SECOND ANNUAL

INTERNATIONAL GRADUATE STUDENT SHOWCASE

MAY 1, 2024

Thank you for joining the Second Annual International Graduate Student Showcase at the University of Rhode Island. The purpose of this Showcase is to celebrate not only the quality and diversity of international graduate student scholarship across the University, but also the sharing of perspectives and life experiences that enrich our community. There are currently over 300 international graduate students enrolled at URI from 63 different countries across the globe. They are pursuing Ph.D., Master's, and professional degrees in departments throughout the University.

Posters in the Showcase reflect the variety of international students' academic interests with projects ranging from mapping iceburgs to black holes and urban agriculture. Conversations with student presenters provide an opportunity not only to gain a technical understanding of their poster topics, but also a global perspective on the importance of their field and, in some cases, a greater appreciation of places far from Rhode Island.

Enjoy the Showcase!

Projects

Size Matters: Short-Term Momentum versus Long-Term Reversal Risk-Adjusted Returns in Investment Strategies

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Business Administration, PhD.

Additional Author: Georges Tsafack, PhD.
Poster Number: 01

Abstract:

Among the risk-adjusted portfolio performance measures, Sharpe Ratio is almost the most common one among both scholars and practitioners. Though its momentum effect has shown virtually insignificant results over the future returns, the study of this measure's reversal phenomenon has been overlooked in the literature.

By taking 60 months of monthly and then 12 months of daily total returns into consideration, we calculate the Sharpe ratio for the US stocks traded between 1927 and 2022 for two investment horizons: long-term or one year and short-term or one month holding periods respectively. Then by constructing a zero-investment portfolio with taking a long and short position, we study the momentum and reversal effect of this performance measure on future returns.

Our analysis shows that taking both returns and risk into consideration size matters such that the short-term momentum works for medium and large market cap stocks, while long-term reversal favors small ones.

Inter-sectoral mobility, income change and family duty of agricultural laborers

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Poster Number: 02

Abstract:
This study examines how inter-sectoral mobility of agricultural laborers lead to higher incomes and less poverty, and it also identifies various factors influencing rural laborers' engagement in non-farm activities (manufacturing and service jobs separately). These determinants may include demographic characteristics (such as age, gender), family duty (the responsibility to take care of children), human capital (education and training), information accessibility. Using the China Family Panel Studies dataset from 2014 to 2020, we employ the multinominal logit regression model and Ordinary Least Squares (OLS regression model that both forms of mobility help alleviate rural poverty. The results show that agricultural labor mobility to manufacturing results in a higher income increase (7,847.333 yuan) compared to a service job (5,106.474 yuan). Education attainment, training, social capital, and internet usage show positive effects on inter-sectoral mobility, while children have negative effect on inter-sectoral mobility especially for rural women. Further, males are more likely to find manufacturing jobs than females. Our findings provide agricultural laborers with relevant economic information on how to make better inter-sectoral mobility decisions, and indicates the gender wage gap and gender difference based on family duty. This research also has public policy implications for improving the economic wellbeing of rural laborers.

Mapping Urban Forest Development Using GIS-based Multi-Criteria Analysis: A Study in Banda Aceh, Indonesia

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Advisor/Mentor: Farhad Atash, PhD.
Poster Number: 03

Abstract:
Indonesia is the fourth most populous country in the world, with a population of more than 270 million, two-thirds of them live in urban areas. Indonesia's Central Bureau of Statistics predicts over 67% of the population will live in urban areas by 2035. Urban development in the cities leads to a drastic loss of green spaces. Urban green spaces provide numerous benefits and ecosystem services, which can enhance the city's quality of life. Developing urban forest areas is known as an effective solution to expand green spaces in the city. In recent years, land suitability analysis using the integration of geographic information system (GIS) and multi-criteria analysis (MCA) has been used as a comprehensive approach in land use planning. However, in Indonesia, its application for urban forest development is limited. This study aimed to apply GIS-MCA suitability analysis using analytical hierarchy process (AHP) to select the potential locations for urban forests in Banda Aceh, Indonesia. Criteria affecting the urban forest site selection process such as population density, proximity to settlement area, proximity to road, slope, vegetation cover, land use/land cover, flood-prone area, and proximity to water sources were mapped, weighted using criteria weight obtained from AHP, and overlaid to produce a final suitability map. The result showed that 42% of the study area is suitable for urban forest development. The final suitability map demonstrated that most of the suitable areas are located in the northern and western parts of Banda Aceh, near the existing urban forests location. The outcome was linear with previous planning authorities' establishments in Banda Aceh. This proves the GIS-MCA model's effectiveness in mapping the suitable area for urban forest development. The final map will be useful to provide information for the future development of urban forests in Banda Aceh.

A surrogate model for spinning comparable to intermediate mass-ratio binary black hole gravitational wave signals

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Poster Number: 04

Abstract:
Laser Interferometer Space Antenna (LISA), now commissioned, marks a significant milestone as a space-based gravitational wave observatory, led by European Space Agency. Unlike ground based gravitational wave observatories (LIGO-Virgo-KAGRA), which are sensitive to high frequency gravitational waves (GW) such as merger of solar mass back holes, neutron star merger etc, LISA will be sensitive to lower band in GW frequencies. Detection, analysis and interpretation of observed GW signals accurate waveform models are essential. Over the last two decades the primary focus was to build waveform models for binary black hole systems composed of solar mass black holes with equal or nearly equal mass ratio. But for LISA, there is an emerging need for high-quality waveform models that can accurately represent BBH systems with highly asymmetric mass ratio and massive black hole. One way to model such systems by point-particle black hole perturbation theory (ppBHPT). In this framework the smaller black hole is taken to be a point particle. This is ideal for sources observable by LISA. Solving ppBHPT equations numerically to generate a single waveform is computationally expensive and can take upto hours to compute even on a modern day supercomputer.
However, for the estimation of binary parameters, rapid generation of waveform models is necessary, which is beyond the capabilities of the ppBHPT framework. To address this, we build a data driven waveform model called surrogate model. In this approach we first build a basis using the ppBHPT waveforms themselves and then using some fancy interpolation technique to construct a waveform model. We have developed a surrogate model for binary black holes with mass ratio ranging form 3 to 1000 and spin on the heavier black hole between -0.8 to +0.8. Generating a waveform using our model takes only few millisecond, a stark contrast to the several hours required by ppBHPT framework. This reduction in computation time without sacrificing the accuracy ensures our surrogate model will be an invaluable tool for the gravitational wave community, especially in the era of space-based gravitational wave astronomy. Our model is publicly available through gwsurrogate and BHPTNRSurrogate python packages.

Breaking the Biofilm: Magnetic Nanoparticles for Cleaning Surfaces in Marine Environment

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Poster Number: 05

Abstract:
Marine biofilms, which are formed by the growth of various organisms, can significantly compromise underwater equipment especially for devices like sensors and camera lenses by obscuring sensor readings and camera clarity. They can also escalate fuel consumption and corrosion on ships by altering hydrodynamics. These persistent biofilms necessitate costly removal and maintenance, posing a challenge to marine operations. Removing bacterial biofilms early on can prevent the attachment of harmful macro-organisms. This project proposes using magnetic nanoparticles (MNPs) to remove marine biofilms under alternating magnetic fields. Spherical iron oxide MNPs (dimeter ~20 nm) were synthesized by the hydrothermal method and their morphology, crystallinity and magnetic properties were evaluated by electron microscopy, X-ray diffraction and static and dynamic magnetometry. The synthesized MNPs has polyethyleneimine coating, a positively charged polymer with antimicrobial properties. The integrity of these coatings was verified and quantified using Transmission Electron Microscopy (TEM), Z-potential measurements, Fourier-transform infrared spectroscopy (FTIR) and X-ray Photoelectron Spectroscopy (XPS). The MNPs were internalized within lab grown C. marina biofilms and placed under alternating magnetic fields. Several high frequencies alternating magnetic fields, in the hundreds of kHz range, were tested. This frequency range is designed to promote MNP heating for the MNP morphology and composition. Also, the MNPs will be placed in low-frequency magnetic field which will make the rotation of the particles due to their interaction with the magnetic field. This rotation generates mechanical torque that can disrupt the biofilm physically, augmenting the MNP's ability to disturb and displace the biofilm matrix. The morphology of the biofilm and viability of the bacteria before and after alternating magnetic field treatment were evaluated by fluorescence microscopy. The study will investigate the most effective MNP treatment regime and the effects of mechanical or thermal excitation on biofilm and bacterial physiology. The proposed research holds potential for providing a new and effective approach to addressing the problem of marine biofilms and could be used to treat biofilm caused by antibiotic resistant bacteria strains.

Multifunctional composite structures for shock load monitoring and immediate failure detection

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Advisor/Mentor: Helio Matos, Ph.D.
Poster Number: 06

Abstract:
This study evaluates the performance of composite structures with embedded conductive yarns during shock loads to create a multifunctional system for immediate failure detection. The multifunctional structure was subjected to a Mach 2 air blast load using a shock tube apparatus. The embedded sensor yarns were used to record their electrical performance, while Digital Image Correlation captured full-field displacements, velocities, and strains. In addition, pressure transducers measured shock event pressures. The results revealed that through-thickness failure of the laminated composite occurred at approximately 2.5% strain, which was visually observable. However, the embedded sensor exhibited out-of-range electrical measurements at around 1.5% strain, even though no visible structural damage was present. This demonstrates the embedded sensing yarns' ability to detect delamination-type failures by responding to interlaminate damage, highlighting their advantages over conventional external sensors.

Nutrient Loading Models in Urban Watershed

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Poster Number: 07

Abstract:
This paper aims to review scientific works that have developed or applied water quality models to address nutrients in runoff from urban watersheds. Models have been widely used to predict nutrients in waterways and facilitate the management of nutrient flows at various spatio-temporal scales. These models can be challenging, especially in heterogeneous urbanized areas, due to the complexity of the water system. Data availability remains the biggest challenge, and the model predictions and their applicability largely depend on good data quality and quantity spatially and temporally. This paper primarily discusses four widely used water quality models, highlighting their strengths and weaknesses, addressing sensitivity analysis, model confirmation, error propagation within the same region, and model-generated scenarios. We also focus on the models' temporal and geographical scales and track pollution sources. Our analysis identifies a significant challenge in predicting nitrogen loads, primarily due to the uncertainties in forecasting how climate change will impact nutrient loading. Furthermore, there is a critical need to evaluate the long-term effects of phosphorus reduction from both nonpoint and point sources, as well as to anticipate changes in seasonal runoff patterns that may result from global warming

Mapping Potential Fishing Zones Based on Sea Surface Temperature and Chlorophyll-A in Pidie Jaya Waters, Indonesia

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Poster Number: 08

Abstract:
Sea surface temperature (SST) and sea surface chlorophyll-a concentration (SSCC) are two crucial environmental factors that have a significant impact on fish abundance and potential fishing locations. This study investigated the integration of Geographic Information System (GIS) technology to optimize capture fisheries in Pidie Jaya Regency, Aceh, Sumatera, Indonesia. The research focused on understanding how oceanographic factors, specifically SST and SSCC, influenced fish distribution in Pidie Jaya's waters. The study utilized MODIS (Moderate Resolution Imaging Spectroradiometer) satellite imagery for 3 years (2021-2023) with a spatial resolution of 4 kilometers. The data was analyzed seasonally, consisting of the wet season (December-February), transitional season I (March-May), dry season (June-August), and transitional season II (September-November). Potential fishing locations were determined by overlaying SST and SSCC data based on the results of image data processing. The temperature observations indicated a range between 28 - 30 °C, with the highest temperature occurring during transitional season I (less potential) and the lowest temperature during the wet season (moderate). Chlorophyll-a observations indicated a range between 0.14 - 0.28 mg/m^3, with the highest concentration of chlorophyll-a occurring during the wet season (potential) and being moderate in other seasons. The results showed that the distribution of potential fishing locations varied throughout the year. During the wet season, the locations were more abundant and dispersed near the coast, totaling over 90 points. However, during the transitional season I and dry season, potential fishing locations shifted towards the territorial sea boundary, located 12 miles from the coast, totaling less than 50 points. In the transitional season II, potential fishing locations were spread across the area between the coast and the territorial sea boundary, totaling more than 50 points. These findings provided valuable insights for fishermen in determining the best locations and seasons for fishing, supporting the integration of modern technology for efficient and sustainable fishing activities.

Equitable development of LNG bunkering and its infrastructure

Do Hyun Oh
Marine Affairs, Master of Arts

Advisor/Mentor: Elizabeth Mendenhall, PhD.
Poster Number: 09

Abstract:
This paper investigates the equitable development of liquefied natural gas (LNG) bunkering (fueling) and its port infrastructure within the global shipping industry. Despite the imperative need for alternative fuels due to the significant contribution of the shipping sector to trade-related emissions, the development of LNG bunkering infrastructure faces challenges, including a lack of refueling facilities. Academic literature on LNG bunkering predominantly focuses on industrial, technical, and economic aspects, overlooking social considerations such as equitable development. This study addresses this gap by analyzing selected global port master plans of nine LNG bunkering ports and conducting expert interviews. Utilizing a model encompassing four dimensions of equity, the research aims to determine whether these plans adequately consider equitable development in LNG bunkering infrastructure. The hypothesis posits that most port master plans inadequately address equitable development in LNG bunkering infrastructure. Findings reveal disparities in the consideration of equitable development across port master plans, suggesting a need for greater attention to social dimensions in LNG bunkering infrastructure planning. The paper concludes by discussing the implications of these findings and setting agendas for future research and policy interventions to promote equitable development in LNG bunkering infrastructure.

Sonar-driven iceberg surface following path planner for AUV-based underwater iceberg mapping

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Poster Number: 10

Abstract:
cebergs, originated from glaciers and ice shelves, drift in the ocean from polar waters towards low altitude regions. Melting of the icebergs can affect ocean currents and sea levels. To better quantify their climate impacts, icebergs, especially the underwater portion, have to be measured. Recent studies have found that Autonomous Underwater Vehicles (AUVs) can be a potential candidate for iceberg mapping for safety reasons. However, advanced autonomy is needed for obstacle avoidance, online path planning and relative navigation algorithms specific to this application. Particularly, the autonomy should account for the irregular contour of the iceberg boundary so that the AUV is maintained at a constant standoff distance for consistent sensing footprints and measurement resolution thereby, resulting in reliable mapping data products. In this study, we explore the pipeline to generate a nonlinear path that is used for guiding the AUV to follow the iceberg contour. The algorithm is developed based on the measurements from a Mechanical Scanning Imaging Sonar (MSIS), which creates an occupancy grid map (OGM) to help the AUV understand its environment near the iceberg. A desired standoff path is then extracted using the map features. The path will be later imported into the AUV's navigation system to enable full autonomy in iceberg circumnavigation.

Delineation of Groundwater Potential Zone Using Spatial Analysis and Analytic Hierarchy Process (AHP) in West Aceh, Indonesia

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Master of Environmental Science and Management (MESM)

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Poster Number: 11

Abstract:
Groundwater supports various sectors such as economic development, industry, and agriculture, increasing human demand in many regions worldwide including in Aceh, Sumatera, Indonesia. Hence, groundwater resources emerge as one of the primary and viable alternative water sources. The main objective of the study is to analyze and map groundwater candidate zone areas to support the availability of groundwater in West Aceh, Indonesia. The research method involves weighted overlay techniques using a geographic information system (GIS) based on criteria from most important to least important, namely rainfall, soil type, geology, drainage density, land use, and slope, which the data are obtained through official sites such as government agencies and open-source data provider sites. Ratings and weights for these six criteria are determined using the Analytic Hierarchy Process (AHP) method.

Knockoff Methods for Nonlinear Feature Selection in Data with Categorical Features

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Poster Number: 12

Abstract:
The problem addressed in this thesis revolves around a critical gap in the current literature, nonlinear feature selection in datasets containing categorical features. Traditional feature selection methods often struggle with nonlinear relationships and fail to effectively handle categorical variables, leading to suboptimal model performance and interpretability issues. Thus, there is a pressing need to develop methodologies that can robustly handle nonlinearities and categorical features simultaneously.

To tackle this problem, novel knockoff methods are proposed and explored in this thesis. The depth and rigor of this research are evident in our methodical approach, involving extensive simulations and the analysis of real-world datasets to test the efficacy of proposed methods. Such comprehensive research design underscores the thoroughness of our work, ensuring that the proposed methods are not only theoretically sound but also practically viable. By subjecting proposed techniques to a variety of scenarios, we robustly validated the versatility and reliability of novel knockoff methods, showcasing their adaptability to diverse data complexities.

The findings of this thesis demonstrate the efficacy of the proposed knockoff methods in linear and nonlinear feature selection tasks involving categorical data. Through comprehensive simulation, it is shown that the knockoff methods outperform existing techniques in key metrics such as controlling the false discovery rate (FDR) and enhancing power, simultaneously. Additionally, the methods exhibit robustness across different types of relationships including linear and nonlinear and categorical feature distributions, highlighting their versatility and effectiveness in real-world data analysis scenarios.

This superior performance is a testament to the effectiveness of our tailored approach, marking a significant advancement in the analysis of categorical data. Our contributions not only fill a critical gap in the current literature but also pave the way for future research in the field, offering new tools and perspectives for dealing with the challenges of categorical data analysis.

Consumption Patterns of General Scientific Content in New Media

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Biological and Physical Sciences, PhD.

Advisor/Mentor: Sunshine Menezes, PhD.
Poster Number: 13

Abstract:
This study investigates how audiences in new media, specifically the active viewers of the Instagram page of the popular Iranian science magazine Ava Star, consume general scientific content. It explores their patterns, motivations, interactions with the content, and perceptions of it. Employing a qualitative approach, focused interviews were conducted with 20 highly engaged readers to understand their experiences. Thematic analysis revealed three primary motivations for using Instagram for science content: entertainment, news awareness, and education. Additionally, seven themes were identified regarding the specific reasons audiences follow astronomy content: personal interest and concern, surprising or mysterious phenomena, fascination with scientific discoveries and technology, interest in observational events and celestial knowledge, conversational engagement, appreciation for the grandeur of the universe, and job-related application. The discussion analyzes reading and reception practices. A high level of trust was observed in both science and Ava Star, contrasting with distrust towards TV media as a science source. This study contributes to understanding general audience behavior in new media environments regarding public scientific content.

Looking towards future research, my doctoral study aims to explore the identity role(s) of science communicators on social media platforms like YouTube and Instagram in promoting inclusive science communication. Specifically focusing on astronomy influencers, the study seeks to analyze how their unique and intersecting identities influence communication strategies and audience appeal. By examining the racial, gender, cultural, and educational backgrounds of these influencers, the research aims to understand their contributions to accessibility, dissemination, and engagement of scientific knowledge with diverse public audiences. Through this investigation, insights into the role of science communicators in fostering inclusivity and promoting science engagement in the digital age will be uncovered.

The Influence of Social Values on Saving Behavior

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Human Development & Family Studies, PhD.

Additional A**uthors:** Verónica Penãloza (Ceará State University), Nilton Porto (University of Rhode Island)
Poster Number: 14

Abstract:
Financial decisions are not made in a void where individual traits, abilities, and habits are the only mechanisms individuals use to make decisions. Instead, decisions unfold within distinct social frameworks, marked by elements such as organizational structures, hierarchies, and group dynamics (Simon et al., 2014). Recently, research has explored the role of social interactions in shaping individuals' financial decision-making processes (Hartono & Isbanah, 2022; Fuchs-schündeln et al., 2019; Chan et al., 2022). Social interactions involve sharing values representing individuals' beliefs, norms, and ideals. These values serve as guiding principles that steer individuals' behaviors and interactions within their social milieu. This research, conducted with a comprehensive and rigorous methodology, aims to delve deeper into the relationship between human values and financial behavior. We examine the effects of values on savings behavior, using sociodemographic and individual characteristics variables to uncover the nuanced factors that drive saving behaviors across different values. Drawing from a globally representative sample, the seventh wave of the World Values Survey (2017-2020), we employ multivariate analysis techniques, specifically ordered probit, to ensure robustness in examining the relationship between dimensions of saving behavior and human values. This approach enhances the validity and reliability of our findings, providing a solid foundation for further research and discussion in this field. Our findings reveal that consumers with stronger individualist values tend to exhibit higher saving rates than those with more collectivist values. This might be because individualists focus on their needs and do not worry about the group. They might save more money. Also, individualists may think more rationally, as they only consider themselves. However, we also note that human values exert a relatively modest influence on saving behavior compared to other factors such as financial satisfaction, income, and social class.

Treprostinil, a prostacyclin analog, improves renal hemodynamics and protects against renal ischemia reperfusion injury

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Poster Number: 15

Abstract:
Approximately 800,000 people have end-stage renal disease (ESRD) in the US, requiring either maintenance dialysis or kidney transplantation (KTx) for survival, with the latter having a higher survival rate. However, there is a nation-wide shortage of suitable organs available for transplantation. Renal ischemia-reperfusion injury (IRI), which is inevitable during KTx, is a significant contributor to delayed graft function, requiring re-transplantation (of the already scarce donor pool) with no therapy available. Prostacyclin (PGI2) is an endogenous metabolite of arachidonic acid that promotes vasodilation and inhibits platelet aggregation and inflammation. This study investigates the efficacy of treprostinil (Remodulin®), a PGI2 analog, in reducing renal IRI during kidney transplantation. Our preliminary data demonstrates the efficacy of treprostinil in reducing renal IRI in a rat model of bilateral renal IRI. Our current research investigates the mechanisms of treprostinil in reducing renal IRI, including the role of treprostinil on renal hemodynamics as well as the impact of dose and timing of administration of treprostinil.

Methods: Sprague Dawley rats were subjected to bilateral renal IRI (45 minutes) and randomly divided into the following 6 groups: sham, IRI (placebo-treated), treprostinil at low-dose (10 ng/kg/min), or high-dose (100 ng/kg/min), which was administered either at the time of ischemia (immT) or approximately 18-24 hours before renal IRI (preT).

Results: Treprostinil significantly improved the renal blood flow (RBF) to baseline vs. the IRI group in a dose-dependent manner along with a 50% reduction in serum creatinine (2.6 mg/dl vs.1.23 mg/dl) at 24-hours post-reperfusion. Treprostinil significantly improved the creatinine clearance while reducing urinary protein and urinary sodium by 50% vs placebo treated group. Renal IRI increased the renal protein expression of the thromboxane receptor by 4-fold vs. sham, which was significantly inhibited by treprostinil (high-dose). Conversely, IRI reduced the renal protein expression of the prostacyclin receptor (IP) by 50%, which was restored to baseline by treprostinil. Renal IRI also increases the phosphorylation of protein kinase A, which was further increased with treprostinil. In conclusion, treprostinil improves renal hemodynamics via activation of the IP/PKA signaling pathway early post-IRI in a clinically relevant rat model of AKI. These data provide evidence to support the clinical investigation of treprostinil in reducing renal IRI during de novo kidney transplantation.

Screening of Potential Pathogenic and Probiotic Bacteria from Bilalves

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Poster Number: 16

Abstract:
Goal: Disease control is critical for effective hatchery production of bivalve shellfish. Bacterial infections, particularly those associated with Vibrio and Aeromonas, cause rapid larval mortality, with severe consequences for hatcheries and farmers who rely on them. This study aims to screen and identify potentially pathogenic and probiotic bacteria in bivalve shellfish facilities. The probiotic isolates will be used to produce a multi-strain probiotic cocktail that can be applied to bivalve hatcheries to improve larval resiliency against larval crashes. On the other hand, pathogenic isolates will be analyzed for their pathogenic properties and their ability to cause larval mortalities.

Methods: Hatchery samples including larvae, water, and algae will be collected from different hatcheries in the Northeast and will be subjected into microbial analysis by isolating distinct bacterial colonies. The isolated bacteria will be identified using 16S rRNA sequencing and screened for their probiotic and pathogenic properties (e.g. antimicrobial activity, biofilm formation, hemolytic activity and quorum quenching). The selected probiotic and pathogenic isolates will then be tested in oyster hemocytes and bivalve larvae to test their pathogenicity. Furthermore, these isolates will be subjected to whole-genome sequencing to identify novel genes responsible for their probiotic or pathogenic properties.

Summary of key outcomes: A total of 122 bacterial isolates from water, algae, and larval samples were identified using 16S rRNA sequencing and screened for their antimicrobial activity against shellfish pathogens, hemolytic activity, and biofilm formation. Among the 20 genera identified, Vibrio (34%), Pseudoalteromonas (23%), and Alteromonas (18%) are the most abundant. The pathogenicity of the selected potential pathogenic and probiotic isolates was tested with oysters and clam larvae, and adult oyster hemocytes. Results showed that potential probiotic isolates are generally safe while some potential pathogens (Clam15, DEN12, CH1, CH7, CH3, CH30, CH4, CH6) showed host-specific pathogenicity to either clam or oyster larvae. Results from the high-throughput screening assay using oyster hemocytes were concordant with the results of the more labor-intensive larval assays. Further work is being done to optimize the high-throughput screening pipeline.

Examining Land-to-Ocean Dissolved Organic Carbon Transport, Hydrological Patterns, and Land Cover Changes in Asia: A Remote Sensing Approach

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Poster Number: 17

Abstract:
The Carbon Cycle is the transport of the planet's most basic element, Carbon, through the whole biosphere, found in numerous forms in organic and inorganic elements. Loss of terrestrial carbon and its lateral flux from land to ocean is considered a potent pathway of carbon accumulation in the atmosphere and the subsequent greenhouse gas effect. However, the lack of carbon data in Asian freshwater systems poses a challenge in understanding of DOC transport dynamics in Asia. One important route for terrestrial carbon delivery to the ocean is by river discharge. Asia is the second largest contributor, making up 18.8% of the world's inland exports of dissolved organic carbon (DOC) to the ocean. Here, we employed remote sensing techniques using MODIS Aqua imagery combined with sea surface salinity to determine dissolved organic carbon (DOC) concentrations in the outlets of the Ganges Brahmaputra (GBM) and Mekong River basins in South and Southeast Asia, respectively. Utilizing hydro climatic data such as precipitation, land surface temperature (LST), and streamflow measurements, we examined the correlation between DOC and these variables.
Our results revealed that the average annual DOC flux is 0.094 Tg C/year for the Ganges-Brahmaputra and 0.035 Pg C/year for the Mekong, showing a nearly threefold difference. Both DOC concentrations and fluxes followed monsoon patterns in both river basins. Interestingly, DOC concentration exhibited a negative correlation with LST (R=-0.46), suggesting increased microbiological activity during warmer periods, leading to higher DOC production. Further analysis using MODIS land cover data indicated that in the Ganges Brahmaputra, DOC concentration is associated with cropland expansion (R=0.18); while in the Mekong, it is linked to urban expansion (R=0.55). However, the DOC flux in both regions is strongly correlated with evergreen forest, indicating a significant influence of baseflow in their streamflow.The successful integration of remotely sensed DOC and hydroclimatic data from multiple satellite products in our study proves to be a valuable alternative method for estimating and understanding the DOC dynamics in remote areas, especially in regions where in-situ data is limited. These findings lay the groundwork for developing advanced remote sensing models to monitor DOC flux and concentration, enhancing our understanding of river basin variability across Asia and their contribution to terrestrial carbon delivery to the ocean.

Influence of Concentration on AC Susceptibility in Magnetic Nanoparticles

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Poster Number: 18

Abstract:

Magnetic susceptibility is a key parameter that quantifies how much a material can be magnetized in response to an external magnetic field. Alternating current (AC) magnetic measurements involve applying an AC field to a sample and measuring the resulting magnetic moment. The AC magnetic susceptibility provides an insight into magnetic particle dynamics. In this study, we investigated the effect of varying concentrations of magnetic nanoparticles on their magnetic behavior under an AC magnetic field. We synthesized iron oxide magnetic nanoparticles using the polyol method and characterized their size distribution. We measured the AC susceptibility of specimens containing different concentrations of iron oxide magnetic nanoparticles suspended in water. Our analysis of the frequency-dependent behavior of AC susceptibility revealed that the concentration of nanoparticles has a substantial impact on the material's dynamic magnetic properties. This finding is crucial for enhancing the performance of technologies that utilize dynamic response magnetic nanoparticles, such as magnetic hyperthermia, magnetic particle imaging or computer memory recording. Our research contributes to the advancement of these technologies, providing valuable insights into tailoring their magnetic characteristics for various applications.

Evaluating Streamflow Extremes of Pawtuxet River, RI, using Hydrologic Indicators

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Poster Number: 19

Abstract:
Evaluating extreme streamflow events such as floods and droughts is crucial in understanding the impact of changes in hydrological patterns on river systems. The Indicators of Hydrologic Alteration (IHA) tool developed by The Nature Conservancy was originally used to study how river systems, flow regimes, and their dynamics change with regulations and alterations. The tool summarizes long periods of daily hydrologic data into a feasible set of hydrologic parameters. This paper uses the IHA tool to examine how Pawtuxet River flow extremes have changed over the past 60 years by analyzing the daily streamflow data from 1963 to 2023. The daily hydrologic data is obtained from the U.S. Geological Survey (USGS) website. The analysis will allow us to assess the mean streamflow, magnitude, frequency, intensity, timing, and duration of change of streamflow events, providing important information for assessing the vulnerability of the river system. Furthermore, the hydrologic indicator tool allows for comparing streamflow regimes across different sites, making it easier to assess the relative impacts of human activities on hydrological patterns. This comparative analysis can help identify regions particularly vulnerable to extreme streamflow events and prioritize conservation and restoration efforts accordingly.

Advancing Microbial Electrolysis Technology: Isolating Exoelectrogenic Bacteria and Enhancing Electrode Characteristics

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Poster Number: 20

Abstract:
Microbial electrolysis cells (MEC) are bioelectrochemical systems that simultaneously treat wastewater and generate gases such as hydrogen and methane. MEC's efficiency depends on several factors, including the substrate, the bacterial inoculum, the set-up configuration, and the characteristics of the electrodes. The material and surface characteristics of the electrodes affect the biocompatibility, bacterial adhesion and mass, and electron transfer in MECs, therefore fully affecting hydrogen production. This project has two main objectives: a) isolate the exoelectrogens – bacteria capable of extracellular electron transfer – and b) produce and characterize functionalized stainless-steel electrodes coated with nanomaterials such as graphene oxide (GO), MoS2 and MoSe2. These two objectives will allow the development of more effective MEC in terms of wastewater treatment and hydrogen gas production. For the exoelectrogens isolation, 18 microorganisms were isolated from a sludge sample collected in the Fields Point wastewater treatment plant (Providence) and tested for exoelectrogenesis using a novel chromogenic method based on the reduction of MnO2 particles added to the growth media. In the case of the electrodes, three nanomaterials were added to the surface of the stainless-steel to assess their effectiveness increasing conductivity, surface area, roughness and biocompatibility. For the determination of these parameters, RAMAN Spectroscopy, Scanning Electron Microscopy, Atomic Force Microscopy were performed. Other tests such as Impedance Spectroscopy, bacterial cultivation on the electrode surface, detachment by sonication will be carried out in the future to assess the remaining characteristics. The preliminary results show that the highest surface coverage for the materials tested was obtained with 10 layers of GO (94.02%), followed by 5 layers of MoS2 (92.45%), and 5 layers of MoS2 (85.10%). All the electrodes showed the highest roughness when coated with 10 layers: 1.30 µm for GO, 799.45 nm for MoSe2 and 533.77 nm for MoS2. For the next steps, after the characterization of the electrodes, we will select two with the best characteristics in terms of conductivity, biocompatibility and coating stability, and then cultivate a microbial consortium, produced using the best exoelectrogens isolated, on their surface and use these microbial-electrode systems in a MEC for treatment of domestic wastewater and hydrogen production.