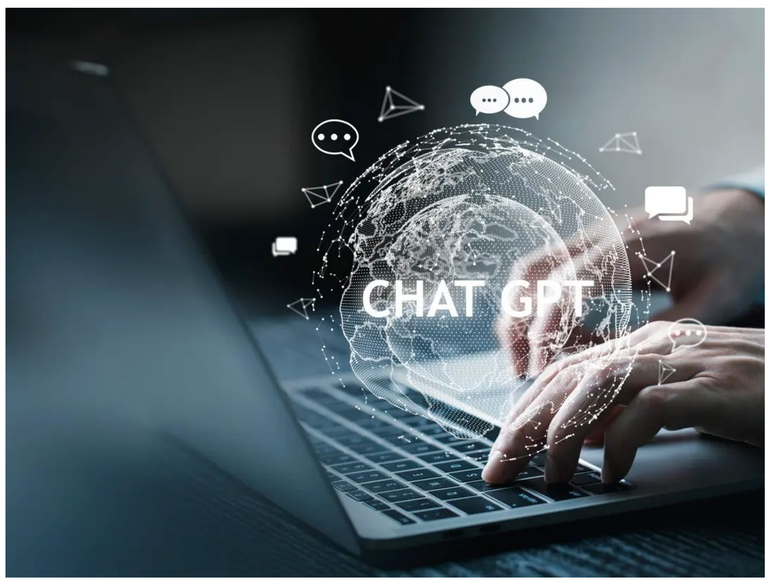
CUNY Emerging Scholars Program

Abstract

This research project explores the potential of ChatGPT to enhance and update existing textbook chapters in order to make learning more engaging and accessible for students in the digital age. The study addresses key questions such as how ChatGPT can be utilized to modernize and improve textbook content, what impact the updated content has on student engagement and understanding, and how the integration of ChatGPT-generated content can contribute to a more effective learning environment. Through the identification of key topics and themes requiring modernization, the development of a plan for incorporating ChatGPT-generated text, and the evaluation of the content's effectiveness, this research aims to provide valuable insights into the benefits of incorporating AI-generated content into educational materials. Ultimately, the project aims to create a more effective learning environment that caters to the needs of students in the digital age, fostering more engaging and thought-provoking learning experiences.

Introduction

This research project aims to explore the potential of ChatGPT in modernizing textbook content and improving student engagement. By identifying key topics and themes within existing textbook chapters that require modernization and incorporating ChatGPT-generated text into the textbook, this study aims to create a more effective learning experience for students in the digital age.



Literature Review

The textbook "Information Systems for Business and Beyond" is a comprehensive guide to the field of information systems, providing students with a broad understanding of the topic. Recent studies have explored the potential of AI-generated content in enhancing textbook material, making it more accessible and engaging for students. By utilizing language models such as GPT-3 and ChatGPT, researchers have aimed to modernize and improve the textbook content, ultimately creating a more effective learning environment for students. However, further research is needed to fully understand the impact of AI-generated content on student engagement and understanding of the material in this specific textbook.

METHOD

1. Identification of outdated content: We first identified the outdated or incorrect content in Chapter 2, such as the discussion of increasing dependency on tablets and decreasing use of desktops.
2. Research and gathering of new information: We conducted extensive research on the latest trends and developments in the hardware layer to gather updated and relevant information to include in the revised chapter. For example, we added information on Huang's Law on graphics processor units to provide a more comprehensive understanding of the topic.
3. Modification of existing text: We modified the existing text to ensure it was accurate and up-to-date. For instance, we clarified the concepts of bit vs. byte, binary vs. digital, and added tables to the Understanding Binary sidebar to improve the readability and understanding of the material.
4. Incorporation of new content: We added new and relevant information to the revised chapter. For instance, we included information on the limitations of Moore's Law and the challenges in maintaining it.

Overall, our approach aimed to provide a more accurate, comprehensive, and engaging learning experience for students in the digital age.

Results

The revised Chapter 2 of "Information Systems for Business and Beyond" focused on updating the content related to the hardware layer. Specifically, we modified and removed outdated information and added new and relevant information to improve student understanding. The sidebar on Moore's Law and Huang's Law was revised to provide up-to-date information on the limitations of Moore's Law and the potential of Huang's Law in extending computing power into the future. The addition of Huang's Law and its potential to extend computing power into the future will help students stay current on technological advancements. The modified text on Moore's Law provides a more accurate reflection of its current limitations. These revisions will contribute to a more engaging and informative learning experience for students in the digital age.

Conclusion

In conclusion, the rewriting of Chapter 2 of the textbook "Information Systems for Business and Beyond" utilizing AI technology was successful in improving the clarity and accuracy of the information presented. Specifically, the removal of outdated information regarding tablet dependency and desktop usage, along with the addition of clarifications on bit vs. byte and binary vs. digital, contributed to a more effective learning experience. Additionally, the incorporation of Huang's Law on graphics processor units and the updated information on Moore's Law provided students with a more current understanding of the field. Overall, the use of AI in textbook rewriting shows great potential in improving the quality of educational materials.

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Applications Of The Golden Ratio

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[1]Department of Architectural Technology [2]Department of Mathematics

Abstract

Two positive numbers a and b are in golden ratio when the ratio of their sum to the larger of the numbers is approximately 1.618. The golden ratio appears in many architectural constructions as well as in the nature. It is also known as the divine proportion since it provides a symmetry that is aesthetically harmonious. We explore some applications by identifying their mathematical dimensions of the golden ratio and analyzing their geometric shapes. We also discuss a relationship with the Fibonacci numbers and exhibit a golden rectangle produced on Scratch, which is a high-level block-based visual programming language.

The Golden Ratio

The **golden ratio** is the positive solution to the quadratic equation $x^2 - x - 1 = 0$. It is denoted by φ whose value is $(1 + \sqrt{5})/2 \approx 1.618033988749895\ldots$. We say that two quantities a and b with $a > b > 0$ are in the golden ratio if

$$\frac{a}{b} = \frac{a+b}{a} = \varphi.$$

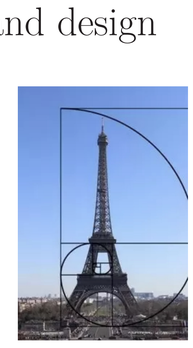
A **Fibonacci sequence** $\{F_n\}_{n\geq 0}$ is defined by the recursive formula

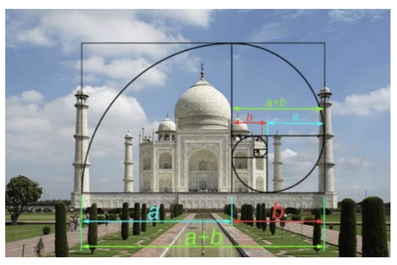
$$F_{n+2} = F_{n+1} + F_n,$$

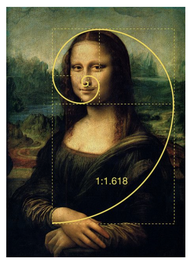
where $F_0 = F_1 = 1$. The first terms are 1, 1, 2, 3, 5, 8, 13, 21, ... Surprisingly, the ratio between two consecutive terms in the Fibonacci sequence, F_{n+1}/F_n, gets closer to the golden ratio when n goes to infinity. A **golden rectangle** is a rectangle whose side lengths are in the golden ratio.

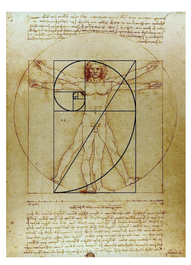
The Golden Ratio in Architecture

The golden ratio is believed by many to be an indicator of beauty and perfection. As such, it can be used as a tool for creating effective compositions in art. Below are some pictures displaying how the golden rectangle appears in some famous constructions and artworks, and design



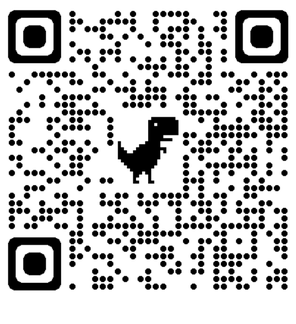




Coding in Scratch

Scratch is a high-level block-based visual programming. During the course of this project we learned Scratch and coded a program to draw a golden rectangle in Scratch.

Because we used integer approximations, our golden rectangle is just an approximation as the second smallest rectangle reveals. The code consists of two blocks: one to draw the rectangles, where the inputs are the four vertices, and the other one to draw half of a semi-circle, where the inputs are the ratio, the coordinates of the center, a parameter that is related to the initial point, and another parameter that indicates the direction towards the terminal point. We used concepts from Trigonometry to build the circle's block. The QR code provides a link to the animation that generates our golden rectangle.



Conclusions

The golden ratio allows us to evaluate harmonic relationships. Many famous artists have used the golden ratio to create aesthetical works based on the golden ratio.

Coding the golden rectangle was a great way to explore numerical relationships and apply several concepts from the College Algebra and Trigonometry course.

A future work would be to improve the code by using non-integer coordinates to produce a more precise golden rectangle. In addition, it would be interesting to design an architectural piece that captures the golden ratio.

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Emerging Scholars Program
Spring 2023

Language Bias on College Campus

Sumiya Jahan & Israt Korno
Prof. L. G. Alatriste
NON-STEM

Introduction

We all use languag every day but often that language contains some kind of bias. Typicallly we are not aware of it or have no knowledge about language bias.

FIndings: When meeting a new person, individuals may consciously or unconsciously focus on their language, accent, or origin, which can lead to negative thoughts and attitudes toward them. This is because some accents are considered more prestigious, such as the British accent within English language varieties.

Research Questions

Language Bias (LB)

What causes language bias?
How do we recognize LB?
How can we reduce it?

Avoiding Language Bias

"Avoiding biased language is not just something to learn in order to be politically correct. Unbiased langu
age sends the message that you're invested in inclusivity".

Literature Review

Many articles identify bias as unconscious. People make statements about someone's language, accent or dialect based on standard or preferred language variety. For example, in many parts of the world, American English is less favored than British English. People have different associations for each version. Bias can be harmful in some instances such as job interviews or social settings.

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Classification of Normal versus Pneumonia from Chest X-ray Using an AI Model

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Hypothesis

Deep learning (DL) algorithms, in particular convolutional neural networks (CNNs), have recently been used to address a number of medical-imaging problems, such as pneumonia detection using chest X-ray , and determining the aggressiveness prostate cancer using magnetic resonance images (MRI) . They have become the technique of choice in computer vision and they are the most successful type of model for image analysis.

Methods

To analyze X-ray images with precision, the advanced technology made the health system use unusual artificial intelligence(AI) techniques and tools that help in smart decision-making.

An algorithm was built in order to use the conventional neural networks (CNNs) to analyze 5862 X-ray images that we downloaded from Kaggle, to distinguish :

- Normal X-ray images .
- Pneumonia X-ray images

The picture format was changed from JPG to PNG since PNG has high quality in digital photographs.

The dataset is categorized into 3 groups randomly as:

- Training
- Validation
- test sets

Each category contains subgroups :

- Pneumonia
- Normal

We used PyTorch which is a library that handles tensors for machine learning, and Google Collab tools .

We developed three layers:

1. convolutional layer
2. pooling layer
3. fully connected layers (FC)

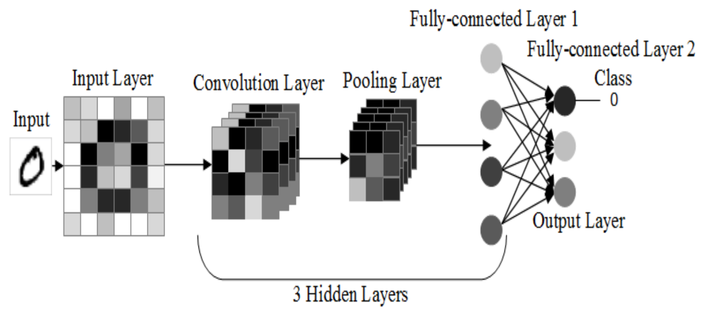

Fig. 1. A typical Convolution Neural Network (CNN)

The Fig 2,shows the three layers of the convolutional Neural Networks convolution layer very significant in convolutional Neural Network (CNNs) because it extract features from the input images to create the image output. The pooling layer is also,fundamental in CNNs because it control the overfeting and enhancing the output by reducing the features.By using a nonlinear activation function the fully connected layer combine features from convolution layer and pooling to provide a possible classification score.

Fig 2: Patchy distribution of interstitial penetrates and infection indicate the presence of viral pneumonia .The bacterial pneumonia X-ray image shows a cloud and it looks like there is the same air exchange in the lung (“Viral vs. Bacterial Pneumonia:

The X-ray images divided into two categories: pneumonia (4276 images) and normal (1586 images)he X-ray image.The dataset is categorized into 3 groups randomly as training, validation, and test sets and each group is divided into sous groupe normal and pneumonia, with a ratio (80%/,10%/,10%)

The input channel is 150x150x1 and the output is either 0 or 1 which mean, 1 symbolizes pneumonia x-ray image and 0 symbolize normal X-ray image.The receiver operating characteristic (ROC)is used to measure the accuracy of the algorithm.

Results and Discussions

Figure 3 from our trained model demonstrates that the model's accuracy is 0.77 and that the receiver operating characteristic (ROC) can distinguish between normal and pneumonia images with an accuracy of 0.71.Given that our result is close to 0.8, it is acceptable.

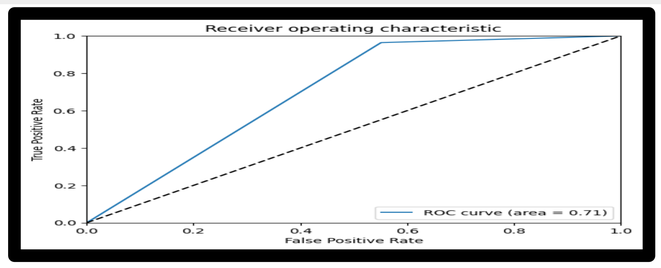

Fig 3: the ROC curve shows the performance of the trained model

True positive rate is plotted on the y-axis against false positive rate on the x-axis in a ROC curve plot.

The matrix number (Fig4) indicates where a model is confused known as the confusion matrix. The confusion matrix is only utilized when the output distribution is known and the accuracy is appropriately calculated.

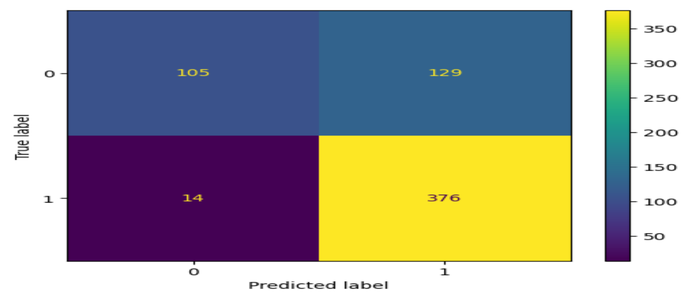

Fig4:Confusion Matrix The true negative:105, False positive :129,False negative:14 and true positive :376.

Conclusions

The thoracic anomaly is identified using X-ray, and this method is critical even though there is advancement technology in medicine. As a result, a certified specialist in the field is required to avoid misdiagnosis of the condition. So, adopting a deep learning CNN model to identify pneumonia from other thoracic diseases will be highly valuable, and will reduce or eliminate significant errors. Our effort will result in a better algorithm that will aid in the detection of pneumonia.

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The Impact of Artificial Intelligence on Business Operations

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Computer Systems Technology

Abstract

The integration of Artificial Intelligence in business operations has significant implications across various industries and functional areas. This research project aims to investigate the following research questions: First, how are businesses using AI to automate and optimize their operations, and what are the benefits and challenges of implementing AI solutions in different industries and functional areas? Second, what are the ethical and social implications of AI adoption in business settings, and how do businesses ensure transparency, fairness, and accountability in their AI systems and algorithms? Third, what skills and knowledge are required for employees to effectively work with AI systems? Fourth, how are educational and training programs adapting to prepare the workforce for the increasing role of AI in the workplace?

The research outcomes will provide valuable insights into the transformative role of AI in business operations, highlighting the potential advantages and challenges that organizations must navigate. The findings will emphasize the importance of ethical considerations in AI adoption and emphasize the need for businesses to ensure responsible and transparent AI integration. Furthermore, the research will shed light on the skills and knowledge required for employees to effectively work alongside AI systems and explore the role of educational and training programs in preparing the workforce for a future shaped by AI. By understanding the all-around impact of AI on business operations, organizations can be better equipped to make use of the potential of AI, while mitigating risks and ensuring ethical and sustainable integration of this technology.

Method

1.Identifying relevant articles and reports by searching academic databases and online repositories using keywords related to AI, automation, business operations, and workforce development.

2.Analyzing the selected sources to extract key findings, trends, benefits, and challenges of AI integration in business operations.

3.Incorporating the findings from different sources to gain a comprehensive understanding of the impact of AI on various industries and functional areas, ethical and social implications, and the required skills and knowledge for employees.

4.Identifying potential gaps in the literature and areas that warrant further investigation in future research.

This method allowed for a thorough examination of the current state of AI in business operations and the identification of key insights and implications for organizations and their workforce.

Introduction

•In recent years, Artificial Intelligence has emerged as a transformative force, driving innovations and reshaping industries. Its impact on business operations has become increasingly evident, with organizations leveraging AI technologies to automate processes, optimize decision-making, and deliver enhanced customer experiences. This research project aims to examine the impact of AI on business operations through a comprehensive literature review and analysis of key findings. The study explores how businesses use AI to automate and optimize operations across industries and functional areas, the ethical and social implications of AI adoption, the skills and knowledge required for employees to effectively work with AI systems, and the adaptation of educational and training programs to prepare the workforce for the increasing role of AI in the workplace. By providing valuable insights into the transformative role of AI, this research addresses the potential advantages and challenges organizations must navigate as they adopt this powerful technology.

Conclusion

•AI adoption in business operations offers both opportunities and challenges across various industries.

•Research highlights the transformative role of AI in automating and optimizing operations.

•Ethical and social considerations must be navigated when adopting AI technologies.

•Transparency, fairness, and accountability are crucial in AI systems and algorithms.

•Skills and knowledge required for employees to work with AI systems are emphasized.

•Educational and training programs play a critical role in preparing the workforce for a future shaped by AI.

•Organizations must remain agile, adaptive, and focused on ethical and sustainable integration of AI to stay competitive.

Literature Review

•A McKinsey study found that about half of all work activities could potentially be automated using currently available technologies, but less than 5% of occupations can be fully automated

•Demand for labor will play a crucial role in determining the impact of AI on jobs, with some jobs being displaced while others are created or transformed

•The risk of job automation varies across countries, industries, and occupations, with a higher risk associated with routine tasks

Results

•Businesses can use AI to optimize operations, enhance customer service, improve decision-making, and develop new products and services

•AI adoption presents both benefits and challenges for businesses, such as increased efficiency and reduced costs versus the need for skilled workers and managing ethical considerations

•Workers will need to develop new skills and knowledge to effectively work alongside AI systems, such as data analysis, problem-solving, and adaptability

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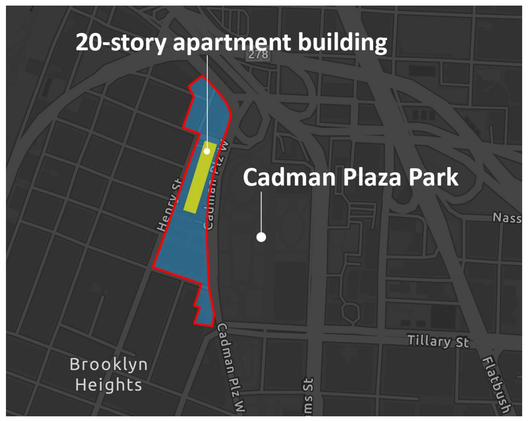
The Cadman Towers in Brooklyn Heights: An Alternative Approach to Urban Renewal

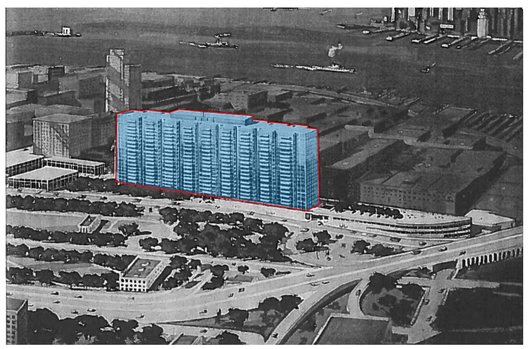
Yanfang Liang
Professor Michael Duddy



The Brooklyn Civic Center boundary

Cadman Towers in the Second Phase

Present



The original Cadman Plaza proposal model

Fulton Street between Cranberry and Middagh Streets

186 Fulton Street (pre-1965) _ Urban Archive

176 Fulton Street (pre-1965) _ Urban Archive

Abstract

The history of Robert Moses, New York's famous Power Broker, is well known. He held many positions in the New York City and State governments and is famous for building highways, bridges, and parks. One of the positions he held was the chairman of the Committee on Slum Clearance which was controlled the federal money distributed to New York under Title I of the Fair Housing Act of 1949. Under his direction, several blocks of Brooklyn Heights facing Cadman Plaza were cleared to make room for a Title I project which eventually became two. Both of these projects reflected a new approach to urban renewal that combined high-rise residential towers with townhouses. Thought at the time to be a breakthrough in modern urban design, the history of this precedent for this kind of architecture will be documented.

In conclusion, this study will evaluate the impact of these buildings on Brooklyn Heights, explore whether they are beneficial, and make suggestions on improvements.

Moses' Vision

In the early 1940s, Moses proposed the construction of a large housing complex in the area known as the Brooklyn Civic Center. The complex was intended to provide a 20-story apartment building for middle-income families and a parking garage for 586 cars. Moses envisioned the Brooklyn Civic Center Houses as part of a larger redevelopment plan for the area. However, the project faced significant opposition from local residents and community groups, who were concerned about the impact of the high-rise buildings on the neighborhood.

The project was replaced by the second phase under Title I project. Title I was one of the most significant federal programs to address slum clearance. It aimed to provide affordable housing for middle-income families. In this phrase, the old buildings were intended to be demolished and replacing them with new government building, commercial spaces, and residential towers. The plan was controversial because it involved the displacement of many low-income residents and small business in the area.

Despite significant opposition, some of the proposed buildings were constructed, such as the Cadman Towers, the Cadman Plaza North, and the Whitman Close townhouses. But the project was ultimately scaled back due to funding constraints and community resistance.

Evaluation

Robert Moses was a key figure in this movement, which aimed to revitalize cities through large-scale projects. The Cadman Plaza area was one of many neighborhoods in New York City that was targeted for redevelopment during this time, as part of Moses' broader vision for modernizing and transforming the city. However, the project was never fully realized.

Both phases of the project have a particular relationship to Cadman Plaza and to Henry Street. Their relationship is generally positive, as the plaza serve as an important public gathering space adjacent to the proposed sites for both phase. However, their relationship is more complicated. The proposed redevelopment would have had a significant negative impact on the community.

The project result in a mix of two or three stories brownstone townhouses surrounding with high rise buildings due to historical and political factors, they are incongruous in scale and styles with the neighborhood. As can be seen in the photos above, the demolished buildings were quite usable and would be great value today.

Augmented & Virtual Reality: Advancement of technology and its impacts on medicine, education, and other industries

Student: Yassine Chahid
Mentor: Patrick Slattery

Project Goal

AR and VR technology have been evolving rapidly ever since their invention. This project aims to assess the main impacts these respective technologies have had on current industries, alongside their future prospects in various industries. By examining the capabilities of AR and VR, applications can be developed to help workers in education, medicine, and other industries complete complex tasks more pragmatically and effectively. As it stands, AR and VR have been used as entertainment mediums, with AR also being used in many smartphone apps. But now the technology is being used to assist industry workers in their tasks whether it be through educating, training, or simulating. The project will assess the usage of AR and VR in these industries, especially within health care and education.

Distinction

VR, or Virtual Reality, involves the creation of fully a digitized environment. This digital environment can be interacted with through the use of wearable hardware such as a headpiece fitted with a screen or other body sensors. Movements usually mimic real life.

AR, or Augmented Reality, involves the creation of virtual objects in a real life space. This is achieved through using cameras to capture a real life environment, while overlaying any relevant information or objects digitally on some form of screen, such as a smartphone.

A headset that is capable of VR.

A smartphone that is capable of AR.

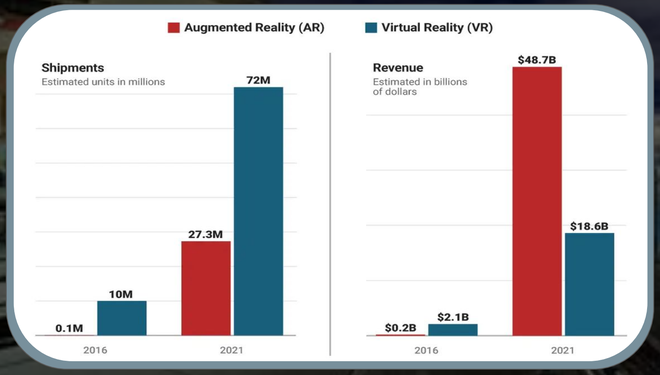
History

The term “virtual reality” was first coined by Jaron Lanier in 1987, the founder of VPL Research Inc. which would be the first company to sell VR goggles. The term “augmented reality” was coined in 1990 by Tom Caudell, a Boeing researcher. Soon after, VR would make its first major introduction through arcade gaming, with arcade machines such as the SEGA VR-1 motion simulator. As for AR, its first major adoption was on a 1998 Sportsvision broadcast of an NFL game, where a yellow line marker would overlay the game in real-time. Another notable release of XR tech was the debut of Google Street View in 2007, allowing its users to visit many attractions and landmarks throughout the real world.

Popular Use

VR and AR have commonly been used as forms to consume media and virtual content, especially in gaming. One of the most notable of brands which control this market is Oculus, a company bought out by Facebook which produces VR headsets, with its flagship series being the Oculus Quest line of headsets. XR technology is not limited to gaming, as in 2017, IKEA debuted its IKEA Place app for mobile devices, allowing customers to utilize augmented reality to see what furniture items would look like in the space of their own homes. Similarly, Amazon has incorporated augmented reality into its main app, allowing customers to display items they may want to purchase in the space of their homes. The two aforementioned uses highlight the potential of XR tech beyond entertainment.

Worldwide AR/VR Headset Shipments & Revenue



Future

AR and VR are capable of branching into many current industries. Some of these industries include medicine, education, architecture, and even journalism. The prospects of medicine and education are especially profound. Within medicine, VR/AR can provide access to health care services typically available in clinical settings at home. For those facing socio-economic hardship, the elderly, or disabled, this greatly expands the availability and quality of these services. Similarly, VR and AR can greatly enrich the quality of education in public schools and institutions. The immersion of AR/VR enables it to convey information in much more engaging and interactive ways. Despite being in its early stages, there are many promising use cases of the technology in its current state.

Health Care

The usage for VR and AR in treating patients can include...

- Mental health
- Neurological disorders
- Surgery planning
- Virtual care
- Rehabilitative therapies

AR and VR can provide many enhancements to current healthcare, making them a promising new advancement for this industry’s technology. Diagnoses could be accelerated while also letting care be more self-directed. Additionally, it expands access to these services for many, while also reducing the invasiveness of said services. Health care professionals also benefit, as they are able to better prepare for specific treatments and help fulfill specific medical needs.

Education

For K-12 education, AR and VR enhances the resources educators have to make classroom learning more interactive. They can provide libraries containing engaging material, experiences tailor made for specific topics, and even resources to help students with learning disabilities.

For those pursuing higher education, AR and VR can help students better understand abstract concepts while also enabling them to get more hands-on experience under low-risk environments. STEM courses are especially enhanced alongside medical simulations or other technical settings.

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Developing a method for X-ray multi-energy output by valence electrons in alkali halide filters

CRSP Scholars: *Somdat Kissoon (Radiologic Technology & Medical Imaging)*

ESP Scholars: Zuonie Ke , Sabina Rakhmatova (Both from Applied Chemistry)

Mentors: *Subhendra Sarkar; Eric Lobel (Both from Dept of Radiologic Technology & Medical Imaging)*

Abstract

This work extends the inelastic x-ray scattering by Compton effect from individual atoms to simple molecules with electrons available in molecular valence orbitals. We started with the theory of Compton type angular scattering by individual alkali and halogen atoms and observed anomalous scattering results from alkali halide salts with molecules arranged in regular halide lattices. We are modeling the results in terms of two novel concepts, that may be named as “Compton Harmonic Generation” and “Compton Steal” and are presented in this work.

Background & Hypothesis

A X-beam machine resembles a camera that permits specialists to see what is happening inside a patient without performing an invasive medical procedure.

An extremely concentrated beam of electro-magnetic waves, known as X-ray photons is produced by an X-ray machine to produce an X-ray image.

History:
After passing through the air and tissues in our bodies, this beam creates an image on a metal film.

The high-energy rays pass through soft tissue like organs and skin because they cannot absorb them. The radiation is absorbed by dense body parts like bones. The X-ray film develops in accordance with the areas that were subjected to the X-rays, just like camera film.

An X-ray's black areas indicate areas where the radiation has penetrated soft tissues. Where denser tissues, like bones, have absorbed the X-rays, white areas appear.

Modern x-ray machines like the one used in our experiments (Hologic Mammography machine) is a digital computerized system. This system allows for more analysis of the output image beyond black, white and grey appearance.

One of the main types of photon interaction is the Compton effect, also known as the Compton scatter. It is the primary factor that causes a material to scatter radiation. It occurs when the photon interacts with free electrons or electrons in the valence shell that are not tightly bound.

The electron receives energy from the scattered incident photon that results. The energy of the scattered photon will be different because it will have a different wavelength. This procedure conserves momentum and energy.

The Compton effect is a process of partial absorption that occurs when the original photon loses energy known as the Compton shift. 0.024 (1-cos), where is the scattered photon angle, can be used to calculate the wavelength change of the scattered photon. Subsequently, the energy of the dissipated photon diminishes with expanding dispersed photon point.

Alkali Metals are metals in Group 1 of the periodic table. The two that are analyzed are sodium and potassium with the following properties:

Element 11: Na Atomic mass: 22.9898

Edge	keV	A
K	1.0721	11.5646

Element 19: K Atomic mass: 39.0983

Edge	keV	A
K	3.6074	3.4369

In this experiment we will be studying the interaction of four salts with X-ray. Nacl, KCl, NaBr and KBr. Ionic salts are made up of a variety of metals and nonmetals with varying atomic numbers. Additionally, the sizes and shapes of these salt crystals vary.

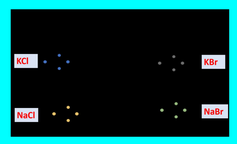
These crystals' orbital electrons and shapes will absorb and scatter various photons from our x-ray beam, resulting in an image on the x-ray machine's image receptor. In certain areas known as "Regions of Interest" (ROI), further analysis of the x-ray image could be done. These ROIs can be used to get and analyze the mean, standard deviation, maximum, and minimum values. The salts can be seen to absorb and scatter light through these analyses.

Method and Materials

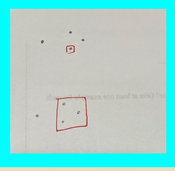
Materials:
Hologic mammography machine
NaCl, KCl, Nabr, Kbr
Paper, paper plates
Sponges, foams

Method:

- The salt was arranged on the receptor plate in several arrangements. One such arrangement is shown in the diagram below.. The collimation was set to a 15 cm x 15 cm exposure field.



- Images were taken at the following exposures: 20 kVp and 4 mAs, 20 kVp and 16 mAs, 25 kVp and 4mAs, and 25kVp and 16 mAs. No Grid. Rh, Al or AG filters were used either.
- The Mean, Standard Deviation , Minimum values, and Maximum values of a 128 pixel square ROI was recorded for each salt. A map of the ROI is shown below.



Results

Many arrangements and combination of salts were used for several exposures at the different exposure factors. Typical Recording of results are highlighted here.

Table 1 (Left) : The result of the data of exposing crystal salt. Table 2 (Right): Typical Analysis of X-ray wavelength based on Energy of X-Ray beams and Unit Cell Dimensions for Salts used.

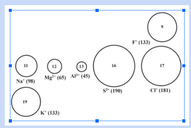
X-ray energy (keV)	λ. (A) and in (pm)	Salt Used	Unit Cell Dimension (A) Ref 2
5	2.48 (248)	NaCl	5.66
10	1.24 (124)	KCl	6.38
15	0.83 (83) x8=6.6	NaBR	5.96
20	0.62 (62) x10=6.2	KBr	6.68

Table 3: Typical nalysis that was done on the experimental data from the salt absorption/scattering experiment. The single grain flux that passes through the thickest region of the grain in comparison to the total background flux is depicted in blue, and the ionic electron numbers are represented by the color red. For instance, 58 of the 77 photons from the incoming beam that were present in the initial entry passed through the KCl grain. The remaining clusters will then be the subject of additional analysis.

20kVp/4mAs/Rh filter/Small Focal Spot	20kVp/16mAs/Rh filter/Small Focal Spot	20kVp/4mAs/Rh filter/Small Focal Spot	20kVp/16mAs/Rh filter/Small Focal Spot
58/77/ KCl 18,18 e-	88/150/ KCl	56/78/ KBr 18,36e-	62/155/ KBr
59/77/NaCl 10,18 e-	79/150/ NaCl	55/78/ NaBr 10,36e-	61/155/ NaBr

Discussion

Ionic radii of ions in alkali halide salts used (in pm)



Discussion (cont'd)

Recall Compton scatter involves the production of scattered x-rays of relatively high energies (relative to k-edges and l-edges) from high energy x-rays in the primary beam.
The x-ray beam is attenuated by mostly Compton and photoelectric interactions. Minimum readout value and maximum readout value within an ROI with a salt (compared to air shots) are important in our experiments. The min values indicate the pixels with the maximum attenuation. The max values (as increased from air shots) indicate scattered x-ray photons reaching a certain pixel or regions of no attenuation (if no relative increase from air shots).

Interference and Harmonization
When two or more waves superimpose (occupy the same point or points space at the same time), the interference can be constructive or destructive. The result could be a wave of higher energy (in phase), of lower energy (slightly out of phase), and wave moving in a different direction or no waves (total annihilation of both waves– destructive interference).

Crystal ionic salts have a regular lattice structure. The electronic arrangements create tunnel like structures with which one or more x-rays can harmonize. Even if no energy from the x-rays are absorbed by the salt, more than one x-ray can harmonize to produce a single ray. This results in fewer x-ray photons exiting the salt that have not undergone a photoelectric, Compton or elastic interaction. However, this interaction attenuates the beam. In our research we refer to this as “Compton Harmonic Generation.”
The Energy levels of the x-rays, depend on the frequency and wavelength of the wave. This wavelengths are theorized to have a relationship to the bond length and the atomic radii. We were unable to measure wavelength during our experiments.

Scatter radiation should increase the number of photons reaching our detector elements (hence affecting the readout at our pixel). Hence, any ROI reading outside of our salt should either maintain the same Min-max value or show a slight increase in these values due to the scatter (relative to air shots). However, some decreases were observed. This may be due to scattered x-rays interfering with x-rays in the uncovered ROI. In theory, the Compton scattered photons could either destroy some beams or at least change their direction. This means that our salts were able to attenuate parts of the x-ray beam without being in the direct path of these x-rays. It is the Compton scatter that facilitated salts to effectively ‘steal’ these x-rays from the underlying DELS (or pixels) so we refer to this as “Compton Steal.”

Conclusion

This series of experiments is continuous and further analyses and modifications are being done to obtain more precise results.
Detailed analyses of the behavior of x-rays on alkali metals, particularly sodium and potassium. This important because sodium and potassium are vital in muscular activity. Their presence in muscles like the heart is at a very high concentration, especially in the infant heart. Further experiments on these elements may therefore lead to better application of radiography in diagnosing conditions involving the metabolism of these vital minerals
i.e. Cancers, conditions of the heart and muscles – cardiac attack in an ER.
There are other non-medical fields in which our experimental results may be also be applied, e.g. scanning for aircraft defects.

Acknowledgment

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