Saint Peter's University

26TH ACADEMIC SYMPOSIUM

APRIL 30, 2025

THE DUNCAN FAMILY SKY ROOM

MAC MAHON STUDENT CENTER

Office of the Vice President for Academic Affairs

Welcome to the Annual Academic Symposium - a celebration of student accomplishments. The Symposium represents a longstanding tradition that highlights the research and scholarly achievements of Saint Peter's students who have worked in collaboration with dedicated faculty members throughout the year. It began as "Poster Day" in April 1998 with Dr. Laura Twersky as the advisor and Amira Roess as the first President of TriBeta, in consultation with Dr. Virginia "Ginny" Bender.

These collaborations represent a model for integrating teaching with scholarship outside the classroom, to promote the intellectual development and professional growth of our students. The Symposium also provides an opportunity for the campus community to gain a greater appreciation of the collective accomplishments of our faculty and students, as well as to celebrate their achievements.

I hope that you enjoy and benefit from viewing the posters, hearing the presentations, and speaking with the authors of these impressive works. Congratulations to all the presenters!

Sincerely,

WeiDong Zhu, Ph.D.
Vice President for Academic Affairs

OVERVIEW

UNDERGRADUATE
STUDENT SYMPOSIUM

Wednesday, April 30, 2025
11 AM - 1 PM

Investigating Microplastic Interactions with Biological Molecules

Andres Zuniga
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Mena and Ukrainian Migration to the U.S.

Noor Fatima Memon
Advisor: Jennifer Ayala, Ph.D

The Bizarreness Effect is Inconsistent in Free Recall

Maria Medrano
Advisor: Maryellen Hamilton, Ph.D

The Effects of Physical Activities and Sports Programs on Social Skills, Language Skills, and Repetitive Behaviors of Children with Autism Spectrum Disorder

Evangelos Koutsopetras
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A Customized Belongingness Intervention at a Small, Diverse Liberal Arts University

Cassidy Mulligan & Sumaiya Tasnim
Advisor: Brittany Hanson, Ph.D

Moral Roots of Intergroup Conflict: A Test of the Moral Motives Model

Ramona Urrutia
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The Great Backyard Bird Count 2025: Our Global Connection to Birds

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Project FeederWatch Goes to Eleven With Goldfinches and A Ruby Crowned Kinglet

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Enhancing Quality of Life through Recreational Dance

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Overcoming Mental Barriers in Soccer Injury Recovery: The Importance of Psychology Rehabilitation

Karen Vanessa Culpatan
Advisor: Joshua Williams, DHSc

The Effects of Mindfulness-Based Strategies on the Mental Health of Athletes

Kasidy Slusser
Advisor: Joshua Williams, DHSc

Focus and Endurance: The Role of Breathing Techniques in Achieving Peak Performance

Brendon Wilson
Advisor: Joshua Williams, DHSc

The Role of Plyometric Training in Enhancing Performance in Children & Adolescents

Elijah Kiboma
Advisor: Joshua Williams, DHSc

Cognitive Learning and its Role in Injury Recovery in Golf and Sport

Pablo Alvarez Jordan
Advisor: Joshua Williams, DHSc

Targeting Early Onset of Parkinson's Disease with Physical Therapy and Exercise

Mariam Bouls
Advisor: Joshua Williams, DHSc

The Effects of Plyometric Training on Vertical Jump and Performance for Basketball Athletes

Jane A Calle
Advisor: Joshua Williams, DHSc

Examine the Effectiveness of Heavy-to-Moderate versus Light-to-Minimal intensity loading in Injury Rehab.

AJ Anglade
Advisor: Joshua Williams, DHSc

Mental Health and Injury Recovery in Athletes: Psychological Factors in Healing

Abdulah Sacko
Advisor: Joshua Williams, DHSc

Effects of Mental and Physical Fatigue on Technical Performance in Soccer Players

Allan Licona
Advisor: Joshua Williams, DHSc

The Effect of Altitude Training on Soccer Players' and Elite Athletes' Endurance and Red Blood Cell Production

Gabriel Flores
Advisor: Joshua Williams, DHSc

Testing dynamic moral construal: Are there physiological correlate of moral judgments?

Emily Perez & Reece October
Advisors: Daniel Wisneski, Ph.D.

Developing an Enzyme free Glucose sensor using Ruthenium Nanoparticles (Ru NPs) and Polyaniline (PANI)

Hiba Zahoui & Allysa Gamlanga
Advisor: Yosra Badiei, Ph.D.

Examining neuropeptide-elicited network oscillations using a mathematical model

Isabelle Bautista
Advisor: Nickolas Kintos, Ph.D.

Learning Skills to Interpret Transmission Electron Microscopy (TEM) Images with Budget-Friendly Hands-On Activities

Noemi G. Carranza
Advisor: Natalie Hudson-Smith, Ph.D.

Effects of Microplastics/Bisphenols on Blood

Carlos Jose Duque Sanchez
Advisor: Laura Twersky, Ph.D.

Developing Molecular Electrocatalysts for the Desulfurization of Fuel Oils

Navleen Virdi & Arham Shafi
Advisor: Yosra Badiei, Ph.D.

Breaking Barriers: The Impact of Poverty on Latino Health and Access to Medical Care

Leslie Gallardo, Katherine Santos, Sarah Nunez & Diana Guerra
Advisor: Erick Caamano, Ph.D.

Germination effectiveness of commercially available strawberry seeds using different seed preparatory treatments and growing mediums.

Justin Capin
Advisor: Brandy Garrett Kluthe, Ph.D.

Native and Medicinal Plant Knowledge Among Immigrant Populations in Jersey City

Maraya Cruz, Justin Capin & Catherine Saldana
Advisor: Brandy Garrett Kluthe, Ph.D. & Erick Caamano, Ph.D.

Improving Catalytic Properties of TiO_2 Nanomaterials for Decomposition Organic Pollutants

Harris Javed Satti & Balikis Iyiola
Advisor: Yosra Badiei, Ph.D.

PCR Identification of Mold Growing in Gannon Hall

Alexandra Ramirez Valdez, William S.G. Minto, Youstena A. Waheb, Darlyn Brenton & Hawaa Diaw
Advisor: Vasilios A. Orologas, Ph.D.

How Physical Activity Builds Stress Resilience and Supports Mental Health Recovery Across the Lifespan

Schneider Tout-Puissant
Advisor: Joshua Williams, DHSc.

Allelopathic phenols in Eucalyptus ssp. and their impacts on seed germination of common agricultural seeds.

Jessica Pagnussati
Advisor: Brandy Garrett Kluthe, Ph.D.

Pilot Study: Implementation of a Campus Wide Plant Biodiversity Database

Alexandra Ramirez-Valdez, William S.G. Minto, Youstena A. Waheb, Darlyn Brenton, Hawaa Diaw
Advisor: Vasilios Orologas, M.S.

Movie Recommendation System
Abhiram Reddy Kotha & Vamshi Tummala
Advisor: Vijay Kumar Reddy Voddi, Ph.D

AI-Powered Search and Summarization for Government Rules and Regulations in India
Vishnu Teja Koduru & Vidhya Sagar Reddy Gontu
Advisors: Vijay Kumar Reddy Voddi, Ph.D.

Electric Vehicle Price Prediction
Lakshmi Meghana Thollikonda and Vivek Pavan Tejaswi
Advisor: Vijay Kumar Reddy Voddi, Ph.D

EV Battery Health Prediction and Optimization
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TWIN.AI: Your Personalized Digital Twin for Smart Living
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A Cosmic Study on the Open Asteroid Dataset

Surya Teja Anupindi & Shesha Sarayu Udugula
Advisor: Dong Ryeol Lee, Ph.D

Classification Algorithm on a Quantum Computer

Essowedeou Jermeie Botobikpissi
Advisor: Rebecca Conley, Ph.D

Comparative Efficacy of Machine Learning Models for Predicting Hospital Readmissions in Patients with Diabetes Mellitus

Aneeta Channar
Advisor: Dong Lee, Ph.D

Playlist-Based Music Recommendation using Word2Vec: A Sequence Learning Approach

Sudhir Balakrishnan
Advisor: Dong Ryeol Lee, Ph.D

A Sentiment Analysis of Horror Movies

Kavya Bhatia
Advisor: Dong Ryeol Lee, Ph.D

Predicting Success of Restaurants

Sai Pavan Rohith Kondamudi & Sarika Kasula
Advisor: Dong Ryeol Lee, Ph.D

Predicting Employee Performance Using Machine Learning

Kaveri Basineni
Advisor: Dong Ryeol Lee, Ph.D

An Evolutionary Approach to Interpretable Machine Learning for ICU Length of Stay Prediction

Eslin Kiran Ilangovan
Advisor: Reshma Kar, Ph.D

Interactive Keyword-Based News Retrieval: Enhancing Content Discovery with NLP and Real-Time Data Processing

Ajay Raj Singh & Akhil Mettu
Advisor: Gulhan Bizel, Ph.D

ABSTRACTS

NOTE: These abstracts have only lightly been edited to preserve students' intellectual property and authenticity.

Investigating Microplastic Interactions with Biological Molecules

Andres Zuniga
Advisor: Hugo Guterres, Ph.D

Polyethylene terephthalate (PET) and polyethylene (PE) are types of microplastics that significantly contribute to environmental pollution. These particles can pass through cell membranes and interact with essential biological molecules, which may have harmful effects on human health. This research investigates the detailed 3D structures of how microplastics (PET and PE) interact with key biological molecules, including the cell membrane and several important proteins like α-2 macro-globulin, fibrinogen, haptoglobin, and fibronectin. Previous studies have shown that these proteins can bind to microplastics using laboratory techniques such as centrifugation and SDS gel electrophoresis, but their atomic-level interactions remain unclear. Here, we modeled the structures of PET & PE and performed molecular docking to obtain multiple complex structures of proteins with microplastics. We expect that our structures and analysis can help elucidate the atomic-level interactions between microplastics and biological molecules.

Mena and Ukrainian Migration to the U.S.

Noor Fatima Memon
Advisors: Jennifer Ayala, Ph.D.

Through the work and the mission of a three-year initiative entitled, Unsettled: An Engaged Research and Advocacy Collaboration, a collaboration was developed between Saint Peter's University (SPU) and Rutgers Presbyterian Church in support of immigrants, refugees and asylees in the Jersey City, NJ area. This collaboration involved 5 different research or community projects offered across academic disciplines and programs with faculty/student teams. The current presentation will describe one of these projects: a collaboration between Dr. Hamdach and undergraduate student Ms. Memon conducted a review and analysis of the waves of conflict, displacement, and hope that have shaped Arab and Ukrainian immigration to the United States. Looking at migration from these areas over time, they described how the first Arab immigrants came to the US in the late 19th century from families who fled Greater Syria due to persecution of its religious elements and the resulting economic distress caused by the Ottoman Empire. Following World War II, the political upheavals around the Arab-Israeli War and revolutions in Egypt and Iraq stirred skilled professionals to move to the U.S. in search of a safer future. Later, the Gulf War in the 1990s and the Arab Spring in 2010 sent waves of refugees fleeing war torn countries such as Syria, Libya, and Yemen. Meanwhile, Ukrainian immigration surged after Russia's invasion displaced millions in 2022, with many seeking asylum in the U.S. under the Uniting for Ukraine program. Whereas both the Arab and Ukrainian immigrants came for stability, they faced imposing challenges in the form of cultural barriers, restricted healthcare access, and economic hardship that can often lead to feelings of isolation. Whereas the former group of immigrants has had to sail through narrow policy restrictions for several decades, the latter group, comprising refugees from Ukraine, has been welcomed with more open arms in the recent past with geopolitical support at the forefront. Despite such hardships, both communities have contributed to American society with great richness, bringing with them resilience, skills, and culture. Their journeys, marked by both adversity and aspiration, reflect a shared human desire for safety, dignity, and the chance to rebuild lives in a new land. This presentation is intended to be part of a panel called: Unsettled: An Engaged Research and Advocacy Collaboration.

The Bizarreness Effect is Inconsistent in Free Recall

Maria Medrano
Advisor: Maryellen Hamilton, Ph.D.

We extended our previous inconsistent findings of a bizarreness effect in free recall. Participants saw objects in either their typical color (pink-pig) or a bizarre color (blue-tomato). During encoding participants rated how bizarre they thought the items were. Even with this encoding manipulation we failed to find a bizarreness effect but instead found a significant typicality effect (greater memory for typical versus bizarre colored objects) in free recall. Implications of these findings will be discussed.

An Empirical Study of Earthquake Prediction Using Machine Learning

Umut Baris Basol
Advisor: Dong Ryeol Lee, Ph.D.

Predicting earthquakes remains a complex challenge due to the unpredictable nature of seismic activity. While it is impossible to determine the exact timing of an earthquake, machine learning techniques can help identify potential regions of an earthquake. This project utilizes several machine learning models to analyze seismic patterns and improve earthquake predicting accuracy. By splitting the dataset into training and testing sets, the model is trained to identify potential earthquake occurrences based on historical data. The goal is to enhance disaster preparedness by providing data-driven insights that can help minimize potential losses and improve early warning systems.

The Effects of Physical Activities and Sports Programs on Social Skills, Language Skills, and Repetitive Behaviors of Children with Autism Spectrum Disorder

Evangelos Koutsopetras
Advisor: Joshua Williams, DHSc.

Children with autism spectrum disorder (ASD) have difficulty with social skills and language skills and exhibit repetitive behaviors, which can prevent them from participating in social settings with their peers. Physical activity and sports can play an important role in helping improve these behaviors. This literature review looks at the potential benefits of physical activities and sports programs in children with autism spectrum disorder (ASD) on social and language skills, and repetitive behaviors that will lead to greater integration into social settings. The evidence overwhelmingly supports that physical activity and sports play a significant role in supporting children with ASD. There are challenges that children with ASD face when participating in physical activity or sports programs. However, the long-term impact of social integration on their future is extremely important.

A Customized Belongingness Intervention at a Small, Diverse Liberal Arts University

Cassidy Mulligan & Sumaiya Tasnim
Advisor: Brittany Hanson, Ph.D.

Previous research has found that belongingness interventions can improve GPA and retention at both selective private universities and broad-access public universities. The current research investigates the effectiveness of such an intervention for STEM students at Saint Peter's University. The belongingness intervention tailored to the student population increased feelings of being prepared for college but did not impact efficacy, end of the semester GPA, or retention for the next semester.

World Happiness Report

Pallavi Guddeti
Advisor: Dong Lee, Ph.D.

This project aims to analyze the key factors influencing global happiness using machine learning techniques and data from the World Happiness Report.

The dataset comprises economic, social, and health-related indicators, which serve as predictors for happiness scores. By leveraging exploratory data analysis, we identify patterns and correlations among these factors to gain deeper insights into their impact on happiness. To achieve accurate predictions, we apply multiple regression models, including Linear Regression, Decision Trees, Random Forest, and Deep Neural Networks, comparing their performance using metrics such as Mean Squared Error (MSE) and R^2 Score. Feature engineering techniques, such as encoding categorical variables and feature selection, are employed to enhance model accuracy. Additionally, hyperparameter tuning and regularization methods are explored to optimize performance. A key focus of this study is determining the most influential factors that drive happiness. By analyzing feature importance across different models, we aim to provide actionable insights into what contributes most to well-being. The results of this research can help policymakers and organizations formulate data-driven strategies to improve quality of life on a global scale. This study not only advances the understanding of happiness determinants but also demonstrates the effectiveness of machine learning in social sciences.

Moral Roots of Intergroup Conflict: A Test of the Moral Motives Model

Ramona Urrutia
Advisor: Brittany Hanson Ph.D & Daniel Wisneski Ph.D.

The current study tests how people's moral beliefs related to social order and social justice may lead them to be more willing to express intolerance following a symbolic or realistic threat manipulation. We predicted that greater endorsement of social order would predict more negative intergroup attitudes in an experimental condition that presented participants with an article about the number of LGBTQ individuals increasing in the US (compared to a control condition). Similarly, we predicted that greater endorsement of social justice would predict more negative intergroup attitudes in an experimental condition that presented them with an article about economic inequality increasing in the US (compared to a control condition). Greater support of social order predicted more intolerance of LGBTQ people, and greater support of social justice predicted more intolerance of the wealthy. However, these relationships were not strengthened following the threat manipulations.

The Great Backyard Bird Count 2025: Our Global Connection to Birds

Darlyn Breton
Advisor: Katherine S. Wydner, Ph.D.

The Great Backyard Bird Count (GBBC) is an event that connects people to birds, nature, and each other! It encourages citizen scientists from every corner of our planet, wherever they are, to undertake an annual survey of birds. The GBBC brings participants together in a common purpose to take at least 15 minutes to notice the birds around them, identify them, count them, and submit the counts to help scientists better understand and protect birds around the world. The data collected are submitted through eBird, a website managed by the Cornel Lab of Ornithology. Set in mid-February, the GBBC in the northern hemisphere essentially functions as a 4 day mid-winter census of birds. Observations of birds can be stationary or traveling, in your backyard or in a park, or anywhere. In our poster, we describe checklists that we made during the GBBC, provide photos of birds taken during the GBBC, and report about some of our experiences and highlights. Birds are one of our strongest connections to nature, serve as an indicator of the health of our environment, and are an indispensable and important part of human culture.

The possible protective effects of selected phytochemicals, individually and in combination, against endocrine disruptors

Catherine Weddle
Advisor: Laura H. Twersky, Ph.D

Bisphenol A is an environmental endocrine disruptor (EED) of estrogen and thyroid hormones used in the manufacturing of plastics and other products. Putative harmful consequences of BPA exposure include cancer, birth defects, and infertility. Despite efforts to eliminate BPA, humans are still exposed to it, as well as its substitutes, bisphenol F (BPF) and bisphenol S (BPS), which exhibit similar endocrine-disrupting properties. Phytochemicals, naturally occurring compounds found only in plants, may reduce the frequency of chronic diseases and have been shown to mitigate BPA effects. In this study, two phytochemicals were tested, individually and in combination, against BPA, BPF, and BPS: crocin, an active component of saffron, and epigallocatechin gallate (EGCG), the main catechin in green tea. While crocin and EGCG have been studied for their effectiveness in protecting against BPA, they have not been investigated on the substitutes, BPF and BPS. Additionally, very little research has been done on phytochemical combinations against bisphenols. Using the model organism *Xenopus laevis* (clawed frog), the effects of these phytochemicals at 5 ug/mL were investigated by evaluating motility, mortality, presence of malformations, heart rate, and developmental rates. Preliminary results indicated that BPF and BPS may be as harmful, por even more so, than BPA. Additionally, pretreatment with EGCG seemed to protect against BPA's adverse effects. Research on the other bisphenols and phytochemical combinations is ongoing.

Movie Recommendation System

Abhiram Reddy Kotha & Vamshi Tummala
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

The movie recommendation system aims to analyze user behavior and provide personalized movie suggestions based on individual preferences. By collecting data on user interactions, such as movie ratings, viewing history, and browsing patterns, the system identifies key factors that influence user decisions. Collaborative filtering and content-based filtering are the two main models employed for generating recommendations. Collaborative filtering predicts user preferences based on the behavior of similar users, utilizing techniques like matrix factorization and nearest neighbor algorithms. Content-based filtering, on the other hand, suggests movies based on their attributes (e.g., genre, director, actors) and how these match a user's past preferences.

AI-Powered Search and Summarization for Government Rules and Regulations in India

Vishnu Teja Koduru & Vidhya Sagar Reddy Gontu
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

AI-powered Retrieval-Augmented Generation (RAG) application designed to help government employees efficiently search, retrieve, and summarize official government orders, acts, and regulations. Initially focused on the Election Commission of India's rules, Our Project processes PDF documents stored in Google Drive, embedding and storing them in a vector database for real-time search and retrieval. The application leverages Mistral as the LLM. Users can query government documents in a ChatGPT-like interface, receiving concise summaries alongside full-text references.

Electric Vehicle Price Prediction

Lakshmi Meghana Thollikonda, Vivek, Pavan & Tejaswi
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

The electric vehicle (EV) industry is evolving rapidly, driven by advancements in battery technology, government policies, and shifting consumer preferences toward greener transportation. This research aims to analyze and compare EV prices, specifications, and consumer behavior using data from the Quickest Electric Cars - EV Database. The dataset includes key attributes such as performance parameters, battery size, range, energy efficiency, and pricing. The analysis begins with data preprocessing, where missing numerical values are imputed using the median, while categorical variables are replaced with the most frequent category. One-Hot Encoding is applied to convert categorical features into numerical representations, and Standard Scaler ensures all numerical variables are on a uniform scale. Two machine learning models—Random Forest Regressor and Gradient Boosting Regressor—are trained to predict EV prices based on technical specifications. GridSearchCV is utilized for hyperparameter tuning, optimizing model performance. The models are evaluated using Mean Squared Error (MSE) and R-Squared (R^2) Score to ensure accuracy and reliability. The results indicate that EV prices are significantly influenced by battery capacity, acceleration, and range. Insights from the best-performing model can assist manufacturers in pricing strategies, policymakers in designing incentives, and consumers in making informed purchase decisions. Future research could explore deep learning models and incorporate real-time market trends to enhance prediction accuracy. These findings contribute to a deeper understanding of EV pricing dynamics and support the broader goal of accelerating sustainable transportation adoption.

UEV BATTERY HEALTH PREDICTION AND OPTIMIZATION

Kusuma Sri Ganachari, Pavan Ajay Varma Kallepalli, Shivaraj Yadav Bandi
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

Electric vehicles are becoming popular as they are environmentally friendly. Still, degradation of EV batteries is a major concern for their reliability and performance. The project utilizes AI to forecast the time when battery capacity starts degrading and offers smart ways to charge and use them. Through these challenges, the project is looking to increase battery life, making EVs reliable and cost-effective. Early research used physics-based models to identify the causes of battery degradation. Although the models were accurate, they needed a vast amount of data and technical knowledge and hence were not easy to apply practically. Employing new machine learning algorithms, researchers now use sensor measurements—voltage, current, and temperature—to predict battery degradation. Methods like Decision Trees, Random Forests, and Long Short-Term Memory (LSTM) networks have been successful in detecting the early signs of battery performance degradation. Also, performance-optimizing techniques like Genetic Algorithms and Reinforcement Learning have been implemented to reduce stress on the battery and increase its lifespan. Using these techniques together, the functioning of EV batteries is optimized.

TWIN.AI: Your Personalized Digital Twin for Smart Living

Sudheer Tanneru & Keerthi Reddy Evuri
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

TWIN.AI is an advanced personal AI chatbot designed to function as a digital twin, learning from daily speech and text inputs to provide intelligent, context-aware assistance. Unlike traditional chatbots, TWIN.AI continuously adapts to user behavior, offering personalized

Id recommendations, smart reminders, and emotional insights. It operates as a background process, automatically collecting speech logs and storing data locally to ensure privacy and security. The AI twin is designed to train itself from past interactions, generating daily, weekly, and monthly reports to help users track their progress, habits, and emotional well-being. Using technologies like Python, LLMs, LangChain, and Speech-to-Text APIs, TWIN.AI delivers meaningful suggestions in real time. It aims to act like a caring sibling, fostering emotional attachment while enhancing productivity and well-being. With future expansions, TWIN.AI will support multiple users, enabling unique AI twins for each individual without data sharing. Additionally, a web and mobile app version will improve accessibility. The project also explores monetization strategies for both consumer and business applications. By integrating automation, self-learning capabilities, and lifestyle impact analysis, TWIN.AI aspires to revolutionize personal AI assistants, making them more intuitive, responsive, and emotionally intelligent.

SpaceNet 7 Multi-Temporal Urban Development

Sai Umesh Bhagath, Sandhya Avineni, Sandeep & Vasanth Reddy
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

Urban expansion is a rapidly evolving phenomenon that influences infrastructure, environmental sustainability, and socio-economic development. Monitoring these changes effectively requires high-resolution, temporally consistent datasets that capture urban growth patterns over time. The SpaceNet 7 Multi-Temporal Urban Development Dataset is a pioneering benchmark dataset designed to support research in urban change detection.

It consists of multi-temporal satellite imagery from Maxar WorldView satellites, covering different time periods across various urban areas globally. This dataset provides an opportunity to analyze spatial and temporal variations in urbanization using geospatial analytics, deep learning models, and big data processing frameworks. This study aims to leverage SpaceNet 7 to detect urban development trends meaningful urban growth patterns. Change detection algorithms, including deep learning architectures like U-Nets and ResNets, are employed to track structural modifications in cities. We also explore spatiotemporal modeling to predict future urban expansion and assess the impact of unplanned development on land use and environmental sustainability. To ensure efficient analysis, this research incorporates big data processing tools such as Apache Spark and Google Earth Engine (GEE) to handle the computational complexity of multi-temporal satellite imagery. The study involves data preprocessing, feature engineering, and exploratory data analysis (EDA), supported by interactive visualizations such as time-series graphs, heatmaps, and geospatial overlays.

Findings from this research will contribute to urban planning, disaster resilience, and infrastructure optimization by providing actionable insights into land-use change.

Policymakers, city planners, and environmental scientists can use these insights to develop data-driven strategies for sustainable urban development. Furthermore, the integration of machine learning-based predictive models will enable better forecasting of urban expansion, assisting in preemptive decision-making for transportation, housing, and resource allocation. By advancing computational methodologies in remote sensing and urban analytics, this research not only enhances our understanding of global urbanization but also provides scalable solutions for monitoring and mitigating the challenges of rapid city growth. The study's results, including geospatial visualizations, comparative trend analyses, and model predictions, will be presented in structured reports and visual dashboards to facilitate data-driven decision-making for urban governance and development.

Thyroid Cancer Risk Prediction

Komal Satyanarayan Rajput & Venkatesh Shamala
Advisor: Vijay Kumar Reddy Voddi, Ph.D.

Since thyroid cancer is one of the cancers that is growing the fastest in the globe, early detection and precise risk assessment are essential. The goal of this project is to create a predictive model for the risk of thyroid cancer by using machine learning techniques to a carefully selected dataset that includes pertinent demographic and medical characteristics. To enhance model performance, the dataset is examined using preprocessing techniques such feature selection, addressing missing values, and normalization. To find the best method, a variety of classification methods are tested, such as logistic regression, decision trees, random forests, and deep learning models. Performance indicators like accuracy, precision, recall, F1-score, and AUC-ROC are used to evaluate the models. Cross-validation and hyperparameter adjustment are used to improve the prediction power and resilience.

Key risk factors for thyroid cancer are revealed using data visualization approaches such as feature significance plots and correlation heatmaps. The results of this study are intended to assist medical practitioners in risk assessment and early diagnosis, which could result in better patient outcomes. The research highlights the top-performing model for predicting the risk of thyroid cancer in a thorough report that includes code, findings, and conclusions. To further improve the predicted accuracy, future research might incorporate more clinical parameters and validate the results in the actual world.

Project FeederWatch Goes to Eleven With Goldfinches and A Ruby Crowned Kinglet

Darlyn Breton
Advisor: Katherine S. Wydner, Ph.D.

In the eleventh season of Project FeederWatch on the Saint Peter's University campus, 17 species have been reported. Highlights of this season include a flock of American Goldfinches that has been present for 12 weeks starting in January and a male Ruby-crowned Kinglet that has been observed on 6 count weeks from January onward. Goldfinches have been rarely reported in three previous winters. The kinglet, an insectivorous species, is foraging on suet and is especially unique because they are reported at less than 2% of PFW sites in New Jersey. Consistent visitations of these two native species are especially encouraging given that our goals include fostering native species and increasing avian diversity through maintaining a supportive space for migrating and wintering birds in the midst of urban habitat. Our PFW data collection began in 2014, a native plant garden was established and feeders expanded in 2018, and food offerings at feeders were further diversified in 2023. A total of 38 species have been reported on campus, and numbers of species reported seasonally have trended upward. PFW runs from November to April annually. Our data are reported to the Cornell Lab of Ornithology which has been tracking the status of North American winter bird populations for 38 years.

NYC EV Charging Infrastructure Analysis

Daisy Dai & Zhuqi You
Advisor: Vijay Kumar Reddy Voddi, Ph.D

For our capstone project, we plan to explore how New York City can become more sustainable through the development of electric vehicle (EV) infrastructure. The city has been expanding EV charging ports and solar carports, led by the Department of Administrative Services, and has partnered with schools to promote sustainability through educational initiatives. We aim to analyze data on the distribution and usage of EV charging stations using Python and apply machine learning techniques to identify patterns and predict areas with high potential for future expansion. Our

goal is to understand how EV infrastructure contributes to the city's broader sustainability goals and to provide data-driven insights that can inform smarter urban planning. By combining data analysis with machine learning, we hope to demonstrate the impact of EV networks on building a greener, more resilient New York City.

Enhancing Quality of Life through Recreational Dance

Eliza Figueroa
Advisor: Joshua Williams, DHSc

Recreational dance, a form of physical activity is very beneficial yet quite underrated. It can remarkably increase an individual's quality of life. This literature review explores the advantages of recreational dance, which provides a unique and pleasurable way that offers benefits such as improved mental and physical health, well-being, and physical fitness. It also can be accessible to people of all ages and abilities, making this intervention very diverse in all populations. However, there are barriers that are acknowledged such as lack of awareness, fear of judgment, and misconceptions about it. The review also mentions how the obstacles can be overcome through corporate wellness programs and public health initiatives so dance can be more widely embraced. Other strategies to promote include cultural differences and programs tailored for individuals with disabilities. By examining the evidence, recreational dance can show its potential for improving quality of life.

Overcoming Mental Barriers in Soccer Injury Recovery: The Importance of Psychology Rehabilitation

Karen Vanessa Culpatan
Advisor: Joshua Williams, DHSc

Playing soccer at a high level, particularly at a young age, demands a significant amount of effort and preparation for each game and practice. This can put a huge physical and emotional strain on athletes, particularly those who are also attending school. Student athletes and youth athletes have a lot on their plates, including the pressure to win and break records, which can feel overwhelming. Because of the extreme intensity, this can result in a variety of injuries, including knee, hip, and ankle injuries, as well as concussions. Adequate therapy and rest are necessary for recovery and optimal physical and mental health. Many athletes experience anxiety, frustration, and tension, which can be difficult to balance with academics and athletics, as they must be academically competent in addition to being good athletes. If an athlete is hurt, they must undergo recovery efforts, which require both physical therapy and emotional therapy. Returning to the field is about more than physical recovery; it entails a full psychological recovery that allows athletes to return stronger and better prepared than before. This review provides insight into the importance of psychological rehabilitation for soccer players.

The Effects of Mindfulness-Based Strategies on the Mental Health of Athletes

Kasidy Slusser
Advisor: Joshua Williams, DHSc

Rather than attempting to suppress or eliminate negative thoughts, mindfulness-based strategies, including the Mindfulness-Acceptance-Commitment Approach and the Mindfulness-Based Stress Reduction Program, encourage athletes to acknowledge and accept these thoughts while focusing on the present moment in a nonjudgmental manner. Studies throughout this literature review highlight how such mindfulness practices help athletes shift their mindset to become more present, strengthening resilience and emotional stability during intense competition. The evidence presented in the review demonstrates that this approach of accepting discomfort and distrac-

-tions without judgment helps athletes enter a flow state and become more zoned in on the sport, ultimately reducing the likelihood of burnout and injury and increasing performance.

Focus and Endurance: The Role of Breathing Techniques in Achieving Peak Performance

Brendon Wilson
Advisor: Joshua Williams, DHSc

Throughout history, humans have sought ways to better their breathing and endurance. This review investigates the different breathing techniques that can help people with this goal. Another aspect this review examines is the association between stress and cardiovascular disease, and how proper breathing significantly influences these factors. Through the review, it is consistently shown that breathing techniques can help humans control their breathing, leading to better athletic ability. The studied breathing techniques include diaphragm breathing, deep breathing, box breathing, and resonant breathing. Stress reduction before or during competition greatly impacts performance, and breathing is the biggest variable that can be controlled during physical stress examinations. The final aspect of the review is the impact that breathing techniques have on cardiovascular disease, as cardiovascular disease is an extremely devastating illness that is the number one killer worldwide. The purpose of this review is to give people insight into how to achieve peak performance by improving their cardiovascular and respiratory abilities.

The Role of Plyometric Training in Enhancing Performance in Children & Adolescents

Elijah Kiboma
Advisor: Joshua Williams, DHSc

Plyometric training has become a popular technique for improving children's and adolescents' athletic performance. By contrasting its effectiveness with conventional strength training, this literature review looks at the advantages, disadvantages, and implementation techniques of plyometric training in youth sports. According to research, plyometric workouts are crucial for athletic development because they significantly improve neuromuscular coordination, agility, power, and movement efficiency. The significance of age-appropriate programming, appropriate supervision, and progressive overload principles is highlighted by concerns about injury risk. Real-world applications reveal that well-structured plyometric regimens contribute to enhanced performance and injury prevention. While studies support the beneficial effects of plyometric exercise, gaps remain on its long-term effects on young athletes. Future research should examine the best training regimens, psychological advantages, and long-term athletic development all through adulthood.

Cognitive Learning and its Role in Injury Recovery in Golf and Sport

Pablo Alvarez Jordan
Advisor: Joshua Williams, DHSc

Cognitive learning plays a crucial role in injury recovery, and to be competitively capable for any sport, where precision and technique are essential to be consistent. Athletes recovering from injuries rely on motor learning to reinforce neural pathways, regain lost abilities, and enhance performance. This review explores how cognitive demands influence skill acquisition and how strategic practice can accelerate recovery. We will examine motor learning principles, the psychological impact of rehabilitation, and the role of attention in skill execution. This paper also highlights the relationship between cognitive processes and athletic performance. A key focus for better performance is the balance between internal and external attention, as research suggests that shifting attention from bodily mechanics

to environmental cues can enhance skill retention and prevent overanalysis. Additionally, emotional variability plays an important role in performance confidence, frustration, and anxiety, that may impact execution, making emotional regulation a critical factor during recovery. Visualization is also described as the channel that materializes the desire. This review also emphasizes the importance of motivation and autonomy through rehabilitation, exploring strategies such as goal setting, mindfulness, and self-directed practice to improve engagement and resilience. By integrating cognitive training techniques, athletes can optimize skill acquisition and recovery time, ensuring a smoother and more effective return to performance. These insights extend beyond golf, offering valuable applications for any technique-based sport.

Targeting Early Onset of Parkinson's Disease with Physical Therapy and Exercise

Mariam Bouls
Advisor: Joshua Williams, DHSc

Parkinson's Disease (PD) is a progressive neurodegenerative disorder that significantly impacts motor function, causing symptoms such as tremors, stiffness, and bradykinesia. Early intervention with Physical therapy (PT) and exercise have been demonstrated to enhance mobility, balance, and strength, which may halt disease progression. This research investigates the role of early-stage physical treatment, which includes gait training, strength exercises, and high-intensity aerobic exercise, in people with early-onset PD. Structured exercise programs have been shown in studies to improve motor function, lower the risk of falls, and improve overall quality of life by addressing both motor and non-motor symptoms. The research also looks at the neuroplastic benefits of exercise, which can increase brain function and help compensate for neuronal loss in Parkinson's disease. The findings underscore the importance of early intervention in improving patient outcomes and maintaining independence.

The Effects of Plyometric Training on Vertical Jump and Performance for Basketball Athletes

Jane A Calle
Advisor: Joshua Williams, DHSc

Basketball players require explosive power, speed, and agility, as this helps improve their athletic performance. This review of the research examines the role of plyometric training with a secondary emphasis on strength training. Both plyometrics and strength training programs benefit vertical jump height, and this review investigates the additional beneficial role of plyometric training for injury rehabilitation. Plyometric training is more advanced than simple forms of training and focuses on the factors of strength, agility, and explosive power. This review also explores the physiological mechanisms, such as the stretch-shortening cycle, and compares resistance training with plyometric training. Lastly, the review addresses how plyometric training can help improve the lower limb extremity stability for athletes and serve a dual purpose in any basketball player's exercise program.

Examine the Effectiveness of Heavy-to-Moderate versus Light-to-Minimal intensity loading in Injury Rehab

AJ Anglade
Advisor: Joshua Williams, DHSc

Injury rehabilitation is a type of care that benefits all age ranges and populations. One topic that has been heavily debated is the effectiveness of heavy loads in comparison to lighter loads, specifically in rehabilitation. This literature review examines the effectiveness of heavy resistance and light resistance for different types of patients, such as geriatric and athletic populations. It also examines the muscular changes and effects of each type of loading for these populations. Research demonstrates that light exercises can promote

hypertrophy, especially in post-operative surgeries and deconditioned patients; however, it was not shown to be as effective as heavy loads. Heavier loading more consistently and effectively produces improved muscle strength and bone density, particularly in older populations, without significantly increasing injury risk when prescribed appropriately. This review also evaluates possible solutions to the limitations of light loading, such as blood flow restriction cuffs, to help close the gap between heavy and light loads. Ultimately, the findings show that as long as they are being prescribed safely by a medical professional, heavy loading is more beneficial for injury rehabilitation.

Mental Health and Injury Recovery in Athletes: Psychological Factors in Healing

Abdulah Sacko
Advisor: Joshua Williams, DHSc

During the recovery stage of injured athletes, the rehabilitation process and duration can vary for different athletes. Injury healing isn't always attributed to the severity of the injury, due to the fact that two athletes can have the same injury and still have two completely different recovery times. The reason behind the difference in recovery time despite having the same injury is due to the mental health and mental state of the athlete during their healing process. Multiple studies have shown that athletes with negative mental health traits or mental health disorders heal more slowly and are less likely to return to their sport than those with proper mental health. It would benefit injured athletes worldwide if athletic trainers and physical therapists were to implement psychological interventions in tandem with physical interventions into the rehabilitation process of patients. By doing this, it would increase the chance of the athlete returning to their sport, decrease the time the athlete spent injured, and make them less injury-prone in the future.

Effects of Mental and Physical Fatigue on Technical Performance in Soccer Players

Allan Licona
Advisor: Joshua Williams, DHSc

This literature review explores the impact that mental and physical fatigue causes on the technical performance of soccer players, engaged on key skills in areas such as passing, dribbling, shooting, and defensive actions. Research reveals that mental fatigue can lower cognitive sharpness, increase mistakes and weaken the defense effectiveness. Additionally, physical fatigue leads to a decline throughout very high intensity movements and technical performance in the game. Other researchers underline the negative effects of fatigue, many other studies show the effects physical fatigue may have on tactical decision making and player adaptation. This review will examine the physiological effect of overtime where the consumption of metabolic and neuromuscular fatigue become prominent. Recovery strategies are important in routines such as sleep optimization, nutrition, cold-water immersion, and massage are assessed for their importance in many common approaches to treat a players physical fatigue or mental fatigue and improve the players overall performance. Despite the process in trying to understand the effects of fatigue, gaps appear in long term management strategies and personal recovery guidelines. Future researchers should be able to point out these gaps by clarifying fatigue management techniques and search for the two links between fatigue and tactical efficiency.

The Effect of Altitude Training on Soccer Players' and Elite Athletes' Endurance and Red Blood Cell Production

Gabriel Flores
Advisor: Joshua Williams, DHSc

Hypoxia-induced adaptations observed during athletic training have various physiological and performance effects that will be discussed in this literature review. Hypoxia can be described as one of the physiological stressors that mainly induce erythropoietin (EPO) production, which further acts to increase erythropoiesis, increasing oxygen transport capacity. This mechanism is used quite unanimously in improving endurance performance by altitude training or hypoxic chamber use. The more adaptations, the longer the duration and severity of hypoxic exposure; a longer sustained exposure would yield more sustained hematological benefits. Additionally, individual genetic differences in reactions to EPO stimulation can impact the production of red blood cells as well as performance outcome variables. Hypoxic training is a method for enhancing endurance athletes; therefore, any subsequent discussion will present the other side of the equation, the unethical nature of the artificial use of EPO, and the health risks involved. It becomes paramount to understand how hypoxia influences hematological adaptation toward performance enhancement to optimize training protocols and keep the athlete protected and compliant with sports regulations.

Testing dynamic moral construal: Are there physiological correlate of moral judgments?

Emily Perez & Reece October
Advisor: Daniel Wisneski, Ph.D

Most research on how attitudes or behaviors come to be seen as morally relevant (i.e., moralized) have examined the process as it occurs over longer periods of time such as over the course of a semester (Feinberg et al., 2019) or a presidential election (Brandt et al., 2012). Other research indicates, however, that people can dynamically shift between moral and non-moral evaluative modes over much shorter periods of time (Van Bavel, Packer, Haas, & Cunningham, 2012). This past work found that merely framing judgments in either moral or non-moral (e.g., pragmatic) terms produced judgments that are made more quickly, are more extreme, and are applied more universally. The current study attempts to replicate and extend these findings showing that moral construal can shift from moment to moment. Specifically, our methodology mirrored that of Van Bavel et al (2012) in an attempt to replicate their results while also extending their work by collecting participants' skin conductance responses. Results showed the finding that moral judgments were made more quickly replicated, however, we found no evidence that skin conductance was differentially related to moral and non-moral judgments.

Developing an Enzyme free Glucose sensor using Ruthenium Nanoparticles (Ru NPs) and Polyaniline (PANI)

Hiba Zahoui & Allysa Gamlanga
Advisor: Yosra Badiei, Ph.D.

Diabetes management relies on continuous glucose monitoring (CGM) systems, but existing enzymatic glucose sensors face challenges such as high production costs and instability. This study explores the development of a non-enzymatic electrochemical glucose sensor for convenient, economic, and sensitive glucose sensing. The electrochemical polymerization of aniline monomers and oxidation to poly(aniline) (PANI) was performed using fluorine-doped tin oxide (FTO) electrodes, the anode of the electrochemical cell. Bulk electrolysis at varying polymerization times and concentrations was performed to study the formation of the PANI polymer on the surface. Electrochemical characterization using cyclic voltammetry (CV), FTIR spectroscopy, and UV-Vis confirmed successful PANI deposition. The sensor will be further fabricated by incorporating Ru molecular complex, $[Ru(tpy)(bpy)(OH_2)]Cl_2$ (tpy = terpyridine, bpy = bipyridine ligand) into the polymer surface through immobilization coating

experiments. A comparative study through electrochemical testing will be shown to evaluate the performance of Ru-PANI-FTO compared to PANI-FTO and bare FTO (control) for sensing glucose in alkaline solutions.

Examining neuropeptide-elicited network oscillations using a mathematical model

Isabelle Bautista
Advisor: Nickolas Kintos, Ph.D

Rhythmic oscillations are ubiquitous in the nervous systems of animals. They underlie stereotyped behaviors such as breathing, heartbeat, and food chewing. Rhythmic neural networks produce such oscillations in the form of motor output, which controls muscle movements. We are studying this issue in the gastric mill network, which controls food chewing, in the stomatogastric ganglion (STG) of the crab, Cancer Borealis. The output of the gastric mill network is called the gastric mill rhythm. Activation of this rhythm by outside projection neurons has been well characterized in previous experiments and modeling. Conversely, a gastric mill rhythm can also be elicited by in vitro bath application of the neuropeptide, CabPK. However, this CabPK-elicited rhythm is not as well characterized. To address this, we use a simplified mathematical model of the CabPK-elicited gastric mill rhythm. The model is analyzed using phase plane dynamics of the relevant differential equations. Moreover, by exploiting the difference in time scales inherent within the biological system, we are able to simplify the model and make it more mathematically tractable. Utilizing this model, we show how CabPK-activated currents, identified in previous experiments, can underlie the generation of this rhythm.

Learning Skills to Interpret Transmission Electron Microscopy (TEM) Images with Budget-Friendly Hands-On Activities

Noemi G. Carranza
Advisor: Natalie Hudson-Smith, Ph.D

Two methods of teaching Transmission Electron Microscopy (TEM) micrograph interpretation are presented. One method includes the use of a low-technology, low-budget, model transmission electron microscope to create 'pseudo-micrographs' using cyanotype paper. This first set of activities allows students to investigate properties of TEM micrographs, including thickness contrast, diffraction contrast, plan view, and tilt series imaging. The second method builds on this concept by using a standard document scanner to create digital images that emulate the properties of thickness contrast, diffraction contrast, and plan view imaging. These digital 'pseudo-micrographs' are suitable for activities with upper-division undergraduate students and provide an opportunity to develop both micrograph interpretation and ImageJ analysis skills.. Student data indicates increased engagement and improved micrograph interpretation skills through both activities.

Effects of Microplastics/Bisphenols on Blood

Carlos Jose Duque Sanchez
Advisor: Laura Twersky , Ph.D

Microplastics—small plastic particles ranging from 1 to 5 mm—are widespread in the environment and have raised concerns due to possible links to cancer, abnormal neurulation, and cardiovascular effects. Plasticizers such as bisphenols (BPA, BPF, and BPS), commonly found in microplastics, have been preliminarily linked to adverse biological effects in *Xenopus laevis*, including decreased heart rate, internal bleeding, enlarged hearts, and altered blood pigmentation (Munoz & Duque-Sánchez, 2024). To investigate the hematological effects of these compounds, hemolysis assays were performed using a 1% erythrocyte suspension of sheep blood exposed to 23, 46, and 69 µg/mL of BPA, BPF, and BPS. Hemolysis was quantified by measuring

absorbance at 405 nm. In parallel, *Xenopus laevis* tadpoles at Nieuwkoop and Faber stage 31 were exposed to 5 µg/mL BPA for in vivo blood flow analysis. Blood flow velocity was determined from 30-second video recordings analyzed using Farneback optical flow in OpenCV, with automation via ChatGPT-4 Turbo. All bisphenol treatments significantly affected hemolysis ($p < 0.0001$, ANOVA), with BPS causing the highest and BPF the lowest levels. BPA-treated samples showed absorbance below the negative control. A chi-square test revealed significant distribution differences ($p = 0.0496$). BPA-exposed tadpoles showed reduced mean blood flow velocity (4.34 ± 0.47 µm/s) compared to controls (6.08 ± 2.03 µm/s), though the difference was not statistically significant ($p > 0.05$).

Developing Molecular Electrocatalysts for the Desulfurization of Fuel Oils

Navleen Virdi & Arham Shafi
Advisor: Yosra Badiei, Ph.D

Making cost-effective and intelligent designs to eliminate sulfur-containing compounds from hydrocarbon fuels is critical to meeting strict environmental standards. Research has shown that using catalysts for the S-oxidation of organic substrates by chemical oxidants (example being hydrogen peroxide). However, that can be difficult to do on a large scale and highly expensive. Our project is creating active electrodes that utilize an electrocatalyst that encourages the S-oxidation of petroleum. This also promotes “green chemistry” to produce renewable resources. We will synthesize Ru(II) based complexes with polypyridine ligands using microwave and traditional heating. We will then compare and analyze both techniques for efficiency of microwave synthesis and convection heating. The surface immobilization of the electrocatalyst will be achieved with polymer encapsulation. The modified electrodes will be characterized by attenuated total reflectance (ATR) infrared spectroscopy and many electrochemical methods. Our project’s goal is to provide insight into interfacial structures and electrochemical properties of hybrid electrode assemblies, which have well-defined molecular catalytic structures to further the field of electrochemical oxidation reactions of SCC’s.

A Cosmic Study on the Open Asteroid Dataset

Surya Teja Anupindi & Shesha Sarayu Udugula
Advisor: Dong Ryeol Lee, Ph.D

An asteroid diameter prediction model utilizing data science and machine learning approaches is presented in this study. The dataset, which comes from astronomical observations, contains physical and orbital features such magnitude slope parameters, eccentricity, and semi-major axis. In order to identify important trends and correlations, the study entails a great deal of data preprocessing, which includes handling missing values, feature engineering, and exploratory data analysis (EDA). Understanding asteroid distributions can be gained by visualization tools that make use of Matplotlib, Seaborn, and Plotly. We used a variety of regression techniques for predictive modeling, such as XGBoost, Multi-Layer Perceptron (MLP) Regressor, tree-based models, and linear regression, to estimate asteroid diameters based on available characteristics. We optimized each model's performance through grid search hyperparameter adjustment to increase accuracy. To verify robustness and dependability, the models were assessed using performance indicators including RMSE and R2. The use of cutting-edge methods greatly enhanced generalization performance and prediction accuracy. By offering a data-driven approach to asteroid size estimation—a critical component of impact risk assessment and space exploration—this effort advances astronomical research.

Classification Algorithm on a Quantum Computer

Essowedeou Jermeie Botobikpissi
Advisors: Rebecca Conley, Ph.D

Quantum computing and machine learning are two rapidly advancing fields that show great promise in solving complex computational challenges. Quantum computing, in particular, has the potential to overcome the "curse of dimensionality," which often limits classical machine learning methods as datasets increase in size. Classification, a key task in supervised learning, involves predicting the correct class for input data based on labeled training data. This research explores the application of quantum computing to classification tasks by reproducing the distance-based quantum classifier described in the 2017 paper "Implementing a distance-based classifier with a quantum interference circuit" by Schuld, Fingerhuth, and Petruccione. The algorithm was adapted and applied to the mtcars dataset. The data preparation and encoding process on classical hardware prior to quantum execution is discussed, as well as the challenges posed by hardware noise in real quantum devices. In the original paper, the authors acknowledge the destructive effect of quantum noise. We explore whether there have been sufficient hardware advances to overcome this challenge. The results reveal that the 2D quantum classifier demonstrated a high degree of accuracy on both simulation and real hardware. For instance, class 1 inputs achieved probabilities greater than 0.75 for the correct classification on real hardware. In contrast, the 4D quantum classifier results were less conclusive on real hardware, with probabilities approximating 50% for both classes in most cases, despite accurate simulation results. This discrepancy highlights the impact of noise as the dimensionality of the input increases.This study underscores the potential of quantum computing for low-dimensional classification tasks, showing promising performance even on noisy quantum hardware. However, as dimensionality increases, the accuracy diminishes due to the noise inherent in current quantum devices. These findings emphasize the need for advanced error mitigation techniques and optimization strategies to enable the scalability of quantum classification algorithms to higher-dimensional datasets. Future work could also explore integrating hybrid quantum-classical models to address these challenges

Breaking Barriers: The Impact of Poverty on Latino Health and Access to Medical Care

Leslie Gallardo, Katherine Santos, Sarah Nunez & Diana Guerra
Advisor: Erick Caamano, Ph.D.

The Latino community faces some of the most significant healthcare disparities in the United States, stemming largely from socioeconomic vulnerability and cultural stigmas. Barriers such as language differences, immigration concerns, and limited access to culturally competent care contribute to the underutilization of preventive and routine health services. Many Latinos avoid seeking medical attention due to fear of discrimination, lack of health insurance, or the belief they will be treated unfairly by healthcare providers. Research indicates that implicit bias among providers can lead to substandard care, further discouraging healthcare utilization. Additionally, communication challenges often leave Latino patients without adequate translation services, intensifying mistrust within the healthcare system. As the Latino population continues to grow and is projected to surpass the white population in the coming years, it is increasingly vital to develop culturally tailored interventions that promote equitable access to care. This project uses theoretical frameworks such as the Health Belief Model, Inoculation Theory, and Social Cognitive Theory to explore the underlying factors contributing to these disparities. These models provide insight into the attitudes, beliefs, and environmental influences that shape health behaviors in the Latino community. Through a multi-theoretical lens, we propose evidence-based strategies

land interventions to empower Latinos to overcome healthcare barriers and encourage greater engagement with the medical system. Ultimately, addressing these disparities is essential to improving long-term health outcomes and promoting health equity for Latino populations across the United States.

Germination effectiveness of commercially available strawberry seeds using different seed preparatory treatments and growing mediums

Justin Capin
Advisor: Brandy Garrett Kluthe, Ph.D

Strawberries *(Fragaria spp.)* are a highly valued fruit crop worldwide, known for their economic significance and nutritional benefits. However, establishing fruiting plants from seeds, especially strawberries, is challenging due to seed dormancy. This study investigated different seed treatments and growing mediums to determine the most effective method for germination. Seeds were germinated in soil, rockwool, and moisture chambers. Seeds also underwent several pretreatment protocols for evaluation. All groups were observed for six weeks after being set for germination. The initial hypothesis proposed that the eight-week stratified group would have the highest germination rate. Results showed that while the eight-week stratified group had the highest percentage of seed coat breaks, overall germination rates remained low across all methods. This suggests that physical seed coat dormancy may not be the primary barrier to germination in strawberries. Further research is needed to explore potential physiological dormancy and alternative treatments to enhance germination success.

Playlist-Based Music Recommendation using Word2Vec: A Sequence Learning Approach

Sudhir Balakrishnan
Advisor: Dong Ryeol Lee, Ph.D.

In the era of music streaming, effective recommendation systems play a crucial role in enhancing user experience. This project explores a novel approach to song recommendation by leveraging Word2Vec, a natural language processing technique, to model song relationships from Spotify's Million Playlist Dataset. By treating playlists as sequences, similar to sentences in text processing, the model learns meaningful song embeddings that capture contextual similarities. Unlike traditional collaborative filtering, which relies on explicit user ratings, this approach harnesses implicit co-occurrence patterns within playlists. The trained model enables personalized song recommendations by identifying tracks with high cosine similarity in the learned vector space. The project evaluates the impact of embedding size, window size, and training epochs on recommendation quality. This research contributes to the ongoing advancements in sequence-based recommendation systems and provides insights into enhancing music personalization through machine learning.

Native and Medicinal Plant Knowledge Among Immigrant Populations in Jersey City

Maraya Cruz, Justin Capin & Catherine Saldana
Advisor: Brandy Garrett Kluthe, Ph.D & Erick Caamano, Ph.D

Jersey City, which is considered one of the most diverse US cities, has become a popular destination for immigrants. As immigrants assimilate into US culture, the use and knowledge of their traditional foods and medicines are at risk of decline. This study predicted that immigrant populations who relocate to urban areas like Jersey City will lose their valuable knowledge of native and medicinal plants and that the loss of knowledge will be

greater in the subsequent generations. Student-led research groups surveyed Jersey City residents in different neighborhoods of Jersey City to collect data on demographics, knowledge of medicinal plants, plant types, and their uses. The results indicate that in some immigrant communities, native and medicinal knowledge is lost, which could significantly impact their cultural identities and result in the loss of important medicinal knowledge.

Comparative Efficacy of Machine Learning Models for Predicting Hospital Readmissions in Patients with Diabetes Mellitus

Aneeta Channar
Advisor: Dong Ryeol Lee, Ph.D

Diabetes Mellitus is a leading cause of morbidity in the United States, contributing significantly to hospital readmissions. With the growing integration of machine learning in healthcare, predictive models can help identify high-risk patients and improve clinical decision-making. This project aims to compare the effectiveness of different machine learning techniques in predicting hospital readmissions among diabetic patients. A publicly available dataset containing records of 70,000 diabetic patients has been selected. The dataset will undergo preprocessing to handle missing values, normalize features, and ensure data integrity. The models will be implemented in Python, with an 80-20 split for training and testing. We will evaluate logistic regression, Naïve Bayes, decision trees, and random forests based on accuracy, precision, recall, and F1-score. The results will be comprehensively summarized in a poster, highlighting the best-performing model for predicting hospital readmissions. This comparative analysis will provide valuable insights into the most effective machine learning techniques for healthcare applications, potentially guiding future research and clinical interventions.

Improving Catalytic Properties of TiO_2 Nanomaterials for Decomposition Organic Pollutants

Harris Javed Satti & Balikis Iyiola
Advisor: Yosra Badiei, Ph.D

TiO_2 nanoparticles are widely used as photocatalysts for environmental remediation. TiO_2 has a large band gap of 3.2 eV, resulting in electronic excitation only with UV light. The radiation forms electrons and holes on the nanoparticle's surface, which assists in degrading organic pollutants. Another limitation is the rapid recombination of the light generated electron-hole pairs, which can lower the degradation efficiency. In this work, the TiO_2 nanomaterials were synthesized and modified using a polymer that absorbs visible light. Our hypothesis is that the incorporation of pol(aniline) PANI was done, thus activating TiO_2 in the visible light spectrum by reducing the band gap. It is hypothesized that polyaniline has a band gap of its own that lies between the TiO_2 band gap. Therefore, it can serve as a ladder for electrons to climb up, reducing the rate of recombination and making the catalyst more efficient. Experiments have shown that TiO_2/PANI is photoactive under solar light with a sulfur organic pollutant. The study will focus on looking at how the composition of TiO_2:PANI can influence the photocatalytic reaction with the organic pollutant.

PCR Identification of Mold Growing in Gannon Hall

William S.G. Minto, Alexandra Ramirez-Valdez, Youstena A. Waheb, Darlyn Brenton & Hawaa Diaw
Advisor: Vasilios A. Orologas, Ph.D

A common feature of industrial HVAC systems is the pervasiveness of mold. Due to favorable conditions associated with these systems such as temperature, humidity, and

moisture; mold growth is encouraged and amplified. The presence of mold within HVAC systems poses unique threats to human health and quality of life as these ventilation systems facilitate the transfer of biological material (IE: mold) from fomites like condensers, blower fans, and duct work, directly into the indoor atmosphere as bioaerosols. Commonly, occupational health and safety protocols utilize MSQPCR (Mold Specific Quantitative PCR) to determine mold species of a given sample. In this study- we attempt to apply a simple DNA barcoding PCR method followed by Bioinformatic analysis to determine the species of an isolated mold culture collected from an air duct in Gannon Hall.

How Physical Activity Builds Stress Resilience and Supports Mental Health Recovery Across the Lifespan

Schneider Tout-Puissant
Advisor: Joshua Williams, DHSc.

Physical activity is vital for stress resilience and mental health recovery validation. Research shows that physical activity helps regulate stress hormones, improves mood, and increases emotional health. Therefore, physical activity reduces symptoms of anxiety and depression and increases the proclivity to relax due to endorphins released in the process. At the same time, it provides a natural outlet for coping with stressors and emotional disturbances. For example, teens and adults learn to better manage stress post-workout, while children and older adults have shown the most success in emotional health when engaged in physical activity. This review reinforces the notion that physical activity fosters stress resilience and mental health recovery potential by examining how positive brain functioning, social interaction quality, and long-term quality of life are influenced in all populations by the presence of physical activity. Therefore, regardless of whether the layperson or practitioner understands this phenomenon, they must know this connection to encourage the proper direction and implementation of health physical diversions for mental stabilization. In a world where individuals face mental health challenges, understanding how physical activity can foster resilience is more crucial than ever. Stress and mental health issues affect people of all ages, and the prevalence of such issues is on the rise globally, with one in four people suffering from serious mental illness. This increasing incidence reveals the importance of easily available and efficient interventions like physical activity to enhance coping and recovery. This literature review explores how physical activity enhances stress coping and facilitates recovery from mental illness throughout childhood and adolescence, adolescence, adulthood, and aging adulthood. Physical activity, which encompasses structured exercise and unstructured movement, is a simple and easily applicable way to improve mental health. Resilience is explained as a psychological process of adaptation to stress and it is a protective resource, while mental health recovery refers to the process of improving emotional well-being. Recent work shows that physical activity is effective at reducing anxiety and depression, with studies such as Manzini (2024) investigating university students and Pilkington et al. (2024) investigating athletes transitioning to elite sports. Also, physical activity has a positive impact in all age groups as found by Mumu (2024). This widespread applicability and the benefits of physical activity shown in this review justify its use in the management of stress and mental health problems and further research and articles are therefore important in developing public health policies.

A Sentiment Analysis of Horror Movies

Kavya Bhatia
Advisor: Dong-Ryeol Lee, Ph.D

Horror films have long reflected societal fears and biases, shaping audience perceptions in ways that often go unnoticed. This project will explore the relationship between sentiment in horror movie narratives and the racial/ethnic representation of characters. By extracting sentiment from textual data—such as movie overviews, taglines, and reviews—we will investigate how sentiment polarity (positive, neutral, or negative) aligns with different racial and ethnic groups depicted in these films. We tend to leverage Natural Language Processing (NLP) techniques, utilizing sentiment classifiers from Hugging Face, to categorize sentiment and analyze its correlation with metadata attributes. Machine learning models—including logistic regression, random forests, and deep learning-based transformers—will be applied to study these relationships, uncovering potential biases in horror storytelling. Through classification and regression-based modeling, this research will provide data-driven insights into media representation and audience reception. By identifying patterns in sentiment and racial/ethnic portrayal, this study will contribute to broader discussions on fairness, inclusivity, and the evolving landscape of horror cinema.

Predicting Success of Restaurants

Sai Pavan Rohith Kondamudi & Sarika Kasula
Advisor: Dong-Ryeol Lee, Ph.D

This project aims to improve the dining experience for customers and help restaurant owners make smarter business decisions by analyzing the Zomato dataset using data science and machine learning. We start by cleaning and preparing the data—removing duplicates, fixing missing values, and converting text data (like cuisines and locations) into numbers so that computers can understand it. Next, we explore the data visually to uncover key trends, such as:

- Which cuisines are most popular in different cities.
- How price ranges affect restaurant ratings.
- Whether online delivery leads to higher customer satisfaction.

We then use machine learning techniques to group similar restaurants based on factors like cost, ratings, and customer votes. This helps us identify patterns, such as:

- Low-cost, high-rated restaurants that offer great value.
- Expensive restaurants that consistently get top reviews.
- Cuisine trends that attract more customers.

To make the project even more useful, we predict restaurant ratings using Random Forest, a powerful machine learning model. This allows customers to see estimated ratings before visiting a restaurant. We also analyze customer reviews using sentiment analysis to detect positive and negative feedback, helping restaurants improve their service.

Predicting Employee Performance Using Machine Learning

Kaveri Basineni
Advisor: Dong-Ryeol Lee, Ph.D

For this project, I will be using machine learning to predict employee performance based on various features such as job title, work hours, promotions, satisfaction, and more. The objective is to create a classification model that categorizes employees into different performance levels like low, medium, or high performance. I will focus on using a decision tree model to make predictions, as it is interpretable and easy to understand. The project will involve preprocessing the data, performing exploratory analysis, and fine-tuning the model using parameter sweeping to find the optimal decision tree configuration. After building the model, I will evaluate its performance using metrics like accuracy, precision, recall, and F1-score. The goal is to help organizations predict employee performance, which can aid in decision-making related to promotions, training, and resource allocation.

Allelopathic phenols in Eucalyptus ssp. and their impacts on seed germination of common agricultural seeds

Jessica Pagnussati
Advisor: Brandy Garrett Kluthe, Ph.D

Eucalyptus trees, introduced to Costa Rica, are suspected of releasing allelopathic phenols through leaf litter and bark, potentially inhibiting crop growth. This study tested the impact of Eucalyptus extracts on the germination of corn, peanuts, and morning glory, which were chosen for their significance in Costa Rican agriculture as staple crops. The crops were exposed to 1% and 5% concentrations of Eucalyptus extracts, with water as a control. Phenols were detected using the Ferric Chloride Test and Folin-Ciocalteu Method. Results showed that higher concentrations of Eucalyptus extracts had a higher amount of phenols which could significantly reduce plant growth and germination rates. These findings suggest that Eucalyptus allelopathy could hinder crop establishment, posing potential ecological and economic challenges for Costa Rican farmers and agriculture.

Pilot Study: Implementation of a Campus Wide Plant Biodiversity Database

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Urban University campuses are often considered devoid of plant biodiversity. In this project, we attempt to identify the genus and species of plants growing within the Saint Peter's University campus by means of PCR amplification, genetic sequencing, and bioinformatic analysis of the rbcLa (Ribulose bisphosphate carboxylase large chain) gene of multiple plant samples with the help of the BLAST database. With the data we collect, we attempt to non-invasively tag identified plants to eventually create an online database where all plant biodiversity on the University campus may be recorded and tracked.

An Evolutionary Approach to Interpretable Machine Learning for ICU Length of Stay Prediction

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Neural networks have repeatedly demonstrated the ability to accurately model complex nonlinear relationships. However, the black-box nature of such models has led to concerns about bias and trustworthiness especially in settings like healthcare where it impacts multiple aspects of patient care including prognosis and resource allocation. Existing model-agnostic methods to enhance neural network interpretability only offer an external perspective on the working of neural networks. To solve this issue, we designed an Evolutionary Multiple Gaussian Model that replaces the activation function of a perceptron with an aggregate of multiple Gaussian functions. The parameters of this model were evaluated using the gravitational search algorithm with the objective of minimizing a function of the mean absolute percentage error (MAPE) and mean squared error between the predicted and actual values. We also implemented the early stopping algorithm with our proposed model to prevent over-fitting. We performed multiple experiments on the MIMIC IV dataset to predict the patient length of stay in Intensive Care Units (ICU). Results indicate that the proposed algorithm outperforms it's popular counterparts in terms of MAPE while offering better interpretability. In the future, we plan to implement our model on larger and more diverse datasets and open new possibilities in machine learning.

Interactive Keyword-Based News Retrieval: Enhancing Content Discovery with NLP and Real-Time Data Processing

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The rapid proliferation of online news has made information more accessible than ever. However, the overwhelming volume of content often leads to information overload, making it challenging for users to efficiently locate relevant information. Traditional news platforms rely heavily on text-based articles, requiring users to sift through multiple sources to grasp key themes and trends. This issue is particularly critical for underserved populations, non-native speakers, and individuals with limited time, who may struggle to process dense textual content effectively.

To address this challenge, we propose an interactive, keyword-based news retrieval system that enhances content discovery and accessibility. Unlike static word clouds, our system dynamically processes real-time news data using Natural Language Processing (NLP), web scraping, and API integration. It extracts and visualizes frequently occurring keywords, allowing users to interact with them. Upon selection, the system triggers a query-based retrieval mechanism to fetch relevant multimedia content, including articles and videos, in real time. This interactive approach bridges the gap between static visualization and dynamic content retrieval, enabling users to explore evolving news trends efficiently.

By providing an intuitive and interactive content discovery experience, our system serves as a valuable tool for media organizations, educators, and researchers tracking global news trends. It offers an innovative solution to mitigate information overload, making news consumption more efficient, engaging, and accessible to a diverse audience