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EXPO 2025 CONFERENCE

April 23-24, 2025

Location: **Setzer Center**

Book of Abstracts

Part II - Poster Presentations

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Locations: Setzer Student Center – Atrium Hallway – 1st floor

Posters are mounted on frames - Tuesday, 4/22 from 3:00 to 6:00pm.

NOTE: Please place your poster on the number allocated. In this book the posters are listed in alphabetical order. During the conference sessions, they will be NOT organized in alphabetical order but by discipline or topics. Such organization helps to make the judging effort easier.

We prefer that you drop the poster in Archer 100D or 112, on Tuesday 4/22 between 9 until 1:00pm. We can take care of mounting the posters.

Poster Session I – 8:00 A.M. to 9:00 A.M.

Poster Session II – 4:00 P.M. to 5:00 P.M.

Poster Session III – 8:00 A.M. to 9:15 P.M.

Attendance at all the poster sessions is mandatory.

Glossary:

GR means Graduate student.

UG means Undergraduate student

H – Humanities, Arts, Social and Behavioral Sciences, Education, and Business

S – Science, Technology, Engineering, and Mathematics

UG-H means Undergraduate student in HASBSEB area.

UG-S means Undergraduate student in STEM area.

SURF means Summer Undergraduate Research Fellowship.

URG means Undergraduate Research Fellowship (at Lamar University)

McNair, SURF, Beck, Welch, and other sponsorship programs are indicated.

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Presenter: **Julia Adams** [$]
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Poster_9 / UG-S / In progress

Petro-structural analysis of mylonite in the Memve'ele Shear Zone, Southern Cameroon.

Mylonitic rocks form in shear zones and are characterized by microstructures that serve as crucial indicators of shear kinematics and stress variations during deformation. This study integrates optical petrology with electron probe microanalysis and scanning electron microscopy to investigate the microstructural evolution of mylonites from the Memve'ele Shear Zone in the Ntem Complex of the Congo Craton.

Preliminary observations reveal complex kinematic histories marked by both sinistral and dextral shear indicators, reflecting large-scale, diverse strike-slip motion. These movements were influenced by regional diapirism and transpressive horizontal shortening during craton assembly. Microstructural features such as rotated and fractured delta and sigma-type porphyroblasts suggest a progressive transition from sinistral to dextral shearing. While shear polarity remains consistent along mylonitic foliation planes, it varies across different schistosity orientations. Hydrothermal fluid flow assisted the later dextral shearing, as evidenced by veins and veinlets associated with dextral movement.

Intermediate mineral compositions contributed to both ductile and brittle deformation, forming a full assemblage of proto-mylonite, mylonite, and ultra-mylonite in the shear zone. Mylonitic amphibolites (sulfide- and calcite-bearing) and pyroxene-bearing TTG (tonalite-trondhjemite-granodiorite) gneisses suggest deformation under upper amphibolite facies conditions, driven by medium temperature and pressure metamorphism. This study analyzes the kinematic indicators recorded in the microstructures of these mylonites to decipher the sense of shear which characterized the formation of the Memve'ele Shear Zone and contribute to a broader understanding of cratonic development in the Congo Craton.

Presenter: **Oreoluwa Adeleke** [$]
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Poster_25 / UG-S / In progress

Spectral Characterization and Substrate Promiscuity of F420-Dependent Glucose-6-Phosphate Dehydrogenase from Nocardia brasiliensis.

F420-dependent glucose-6-phosphate dehydrogenase (FGD) plays a key role in bacterial redox metabolism by utilizing the F420 cofactor, a unique two-electron hydride carrier involved in tuberculosis treatment, folate biosynthesis, antibiotic biosynthesis, and energy production. This study investigates the spectral characteristics of F420 and the substrate specificity of FGD from Nocardia brasiliensis. The oxidized cofactor exhibits strong absorbance at 420 nm, while the reduced form shows a shoulder at 320 nm. To characterize FGD, we cloned, expressed, and purified the enzyme in E. coli, followed by kinetic assays to assess its substrate range. Unlike its more selective bacterial counterparts, FGD from N. brasiliensis displayed unexpected promiscuity, acting on glucose-6-phosphate, D-mannose-6-phosphate, and D-fructose-6-phosphate. This finding challenges assumptions about its conserved active site and suggests novel enzymatic flexibility. Future kinetic and structural studies will probe the molecular basis of this substrate promiscuity. By deepening our understanding of FGD's biochemical properties, this research contributes to its potential applications in antibiotic biosynthesis and pro-drug activation.

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Poster_26 / UG-S / In progress

Advancing G-Quadruplex Sensing: Development of High-Sensitivity Fluorescent Probes.

Guanine-rich secondary DNA structures, known as G-quadruplexes (G4s), play critical roles in gene regulation, genomic stability, and cancer pathogenesis. Due to their structural polymorphism and high prevalence in telomeres and oncogene promoters, G4s have emerged as promising targets for cancer diagnostics and therapeutics. This study aims to develop high-sensitivity fluorescent probes capable of real-time detection and stabilization of G-quadruplex structures. We explore various classes of G4-targeting probes—including polycyclic aromatic hydrocarbons, carbocyanines, flavonoids, and pyridinium salts—highlighting their chemical interactions and fluorescence signaling mechanisms. These structural activity relationships direct to improve specificity, selectivity, and aqueous solubility include enhancing π–π stacking interactions, groove binding, and metal ion coordination. Real-time visualization of G4 structures facilitates a deeper understanding of their biological functions, which remain only partially understood. Despite recent advancements, current probes face challenges such as narrow emission spectra, low quantum yield, low stoke shift, poor solubility and cellular infiltration, low selectivity, and

limited real-time detection capabilities. Flavonoids are water soluble natural products and exhibit anti-cancer activity through multiple molecular mechanisms. Therefore, in this study we proposed flavonoid based dual fluorescence probe with improved photophysical characteristics. The continued development of such dual-targeting probes and optimized ligand architectures holds great promise for improving cancer diagnostics and therapeutic interventions.

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Poster_11 / UG-S / Advanced

Impact of Back-Assist Exosuits on Productivity, Physical Capability, and Health Outcomes in Construction Work.

Construction work is physically demanding, often leading to musculoskeletal injuries, particularly in the lower back. Back-assist exosuits have been developed to alleviate strain and enhance worker performance, yet their effectiveness in real-world construction settings remains underexplored. This study evaluates the impact of back-assist exosuits on productivity, physical capability, and health outcomes among construction workers.

A two-phase methodology is employed: a comprehensive literature review and experimental testing. The literature review brings together existing research on exosuit benefits and challenges, including productivity gains, injury risk reduction, and potential limitations such as discomfort and mobility restrictions. The experimental phase involves controlled lifting tests conducted at Lamar University's Recreation Center, where participants perform repetitive lifting tasks with and without an exosuit. The thing that was measured was task completion time and were recorded and analyzed for later evaluation.

This study aims to determine whether exosuits enhance efficiency and reduce physical strain without compromising worker comfort. If proven effective, exosuits could serve as a viable solution for reducing workplace injuries and extending career longevity in the construction industry. However, challenges such as adaptation and cost must also be considered. The findings will contribute to a deeper understanding of exosuit applications in construction and their role in improving worker safety and productivity.

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Poster_15 / GR-H / In progress

LGBT Inclusion in the Military: A Comparative Study of Policies and Practices in The Netherlands and The United Kingdom.

According to Goodhart and Taylor (2020), the United States of America is still grappling with the challenge of fully integrating LGBT inclusion in the US military. While President Obama removed all restrictions on lesbians, gays, and bisexuals (LGB) personnel there continue to be restrictions on transgender personnel within the Department of Defense (DoD).

While America faces challenges with the LGBT issue, Europe may have advanced in finding a clear path to including LGBTs fully in their militaries. European countries dominate the first 20 places on the LGBT Military Index with 16 countries (Polchar, Sweijs, Marten and Galdiga, 2014). Polchar et al (2014) find as European countries have become more accepting of the LGBT community, they have embraced policies allowing LGBT to serve openly in their militaries. The study found the existence of evidence to link social acceptance to these societies' attitudes to military policies, which further confirms the relationship between public opinion polling on homosexuality and the acceptance of LGBTs in the military.

The main research question is: "How have shifts in public opinion affected the ability of gays to openly serve?" I will use process tracing to conduct a comparative case study on the Netherlands and the United Kingdom to understand the relationship between social acceptance and societal attitudes toward military policies and the military personnel's level of tolerance and acceptance of colleagues who are LGBT as it relates to cohesion in service.

Presenter: **Madeleine Izaguirre Arostegui** [$]
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Poster_6 / UG-S / In-progress
NSF grant support

Analyzing Presence of Staphylococcus Aureus and Epidermidis in Gym Equipment Samples by Using Polymerase Chain Reaction.

Gymnasiums are crowded spaces where biological material can be exchanged through skin contact. This study aims to assess the presence of Staphylococcus aureus and Staphylococcus epidermidis on gym equipment surfaces at the Galveston College Fitness Center, using acid-based assays such as polymerase chain reaction (PCR). A total of 36 samples were collected from various gym machines and accessories, swabbed, cultured within 48 hours, and then subjected to DNA isolation for PCR analysis. The results revealed the presence of 16S gene in 35/36 samples, suggesting microbial communities interacting with the environment. However, Staphylococcus aureus was absent in all samples (0/36), indicating it does not pose a significant threat for gym users and staff. On the other hand, Staphylococcus epidermidis was detected in 2/36 samples, representing 5.56% of the total. Although typically considered a commensal bacterium, S. epidermidis can pose a risk to individuals with weakened immune systems. This study was funded by the Galveston College STEM Honors Program through an NSF grant.

Presenter: **Julio Delgado** [$]
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Poster_28 / GR-S / Early phase

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Analyzing Variations in Texas Public High Schools Using Student Success Metrics Pre- and Post-COVID-19 Through Data Mining.

The COVID-19 pandemic caused unparalleled disruption in various sectors of society. Without a doubt, the COVID-19 pandemic affected the education sector. This project utilizes data mining techniques to analyze the impact of the pandemic on student success rates in Texas public schools at the high school. Using quantitative data primarily from the Texas Education Agency's (TEA) Academic Performance Reports (specifically comparing 2018 pre-pandemic data to 2024 data), this study aims to quantify variations in student success indicators following the pandemic's peak. Key variables examined include STAAR pass rates, graduation and dropout rates, college readiness metrics, attendance, AP/IB and SAT/ACT participation and performance. Data preprocessing will involve extracting and normalizing numerical values. Data mining techniques such as K-Means Clustering, Decision Tree Classification, and Logistical Regression Analysis will be employed to identify performance patterns and predict high school success or failure based on defined criteria. Recommendations based on potential findings include targeted STEM initiatives and attendance incentive programs. Future research directions involve expanding the time scope, incorporating machine learning for predictive analysis, and investigating long-term remote learning effects. Continuous monitoring using future TEA data is recommended to track the recovery of the Texas public education system.
Keywords: COVID-19, Texas public schools, education, data mining, student success, TEA reports, pandemic impact.

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Poster_41 / UG-S / Early phase

Modeling Thermonuclear Explosions on the Surface of Neutron Stars.

The crux of astrophysics research is that the physics experienced on Earth is the same as that observed in deep space. Advances in our understanding of physics, together with improvements in technology and instrumentation, inform our observations of stellar phenomena and help us refine models of the universe. An exciting example of this are Type I X-ray bursts, which occur on the surfaces of accreting neutron stars (dense remnants of massive stars formed from core-collapse supernova explosions). The intense gravitational pull of the neutron star draws in material (accretion) from an orbiting companion star. As this material accumulates, it undergoes rapid fusion at extreme temperatures and pressures (thermonuclear burning), leading to a bright, explosive flash that emits mostly in X-ray wavelengths. Since their discovery more than 50 years ago, X-ray bursts have provided valuable insight into neutron star structure and fundamental physics. The present research highlights recent advances in X-ray burst research and the impact these findings have on future scientific inquiries. These allow scientists to confirm and streamline scientific models of the universe and further fundamental physics research, including the dynamics of the strong nuclear force.

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Poster_8 / UG-H / Advanced URG project

Classroom Seating Preference and Auditory Capabilities in Students with Hearing Loss.

Students with hearing loss in higher education face unique challenges, particularly in selecting classroom seating that maximizes their auditory capabilities and academic success. This study investigates the seating preferences of students with hearing loss based on their auditory abilities and compares these preferences with those of students with typical hearing.

METHOD: Fifteen students diagnosed with hearing loss undertaking any level of course in Lamar University were recruited in the target group. A mix of students who use hearing aids, cochlear implants, and those not using any hearing devices were recruited. 38 students with typical hearing and undertaking any level of course in Lamar University were recruited as a control group. All the participants participated in an online survey consisting of three parts. Part A consisted of demographic questions, while Part B assessed various aspects of classroom seating preferences. Part C comprised of questions from the Speech, Spatial and Qualities of Hearing Scale - 12 item version (SSQ-12) questionnaire to assess hearing abilities in everyday situations.

RESULTS: The SSQ-12 scores and seating preferences will be compared across the two groups and the relationship between the SSQ-12 scores of target group with seating preferences will also be assessed. The study findings will aid in understanding how seating preferences of students with hearing loss or typical hearing vary with auditory capabilities.

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Poster_34 / UG-S / In progress
Independent reseach

Markov Chain Model in Ecological COVID-19 Infection Analysis.

Predicting the trajectory of COVID-19 infections is crucial, especially given the initial lack of prior knowledge about the disease. In the absence of comprehensive historical data, mathematical modeling serves as a valuable tool for public health professionals to analyze and understand the dynamics of disease spread. In this project, we employ a Markov Chain Model to study the behavior of the COVID-19 survival system. The long-term behavior of a Markov Chain is often analyzed through its steady-state equilibrium, where the probabilities of different health states stabilize over time. Our model begins with a simple three-state system, representing non-infected individuals, infected individuals, and hospitalized patients. We then extend this model to include additional states to account for more complex situations. We use real-world data from Houston to run simulations to analyze infection dynamics. The calculations and simulations are implemented in Python. This project provides insights into the potential long-term trends of COVID-19 spread and can aid in public health decision-making.

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Poster_1 / UG-S / In-progress

Assessment of a Man-made Dredge Placement Compartment as a Supplemental Nursery Habitat on the Texas Shoreline of Sabine Lake.

Estuaries along the Gulf coast provide nursery habitats (e.g., seagrass beds, coastal marshes) which serve as a refuge for larval and juvenile fishes and invertebrates and are therefore essential in maintaining the ecological integrity of marine ecosystems. The Texas shoreline of Sabine Lake has been heavily altered by hydrological diversions, ship channels and revetments resulting in a greatly reduced connection between the estuary and the surrounding marshland nursery habitat. Despite this, there was a highly productive, local recreational fishery located on Pleasure Island, Port Arthur, Texas that was centered around a dredge material placement area enclosed within the island revetment. The enclosed compartment consisted of open water habitat with emergent vegetation along much of the perimeter and maintained a connection with Sabine Lake via tidal flow through two sets of large diameter pipes, allowing organisms to move freely between the two. We aim to determine if this manmade enclosure served as an important nursery habitat for juvenile fishes and invertebrates along the highly modified Texas shoreline of Sabine Lake. To accomplish this, we conducted population inventories using otter trawls, bag seines and gill nets following the methods of the TPWD Coastal Fisheries Division over the course of a year. The data collected from these surveys was compared to that collected by TPWD for the Sabine Lake System to determine if there is a significant difference in the community assemblage of juveniles within the north levee enclosure compared to the surrounding estuary, including 10 species known to utilize nursery habitat.

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Poster_19 / UG-H / In-progress
Center of Resiliency

Digging Deeper: The World of Accommodation & Participation Through the Workings of Preservice Teacher.

The purpose of this study is to evaluate preservice teachers' abilities to incorporate adequate accommodation and opportunities for social interaction within their lesson and unit plans. The study assessed three-unit plans, each consisting of five sequenced lesson plans developed by preservice teachers. The findings suggest that 72% of preservice teachers were somewhat effective in providing adequate accommodation and descriptions. Additionally, 50% of the lesson plans were either somewhat effective or inadequate in facilitating social interaction and participation. Future studies should focus on

providing additional training for preservice teachers on creating accommodation and fostering social interactions in lesson plans.

Presenter: **Jonah Gigliotta** [$]
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Poster_40 / UG-S / Early phase

MovieRecommender: Modernized Movie Recommender System Using C++.

This paper will explain and explore a movie recommender system that suggests movies the user would prefer by using C++ to recommend or pick movies the user would probably like. The program will choose movies based off a selection of tags that that movies are labeled with that the user selects.

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Poster_33 / UG-S / Advanced

Numerical Calculation of the Energies and the Decay Energy Spectra of Quantum Mechanical Resonances.

In quantum mechanics, unstable states (called resonances) decay spontaneously. Such decays are characterized by their energies and spectra. In this proposal, we intend to develop a numerical procedure to calculate the energies and the decay spectra of quantum mechanical resonances. Through the use of the Fortran and Matlab we were able to find how accurate the experimental calculation of Oxygen-17 was.

Presenter: **George Guy** [$]
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Poster_10 / UG-S / Early phase

Advanced Technologies and Its Growing Role in Modern Construction.

The construction industry is undergoing a massive transformative shift driven by recent advancements, namely the monumental rise of Artificial Intelligence. The purpose of this paper is to provide a comprehensive analysis of AI-driven technologies that are currently being integrated slowly but surely into our industry. Several topics, such as machine learning, predictive analytics, AI-powered Drone technology,

generative design, and 3D printing are discussed along with their applications across the various stages of construction, from the Preconstruction phase to the final stages of Safety and Quality inspection. This study utilizes peer-reviewed published literature, case studies, and industry reports as provided by Lamar's Library. In addition, as it was relevant to the topic, ChatGPT was used as a digital research assistant to aid in summarizing the data of the literature and reports to reflect the very technology under discussion in this paper.

The research highlights a growing body of literature and increasing momentum around AI integration in the construction industry, with ongoing work exploring its application in the broad spectrum of the various phases of construction. Research is continuing in examining how effectively AI-driven tools can analyze construction data, generate relevant data and inspection documents, and possibly even produce visual models to support decision-making in the industry. As AI becomes more accessible and accepted, it promises to redefine construction practices through increased automation, enhanced cost-efficiency, improved safety, and long-term sustainability.

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Poster_35 / UG-S / In progress

Mathematical Analysis for Double Pendulum System.

The double pendulum is a classic example of a nonlinear dynamic system that exhibits complex chaotic behavior. Modeling the double pendulum involves the motion of two masses connected by rigid rods, with one pendulum suspended from the other. The equations of the system are derived based on the second law of Newton, resulting in a set of two nonlinear differential equations. These equations describe the angular positions and velocities of the two masses. It is still an open problem of how to solve for the exact solutions of these nonlinear equations. However, under certain assumptions, we can linearize these equations near equilibria and derive them into two linear differential equations that can be solved for exact solutions. In this project, after finding the exact solutions for the linearized system, we run some simulations for the non-linear system on a computer system MATLAB by applying Runge-Kutta method.

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Poster_24 / UG-S / Early phase

Kinetics of Oxidation using Spectroscopy methods.

Understanding the oxidation kinetics of carbon steel is critical for advancing forensic investigations involving firearms. To determine if oxidation-related changes may be accurately identified and measured using spectroscopy techniques including Ultraviolet-Visible (UV-Vis), Infrared (IR), and X-Ray Fluorescence

(XRF), this study focuses on the corrosion behavior of 1095 carbon steel. The goal is to provide a reliable, scientific technique for detecting and tracking oxidation on carbon steel.

This study addresses a fundamental need in forensic science the ability to accurately assess the environmental and chemical transformations that occur on a firearm over time. By examining the progression of rust formation, we aim to enhance current forensic methodologies and contribute to the development of standardized analytical protocols for temporal estimation and surface analysis in firearm-related investigations. In the early stages of this research, a chemical solution was prepared using 150 mL of hydrogen peroxide, 5 g of salt, and 2 mL of acetic acid to simulate and accelerate the corrosion process. Two pieces of 1095 carbon steel were immersed in the solution for one hour, and changes were observed and recorded every 10 minutes. This controlled setup allowed consistent monitoring of visual and physical corrosion changes over time.Initial results indicate progressive surface oxidation within the first 30 minutes, with visible rust formation and surface texture changes. These findings were obtained using spectroscopy methods such as infrared (IR) and X-ray fluorescence (XRF), to detect and quantify specific stages of oxidation, with future analysis aimed at confirming these techniques for forensic application..

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Poster_29 / GR-S / In-progress
Independent project

Enhancing Learning Efficiency and Ergonomic Well-Being: A Comparative Study of Handwritten, AI-Assisted, and Digitally Structured Notetaking.

How one takes notes in today's hectic learning environment can affect one's learning capacity, including memory retention, lead to physical stress, and even fatigue. This is especially evident in study sessions where students sit for hours. So, how a student dictates his notes could show better or worse results of efficacy. Thus, this research aims to decipher which notetaking technique best balances learning effectiveness and physical comfort. The team will analyze three popular approaches: digital notetaking via tablets, AI-generated notes, and conventional handwriting. Each note-taking technique is allocated to engineering graduate student participants in the study. After viewing a 30-minute instructional video and taking notes using the prescribed approach, students will complete a quick survey and quiz to measure their mental effort. The team will also inquire about physicality- posture, hands, and neck. After a day, a second quiz will assess their memory of the previous activity. The goal is to find an approach that achieves the best efficacy with the least physical and mental stress. This research could help students, teachers, and workplaces gain better focus techniques, understanding, and well-being. Analyzing the brain and body in tandem brings a fresh perspective on how we learn. Discovering ways to take exceptional notes is not the only aim. Still, taking notes in ways that promote the best results and mitigate any potential mental or physical strain for anyone involved is pertinent.

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Poster_5 / UG-S / In progress

American Alligator (Alligator mississippiensis) Hematology.

This study investigates the hematology of the American alligator (Alligator Mississippians) through the examination of blood smears, providing valuable insight into reptilian red and white blood cells (RBC, WBC) and potential abnormalities. Alligators are able to sustain significant injuries without infection and their immune system is therefore of interest to aid in production of antibiotics/antiviral medicines for human use. Samples were collected from live alligators at various venipuncture sites, including the tail vein, abdominal cavity, and regions near the heart. This sampling technique allowed for clean (no contamination) and "unclean" (potential contamination with organ bacteria) analyzes. Blood smears were stained using the Giemsa stain and analyzed under a microscope that was connected to a camera and imaging software. The primary aim of this research was to enhance understanding of the alligator immune cells and evaluate possible differences in immune cell numbers and/or appearance between humans and alligators. Of interest, was the presence of sickle-shaped cells in alligators as well as presence of potential (but unidentified) blood parasites in alligators. Key differences in RBCs included the presence of a nucleus and oval shape of RBCs in alligator red blood cells which are not seen in humans.

This research not only expands knowledge of reptilian hematology but also contributes to broader discussions of evolution, physiology, and comparative pathology and can assist in developing medicines that can aid in human infections.

Acknowledgement: This study was supported by the Galveston College STEM Honors Program through funding from the National Science Foundation (NSF).

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Poster_39 / UG-S / Early phase

EmployeeManager: Modernizing Employee Information and Payroll System.

This program will primarily facilitate the process of tracking employee payroll. To ensure every employee gets paid appropriately, it is imperative to have a flawless tracking system that will manage their payroll and have accurate information on the person. The Java program will use several programming techniques to achieve this desired outcome including inheritance, exception handling, and polymorphism. The use of these techniques will ensure a robust yet flexible code that can be expanded upon with future developments. The program will keep track of employee information including attendance and payroll. Users will be able to add or remove employees as well as modify their

information. Each employee will have a name, contact information, address, and payroll information. The contact information of the person stored in the system will allow employers or managers to inform them of any changes to their pay or other information. The attendance tracker will also be on record as evidence justifying less pay and such. It is important for employers and employees to have a fair system in place, especially when it comes to pay. This is important to me because accurate pay is fair for all parties involved. Hopefully, this project will be perfected to reach the vision of a system that will allow for fairness for all parties involved, prevent issues related to pay from occurring, and allow for future developments.

Presenter: **Brianna Magdaleno** [$] **Poster_2** / UG-S / Advanced
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Optimizing Acid-Free Clearing and Double Staining for Small Vertebrate Skeletons.

The study of vertebrate skeletons is crucial for understanding their anatomy, development, and evolution. Clearing and Double Staining (C&S) is a widely used technique that makes tissues transparent and highlights skeletal structures, enabling researchers to examine cartilage (blue) and bone (red) without sectioning. C&S is particularly effective for studying small vertebrates like fishes and amphibians. Traditional C&S protocols use acidic solutions, which can decalcify bones in tiny specimens, compromising bone staining quality. An acid-free protocol using magnesium chloride ($MgCl_2$) instead of glacial acetic acid has been proposed to address this. However, it has only been tested in zebrafish (Danio rerio) at a single developmental stage. This study aims to optimize C&S methods for the early life stages of vertebrates by testing the effects of both staining time and concentration of $MgCl_2$ in acid-free cartilage staining solution and their impact on the quality of cartilage and bone staining in multiple species. Results showed that lower concentrations of $MgCl_2$ led to excessive uptake of alcian blue in unintended tissues of smaller specimens, while larger specimens were less affected. The results also showed that longer staining durations increased cartilage staining intensity in the same unintended tissues across all sizes. Regardless, of the concentration or duration in the cartilage staining solution, the bone staining remained unchanged.

Presenter: **Carson McCauley** [$] **Poster_22** / UG-S / Early phase
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Plastic Nanoparticles in Soil.

It is understood that microplastics are great harm for both the environment and the health of humans. I have been conducting research to better understand the impact and to see if there are better ways to

minimize the amount that can be found in common places such as soil and natural water sources. My research so far has been to find trace amounts of plastics in soil by extracting the organic bilayer using density separation. With the organic material, I can run a myriad of tests against the standard of polystyrene. This will help me identify any similarities. Using the results I can quantify the amount of plastic material found in my soil sample and theorize from there how to extract nanoparticles of plastic found.

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Poster_30 / GR-S / In progress
Center of Research at Lamar U.

Designing a unique fruit-harvesting robotic manipulator to reduce damage to fruits, leaves and trees significantly.

Existing fruit harvesting mechanisms are still mechanical, which damages fruits and trees. So our main concern is developing a robotic picking system that will be able to recognize and locate the fruit for best quality output without damaging fruit or trees. Y. Sarig et al. (1993) mentioned two robots picking oranges with a 75% success rate and apples with a 50% success rate. In both cases, the success rate is still less. Y. Xiong et al. (2019) mentioned the average picking success rate for a single attempt is 53.6% without causing damage to the berries and 59.0% when including "success with damage" in the natural situation. The struggle is picking clusters of strawberries, where both the detection and the gripper struggle to separate the strawberries. M. Campbell et al. (2022) mentioned a leaf retrieval mechanism that can capture 69.2 percent leaves and only 10.25% (4/39) of viable leaves that are clean-cut.

Now the challenge is creating a smaller efficient faster manipulator. So, my idea is to create a unique small fruit-picking manipulator that will easily reach and capture the fruit and have a pouch to hold some fruits. At the end of that pouch will be an automatic gate mechanism to drop the fruit when it reaches the receiver. The mean success rate will be measured for different fruits and necessary changes to the design will be made to achieve around 95% success rates in small picking time and 3D point cloud system will be used for detection.

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Poster_31 / GR-S / In progress

Mixed Reality in Training.

Over the past few years, augmented and virtual reality technologies have been utilized in education, entertainment, manufacturing industries, and in training the purpose of an individual to engage the user in an interactive environment. To enhance the user experience in this emerging field, various studies has been done using mixed reality which blends (AR/VR) applications by creating realistic simulations that

replicate real-world, high-risk, and complex scenarios leading to skill acquisition, physical (muscle) memory development, and enhancing learning experience in a controlled and safe environment. In sectors such as from healthcare to manufacturing, aviation, workshops, and in sports and fitness. This technology offers hands-on practice, adaptive content, and immediate feedback by trainers during or after training. Furthermore, mixed reality reduces the cost and preparation required by traditional training environment and scenarios by reusing it with minimal expenses and modification. Despite the advantages of mixed reality, this technology is still facing difficulties in adaptation due to high setup cost, special content development for training, and user adaptation. However, ongoing development in hardware and software are making MR platform implementation more feasible and accessible to users. As technology continues to evolve, mixed reality integration into training programs will enhance the learning outcome, bridge the gap between physical and virtual training, and foster innovation in instructional design.

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Poster_37 / UG-S / In progress

EShop: Building a Scalable E-Commerce Shopping Cart to Digitalize Purchase.

We all have problems with shopping experiences, such as prices not showing, and purchases not happening. So, this project aims to develop a shopping cart for a dressing shop that uses HTML, CSS, JavaScript, and Django with Python programming language to make a complete and easy-to-navigate website for a shop. The project aims to simplify the process of digital purchasing. Django facilitates the backend of this project. HTML, CSS, and JS with React framework are used to design the frontend, so that users who are not very experienced with digital purchasing can still find a way to do it. Hopefully, this project can enhance the building of scalable e-commerce shopping cart to digitalize purchase.

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Poster_38 / UG-S / Early phase

RecipeHubAPI: Cookie Generator.

This paper helps learn on the concepts of the try, catch, and finally block with a fun way, to give various types of cookie recipes that the user can cook at home. Providing another alternative for fetching recipes that the user does not have to individually search up. In this recipe generator, we look at different components of ingredients that the user will input with their desired preferences to generate a list of delicious recipes that will satisfy the tastebuds. This project will be using exception handling concepts which are prominently used in Object-Oriented Programming (OOP). The resulting picture will help users to understand the relationship between exception handling and OOP. Hopefully, users will garner more

knowledge and understanding of programs that look simple but delve deeper underneath the layers of computer science.

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Poster_36 / UG-S / In progress

Material Interfaces: Designing a Smart Productivity Display using OOP Principles, API Integration, and Craftsmanship.

A smart mirror consists of a framed computer screen placed behind a two-way mirror. This two-way material allows light from the screen to pass through, making digital content appear on the mirror's surface. The mirror will display real-time information designed to support daily routines. Using JavaFX, Weather APIs, and Object-Oriented Programming, I strive to create a program that will aid in human routine, with aesthetics, security, and innovation in mind. The mirror will display crucial data such as the current time, calendar, and the local weather conditions. The hope is to integrate technology into everyday life, promoting productivity and efficiency in a modern environment.

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Poster_7 / UG-H / Early phase

Inclusion or Exclusion: The Debate Over Asexuals in Religious Communities.

Asexuality, a sexual orientation characterized by a lack of sexual attraction, has gained increased recognition in recent years. While often misunderstood, asexuality challenges traditional norms of attraction and relationships, positioning it as a unique identity within the spectrum of human sexuality. Interestingly, asexuality finds conditional acceptance within conservative religious communities due to its perceived alignment with celibacy, chastity, and traditional family structures. This study explores how religious values shape the reception of asexuality, analyzing the extent to which it is acknowledged as a valid orientation versus merely tolerated under moral and theological frameworks. The findings reveal that while some religious communities interpret asexuality as fulfilling spiritual ideals, others hesitate to fully embrace it due to long standing expectations surrounding marriage and procreation. Additionally, the research highlights debates over the inclusion of asexuality within the queer community, where differing perspectives shape discussions of identity and acceptance. By investigating both conservative and queer spaces, this study contributes to a broader understanding of the socio-cultural dynamics affecting asexual individuals and their place in diverse communities.

Keywords: asexuality, religion, conservative communities, social acceptance, acceptance.

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Poster_42 / UG-S / In progress
NSF grant support

The Detection of Escherichia coli in Food Samples Using Polymerase Chain Reaction.

My project was based on the pathogen *Escherichia coli (E. coli).* According to CDC, Escherichia coli *(E.coli)* was responsible for 37 food outbreaks in 2024. I aimed to detect *E. coli* in food samples from vendors in Galveston Island using nucleic acid-based assays such as polymerase chain reaction (PCR). Culturing and staining methods are time-consuming (several days for initial results up to confirmation). Therefore, accurate and fast E. coli detection methods can assess the microbiological status of food and prevent the spreading of infectious agents. Samples (n = 62) from uncooked beef, chicken, and vegetables were swabbed and later DNA isolated to run PCR for methods. Two meat and two produce samples were detected positive for the E. coli glutamate decarboxylase (gadA) gene. Interestingly, produce samples (lettuce and green pepper) were also positive for bfpA (bundle-forming pilus) but not for eae (intimin) virulence genes; indicating contamination with a potential pathogen, that might not be so virulent to cause disease in those consuming the food product. Safety measures such as hand washing, cooking at safe temperatures, and proper refrigeration are essential to prevent outbreaks. The Galveston College STEM Honors program funded this study through an NSF grant.

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Poster_32 / UG-S / In progress

Creep Test Rig.

Creep is defined as the rate at which a solid material deforms under constant mechanical stress. It is used in industry to better understand how materials will deform over time. This study focuses on creep behavior of low-density polyethylene (LDPE) with the fire-retardant filler, Magnesium Hydroxide (Mg (OH)2), at 10, 20, and 30% loading. A creep test rig was used to find the strain of these samples along the elastic effects over time. Strain was calculated dividing travel by the initial height of the samples. It is known as conventional creep testing since the results were time dependent. The experimental data was analyzed using the Findley power law model. This numerical method helps find a correlation between creep test and time in the form of a simple equation x=mtn. Furthermore, it divides creep into three phases; phase

2 was the focus of this experiment. The stress of the samples was calculated dividing force applied in successive increments by the cross-section area of sample. The data was used to calculate the material stiffness using Young's Modulus. The findings were graphed as strain vs time using Microsoft Excel and Python to compare the graphing tools. The results obtained from the graphs for each sample containing different amounts of $Mg(OH)_2$ were analyzed to determine the phase 2 creep rate.

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Poster_13 / UG-S / Early phase

Retardants' Effect on Concrete in Warm Environments.

In construction projects, the premature setting of concrete due to warm weather conditions has become a significant issue, leading to poor-quality concrete with compromised strength and durability. High temperatures accelerate the hydration process, causing concrete to set too quickly, resulting in reduced workability, increased risk of cracking, and potential long-term structural weakness. This premature setting can hinder the proper finishing of the surface and may lead to costly repairs. This research seeks to identify which retarders produce the most consistent, good-quality results across warm environments, ensuring that concrete can be placed, finished, and cured effectively despite high temperatures. Advantages of retarders in Concrete are as follows. Complex concrete placement or grouting. Special architectural surface finish: exposed aggregate finish. Compensating for the accelerating effect of high temperature towards the initial set, preventing cold joint formation in successive lifts. The specific retarders this article will be discussing are Liquid nitrogen, chilled ice water, and Poly G 83-34 high-range water reducer (CHRYSO Optima 249). Data and technical merit in this paper were sourced as follows, reading 21 posted research report papers/ literary reviews online; search engines used were google and Mary and John Gray library filtered by the key words “concrete, retarder, admixture, cure”, asking companies and industry experts for current/ to date information, and utilizing personal experience on site with retarder applications. How the reader should analyze the literary review is subject to the purpose and/or intentions of the readers' objective with the data provided in the paper.

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Poster_18 / UR_H / Early phase

Improving the Construction Permitting Process in SETX through Technological Integration.

This research investigates methods to improve the construction permitting process in Southeast Texas (SETX), focusing on enhancing efficiency, accessibility, and user experience. The study began with a literature review of residential and commercial permitting procedures to understand current workflows, regulatory structures, and common roadblocks. A detailed process flowchart was created to visualize the permitting process and identify areas of inefficiency. Based on this foundational work, a survey and focus group instruments were developed to gather feedback from contractors. While Institutional Review Board (IRB) approval is pending, initial outreach confirmed contractor interest for future pilot testing. Basically, this past two semester's of research was to build the foundation for the SURF summer research, where we plan on gathering data and later applying said data into a functional solution. To conclude, this study's objectives are to develop policy and technical recommendations that streamlined the permitting process to promote economic growth in the region.

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Poster_17 / GR_H / Advanced

When the Courtroom Becomes the Classroom: Engaging Students in the Transformative Learning Process.

Transformative learning experiences in higher education have become increasingly critical as institutions seek to prepare students for rapidly evolving professional environments. Introduced by Jack Mezirow, transformative learning (TL) articulates a learning process, for post-secondary learners, that results in clear changes in the individual's frame of reference as they move through an active learning process (Mezirow, 2002). Through structured experiential learning opportunities that connect academic concepts with real-world applications, students can develop theoretical knowledge coupled with technical competencies and the broader professional capabilities needed for career success (Pantzos et al., 2023). This research project provided student practicums for students in criminal justice, social work, communication, and education which offered evidence-based experiential opportunities to develop professional skills through the application of access to direct mental health services within the criminal justice system. By utilizing collaborative response programs, educational training and effective communication at all levels, students were able to provide compassionate and cost-effective mental health resources to help keep people out of the criminal justice system when mental health issues present as the primary concern (Dempsey et al., 2020; Gosselin, 2017). Results indicate that throughout this learning process, students developed advanced work-ready skills such as critical thinking, increased awareness of resources and needs, and developing actionable plans with clients.

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Poster_3 / UG-S / In progress

An Assemblage Survey of a Highly Productive Recreational Fishery in a Man-made Dredge Placement Compartment in Sabine Lake.

Estuaries along the Gulf Coast provide nursery habitat (e.g., seagrass beds, coastal marshes) which not only serve as a refuge for larva and juvenile fishes and invertebrates but also provide resources for adult individuals of numerous species. This includes many species collected for sport and as a result, these areas often support popular recreational fisheries. The Texas shoreline of Sabine Lake has been heavily altered by hydrological diversions, ship channels and revetments resulting in a greatly reduced connection between the estuary and the surrounding marshland nursery habitat. Despite this, there was a highly productive, local recreational fishery located on Pleasure Island, Port Arthur, Texas that was centered around a dredge material placement area enclosed within the island revetment. The enclosed compartment consisted of open water habitat with emergent vegetation along much of the perimeter and maintained a connection with Sabine Lake via tidal flow through two sets of large diameter pipes, allowing organisms to move freely between the two. We aim to determine if this manmade enclosure served as an important habitat for adult's individuals, including several popular game fishes. To accomplish this, we conducted population inventories following the methods of the TPWD Coastal Fisheries Division over the course of a year. The data collected is compared to that collected by TPWD for the Sabine Lake System to determine if there was a significant difference in the community assemblage within the north levee enclosure compared to the surrounding estuary and what environmental variables may be associated with these differences.

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Poster_21 / UG_S / Early phase

Effects of Stimulant on Metabolic Pathways.

This study focuses on looking at the effects of a stimulant (caffeine) and an analgesic on the lipids of a plant sample. The purpose of this is to hopefully have a better understanding of how these drugs impact the lipids in humans eventually by using the plants as a reference cell. To conduct this research, two samples of the same plant material were collected, and one sample was treated with a combination of the two drugs, while the other was left untreated to serve as a control. The lipids from both samples were extracted and run through gas chromatography. The results are expected to show a change in the metabolic pathway due to the addition of the stimulant.

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Poster_27 / GR-S / In-progress
Center for Midstream Management and Science, Center for Resiliency at Lamar U.

CFD Modeling of Methane Gas Release from an Underground Pipeline in Different Soil Types (Silt, Sand, and Gravelly).

Subterranean pipelines are crucial for transporting natural gas and light hydrocarbons globally, but these pipelines carry the risk of ruptures that can release hazardous materials, leading to severe financial and human consequences. Effective consequence modeling necessitates a deep understanding of gas flow dynamics and its atmospheric escape to develop robust preventive and mitigation strategies.

This research focuses on developing a computational fluid dynamics model in ANSYS Fluent to simulate the flow of gas from ruptured subterranean pipelines, addressing the critical need for better safety measures. By integrating advanced modeling techniques in ANSYS Workbench, the study aims to predict gas flow regimes such as diffusion, fluidization, and crater formation under various Soil conditions. The model will be validated with experimental work conducted by Yan et al. and assessed for its ability to predict methane concentrations and flow behaviors. This work provides a valuable tool for understanding and mitigating the risks of underground pipeline breaches in oil and gas facilities.

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Poster_23 / UG-S / Early phase

Polypropylene Solutions and Metal Oxides in the Presence of Living Cells for Surgical Settings.

The goal of this research is to evaluate whether specific metal-polymer combinations are suitable for use in professional and biomedical applications, including surgical environments. We began by gently heating and dissolving 2g of polypropylene in 200 mL of toluene. While the sample dissolved, our metal oxide was prepared using 0.1g of Magnesium with 10 mL of ethanol, followed by sonication to ensure dispersion. Once the metal oxide was finished and the polypropylene/ toluene solution was fully dissolved and cooled, they were then cast. A sample was cast on two mediums: one uses water as a standard and another uses Magnesium oxide. In the presence of magnesium oxide, there was visible crystallization. The sample was then taken for analysis through DSC and IR testing.

In our future research, we plan to prepare additional samples to be cast and analyzed to observe similar interactions with the polymer and metal oxide. Additionally, we hope to introduce the compound to living cells in hopes of positive growth. Positive cell growth in the presence of the polymer and metal oxide compound would suggest potential in medical or surgical application.

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Poster_20 / UG-S / In-progress

Search for *Escherichia coli* Under Shoes.

E. coli is a bacterium that is present in everyday life. It is commonly looked for in food samples to check if the food is safe enough to eat either cooked or uncooked. *E. coli* can come from fecal matter, which is present in bathrooms, farms, animal waste, etc. Not all strains of *E. coli* are harmful to humans. There are strains that are symbiotic to humans such as EcN which contribute to the human gut biome. Strains that are virulent such as ETEC, EPEC, EAEC, and EIEC can cause symptoms such as diarrhea. This prompted the question of whether *E. coli* could be found on the bottom of shoes that frequent similar environments, then can be transmitted onto surfaces that small children could encounter, such as the floors of homes. For this study, 37 shoes from random subjects have been swabbed to collect the DNA present on the shoes. After the DNA was isolated from samples PCR was made to test for gada gene (glutamate decarboxylase enzyme encoding gene, specific for *E. coli*). Currently there have been positive samples for bacteria (16s) and *E. coli (gada).* Further testing will be done to determine whether any of the positive *E. coli* samples contain strands of *E. coli* that are dangerous to humans.

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Poster_4 / UG-S / In progress

Predicting Crotonylation Sites and DNA/RNA Binding Proteins: A Machine Learning Approach for Understanding Abnormal Protein Behavior in Cancer.

Crotonylation, a lysine-based post-translational modification, regulates key cellular processes and is linked to diseases like cancer and Alzheimer's. Identifying lysine crotonylation sites in DNA-binding proteins is crucial for understanding abnormal protein behavior in cancer. Large language models (LLMs), pretrained on protein sequences, have shown promise in protein specific tasks like structure and function prediction. In this study, we investigate the effectiveness of Protein Language Models (pLMs) in addressing two significant bioinformatics problems. The first problem is prediction of crotonylation sites, essential for protein function. We use embeddings from the pLM ProtT5-UniRef50-XL, utilizing full protein sequences as input. These embeddings are processed through a Multi-layer Perceptron (MLP) classifier to predict crotonylation sites, resulting in the CrotT5-MLP model. The second problem involves predicting DNA/RNA

binding proteins, formulated as a multi-label classification task to predict DNA and RNA binding proteins simultaneously. Protein-level representations are generated using average pooling on ProtT5 embeddings, and an MLP is employed as the classification head to assign binding labels, referred to as DNA-RNA-T5-MLP.Leveraging pLMs, we obtain robust representations directly from protein sequences, automating the prediction tasks and eliminating the need for handcrafted features. This approach reduces manual effort and offers cost-effective alternative to traditional, lab-intensive methods. Additionally, I would like to acknowledge the support of Dr. Jane Liu (Lamar University) and Dr. Dukka KC (Rochester Institute of Technology) for their immense guidance. I sincerely thank Lamar University's David J. Beck Fellowship Program and the Office of Undergraduate Research (OUR) for their generous financial support in this research.

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Poster_16 / UG-H / In progress
SURF project

Gender Equality Blueprint: How Culture Affects Our Relationship With FML.

Despite decades of progress in gender equality, wage disparities persist across OECD countries. This study investigates how cultural attitudes shape the effectiveness of Family Medical Leave (FML) policies in reducing the gender wage gap. Analyzing cross-national data, the findings reveal that policy implementation alone is insufficient—cultural readiness plays a crucial role. Countries with long-standing leave policies but traditional gender norms, such as South Korea, continue to experience high wage gaps, while those with progressive attitudes, like Norway, see greater gender parity. These results emphasize the need for policymakers to move beyond legislative measures and invest in cultural transformation strategies, such as promoting paternity leave uptake and challenging gender stereotypes in workplaces. Addressing the intersection of policy and culture is essential for achieving sustainable gender equality.

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Poster_14 / UG-S / In progress

The effects of temperature differential within Hot Mix Asphalt at Construction.

This investigation examines the effects of temperature differentials in Asphalt at construction with regards to the longevity and resulting performance of the pavement. The goal was to figure out the effects of the specific temperature or range of temperatures that have a noticeable effect on the pavement. The research employs field evaluations of certain temperature differential (TD) spots, where distress indicators

are systematically monitored, to gain a better understanding of what those spots are telling us. The team used samples of the asphalt from the segregated and non-segregated areas to compare them in the lab. Comparing these samples against a variety of other conditions to figure out exactly what the cores and the areas around them are saying. Information gathered from these assessments unequivocally shows that temperature disparities of more than 25°F correlate with higher amounts of air voids. This means that the finished product is more likely to be compromised. These initial findings are crystal clear: temperature-related construction issues are directly responsible for paving that won't last. The results stress the significance of strict temperature control during construction. They indicate that current regulatory guidelines need to be improved to better manage the risk of temperature nonuniformity. By connecting temperature differences with pavement performance, this research provides clear and useful evidence for improving construction practices. In the end, we hope that it lays a foundation for extending the lifespan of pavements, improving roadway safety, and possibly saving money by reducing the amount of maintenance that is necessary.

WORKSHOPS – Dr. Masud Rana

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W_1 / GR-S / Early phase

A Robust Phishing Attack Detection System Using Random Forest, XGBoost and KNN.

Phishing attacks have become a serious threat to online safety, tricking users into giving away personal and sensitive information through fake emails or malicious websites. As phishing methods become more sophisticated, it's crucial to develop reliable detection systems that can identify these threats in real-time. This project focuses on building an effective phishing detection system using a blend of machine learning techniques two advanced algorithms, Random Forest and XGBoost, along with a basic algorithm, K-Nearest Neighbors (KNN).

Random Forest, known for its robustness, uses multiple decision trees to boost accuracy and handle large datasets efficiently. XGBoost takes it a step further by leveraging gradient boosting, making predictions more precise through iterative improvements. On the other hand, KNN, a simpler yet effective method, classifies phishing instances based on how closely they match known data points.

To create a comprehensive detection model, we collected data from various sources, including phishing and legitimate websites, and extracted relevant features such as URL patterns, email characteristics, and web attributes. After data cleaning and processing, we trained the models to spot phishing attempts while minimizing false positives.

Our approach combines the power of advanced algorithms with the simplicity of KNN to create a balanced and accurate phishing detection system. The results indicate that our model performs well in identifying phishing attacks, offering a practical tool to enhance cybersecurity and protect users from online fraud.

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W_2 / GR-S / Early phase

CREDITRISKML: Credit Risk Prediction using Logistic Regression and XGBoost.

This study presents the CREDITRISKML, a machine learning-based system for credit risk prediction using Logistic Regression and XGBoost. The objective is to classify loan applicants as high-risk or low-risk, enabling financial institutions to make more informed lending decisions. The methodology involves applying supervised learning techniques on a labeled dataset containing information such as income, credit score, loan amount, employment status, and repayment history.

The dataset used to study sourced from publicly available financial datasets, commonly used in credit scoring benchmarks. It underwent preprocessing steps including handling missing values, label encoding for categorical features, and feature scaling to ensure optimal model performance.

Two models Logistic Regression and XGBoost were trained and evaluated. Logistic Regression offered a baseline due to its simplicity and interpretability. XGBoost, a gradient boosting framework, was employed to enhance predictive accuracy through advanced regularization and ensemble learning.

The results show that XGBoost significantly outperformed Logistic Regression in terms of accuracy, precision, recall, F1-score, and AUC-ROC. This indicates its effectiveness in capturing complex patterns and reducing misclassification rates in credit risk prediction.

In conclusion, the study demonstrates that machine learning, particularly XGBoost, can be a powerful tool for credit risk assessment. The implementation of such models can help financial institutions reduce default rates, improve loan portfolio quality, and support data-driven decision-making processes.

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W_3 / GR-S / Early phase

Predicting Customer Churn with Machine Learning: Enhancing CRM Strategies through Advanced Algorithms.

Customer churn prediction is essential for managing relationships and retaining members, especially within student organizations. While commercial CRM systems like Salesforce and Dynamics 365 offer built-

in churn prediction features, they often lack customization tailored to educational settings. This project aims to fill that gap by developing a predictive model specifically designed for student organization CRMs. The model leverages advanced machine learning algorithms, including XGBoost, LightGBM and HistGradientBoostingClassifier, to accurately predict member disengagement.

The project follows a structured approach, beginning with data collection from CRM systems that include engagement metrics, support ticket records, and interaction histories. After data preprocessing and feature engineering, the model is trained to detect members at risk of leaving. To address the unique needs of student organizations, custom metrics such as Engagement Score and Support Ticket Ratio are incorporated, enhancing prediction accuracy.

During the evaluation phase, model performance is measured using accuracy, precision, recall, and F1-score to ensure reliability. XGBoost and LightGBM offer robust and efficient predictions, while HistGradientBoostingClassifier enhances adaptability and learning from data patterns. Once the most effective model is identified, it will be deployed as an API within CRM systems, allowing real-time churn prediction.

By integrating the model directly into CRM workflows, student organizations can proactively identify at-risk members, enabling more targeted and effective retention strategies. This tailored approach addresses the limitations of generic CRM solutions, providing a practical tool for enhancing student engagement and retention.

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HEALTHML: Disease Prediction using Decision Trees and Random Forest.

The rapid advancement of machine learning (ML) technologies has opened new frontiers in the field of healthcare, particularly in disease prediction and diagnosis. Accurate and early detection of diseases is vital to initiating timely treatment and improving patient survival rates. This project, titled HEALTHML, explores the use of two popular supervised machine learning algorithms—Decision Trees and Random Forest—for disease prediction based on patient data, including symptoms, demographic information, and medical history. These algorithms were selected due to their effectiveness in classification problems and their ability to handle large datasets with both categorical and numerical variables.

The Decision Tree algorithm is known for its simplicity and interpretability, allowing healthcare professionals to understand and trace the model's reasoning for a specific diagnosis. However, individual decision trees may suffer from overfitting and reduced accuracy on unseen data. To overcome this, the Random Forest algorithm is introduced as an ensemble method that builds multiple decision trees and combines their outputs to improve predictive performance and generalization. It also ranks the importance of features, helping identify key symptoms contributing to specific diseases.

The data set used in this study was sourced from public medical databases and contains information about various diseases and associated symptoms. After preprocessing, the data was split into training and testing

sets, and the models were evaluated using metrics such as accuracy, precision, recall, and F1-score. Experimental results demonstrated that Random Forest consistently outperformed the standalone Decision Tree in terms of accuracy and robustness.

HEALTHML highlights the potential of machine learning to support clinical decision-making, reduce diagnostic errors, and enhance the overall efficiency of healthcare systems.

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W_5 / GR-S / In progress

Advanced Machine Learning Techniques to train models to detect Network Intrusion Detection.

In this age of interconnected world, keeping the network infrastructure safe from malicious activities is very important. This study presents a Network Intrusion Detection System (NIDS) that utilizes machine learning algorithms for efficient anomaly and cyber-attack detection. The three high-level algorithms utilized in the research are Isolation Forest, Autoencoders, and Support Vector Machine (SVM) with RBF Kernel, applied to traffic data from the KDD Cup 99, UNSW-NB15, and CICIDS 2017 datasets. The datasets are composed of normal and attack traffic and provide a comprehensive ground for model comparison. The Isolation Forest algorithm is used for unsupervised anomaly detection with the main goal of isolating anomalous instances. Autoencoders use deep learning to reconstruct input data and detect anomalies based on reconstruction error. The SVM model is used as a supervised learning method to differentiate between attack and normal traffic. The study concludes that deep learning methods provide a robust solution for intrusion detection but at the cost of higher computational requirements. The findings emphasize the necessity to select appropriate machine learning techniques based on the specific characteristics of network traffic data.

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W_6 / UG-S / Early phase

The Identification of Numerical and Alphabetical Characters through Machine Learning.

This purpose of this document is to showcase how machine learning can be used to interpret numbers and letters. The methodology of machine learning this paper will use is the Decision tree and SVM. This paper will also explain in detail why the decision tree and SVM is used, and how they have operated. The data set this paper will be using is yet to be determined. The conclusion of this paper will show the result of such machine learning, and the process of how this project will end up.

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W_7 / GR-S / In progress

BrainTumorML: Evaluating, Analyzing, and Recommending ML Models for Early Brain Tumor Detection in MRI Imaging.

Detecting brain tumors at an early stage plays a significant role in enhancing patient survival rates. This research aims to evaluate and compare the effectiveness of three distinct machine learning models—Random Forest, Artificial Neural Networks (ANN), and Convolutional Neural Networks (CNN)—for classifying brain tumors using MRI scans. The study utilizes a well-known Kaggle dataset containing labeled MRI images of gFlioma, meningioma, pituitary tumors, and non-tumor cases. Data preprocessing steps involve resizing the images, normalizing the pixel values, and converting the labels into a one-hot encoded format. The models are then trained and evaluated on this dataset, with performance assessed based on accuracy, sensitivity, and specificity metrics. While Random Forest is expected to excel due to its robustness with complex data, ANN is expected to offer advantages in identifying non-linear patterns, and CNN, being particularly designed for image data, is anticipated to achieve superior performance by extracting spatial features. Logistic Regression will be used as a baseline model for comparison. This study aims to demonstrate the utility of various machine learning models in the classification of brain tumors and contribute to the advancement of AI technologies in medical diagnosis and early detection.

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W_8 / GR-S / Early phase

Stock Price Prediction Using Machine Learning Regression Models.

This is a project in predicting EUR/USD price using regression algorithms The data is collected from a CSV with structured formats, using important indicators such as open, high, low, and volume values. After a few preprocessing steps such as normalization of column features and removal of NaN values, the data was split into training and test sets, with the last 50 rows of information used to evaluate the performance of our model on unseen results. A total of three machine learning algorithms were deployed: Linear Regression, Random Forest Regressor, and K-Nearest Neighbors Regressor (KNN). Feature scaling was applied via normalizing for algorithms sensitive to data scale, such as Linear Regression and KNN. All models were trained on this training set and tested on the test set. The performance metrics were Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and R^2 Score. All three had strong predictive performance, and while Linear Regression had the highest R^2 score (0.96+) this was closely followed by Random Forest and KNN. The consistency of the predictions (especially in stable price regions) was confirmed using visual comparisons of actual vs predicted values. Above all, learners can achieve good performance in currency price short-term prediction using a simple set of market features. This indicates that regression models should be included in financial analytical workflows and establishes a foundation

for introducing further developments, including time-series modeling or deep-learning techniques for better long-term predicting power.

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