2023 Online EUREKA! Project List

The following list contains the projects available for the 2023 Online EUREKA! Program. Project details are available in the pages following this list. All students participating in the program are required to have a computer with a camera and microphone, a strong internet connection, and access to Zoom and Microsoft Teams.

Department	Project Title
Accountancy	Forensic Accounting
Agricultural Sciences and Animal and Veterinary Sciences	Economics and Outreach of Climate-Smart Agricultural Practices for Forages and Livestock Systems
Automotive Engineering	Artificial Intelligence for Intelligent Vehicle Driving Safety
Computing	Machine Learning-based Online Abuse Detection
Computing	Ensuring Privacy and Policy Compliance in Smart Speaker Systems
Computing	Machine Learning in Recommendation System
Electrical and Computer Engineering	Responsibility Analysis on AI Applications
Engineering & Science Education	Understanding the Experiences of Neurodivergent Learners in Higher Education
Genetics and Biochemistry	Metabolism and Cyst Formation in the Human Pathogen Entamoeba histolytica
Genetics and Biochemistry	Biotechnology - Crop Genetic Engineering for Enhanced Agricultural Production
Genetics and Biochemistry	Role of Carbon Metabolism in Fungal Pathogenesis
Genetics and Biochemistry	AI in Biomedicine: Prediction of Novel Human Disease Genes by Genomic Data Mining

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Department	Project Title
Languages	Influence of Race, Ethnicity and Social Determinants of Health on Sudden Cardiac Arrest Outcomes in High School and College Student-Athletes in the USA
Languages	Religion and the Republic in Contemporary France
Mathematical and Statistical Sciences	Extreme Value Analysis of World Swimming Records
Mechanical Engineering	Not All Cellulose is Made the Same... Plant Cellulose vs. Bacterial Cellulose, Which One is More Sustainable?
Mechanical Engineering & Bioengineering	Computational Cardiovascular Research
Nursing	Project SUNDAYS: Engaging Rural African American Religious and Spiritual Leaders on Advance Care Planning
Nursing	The Effects of Mediterranean Herb Extracts on Breast Cancer Cells and Assessment of their Metabolic Profiles
Nursing	Facilitators and Barriers to Using Telepresence Robots in Healthcare Settings
Nursing	The Use of Artificial Intelligence Techniques by and for Older Adults

Project Title: Forensic Accounting
Mentor: Mary Gibson, Lecturer
Department: Accountancy

Project Description:

The student will review peer-reviewed articles on fraud awareness and prevention. The student will look for gaps in the research for further study. The student will look at a data set and run basic statistical analysis such as Chi Square to look for relationships between variables (such as does having a whistle-blower program correlate with reduction in fraud occurrence).

Student Involvement:

The research interns will pull peer-reviewed articles and dissertations on accounting fraud. The intern will sort the articles in Excel or Word. The intern will summarize the articles in an annotated bibliography.

Required Skills or Equipment:

The intern should have strong research skills and able to understand the difference between peer-reviewed and news articles. The intern should understand APA and have good grammar. The student should be able to run basic statistical calculations. Students should also have experience with SPSS or Excel statistical programs.

Expected Outcomes:

The students should be able to publish the writings and present at conferences such as the American Accounting Association or Academy of Business Research upon completion of the project.

Future Opportunities:

The students would be welcome to continue their research in the fall.

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Project Title: Economics and Outreach of Climate-Smart Agricultural Practices for Forages and Livestock Systems

Mentor: Ana Thayer, Assistant Professor

Department: Agricultural Sciences and Animal and Veterinary Sciences

Project Description:

Participants will work jointly with Dr. Thayer of the Agricultural Sciences Department and Dr. Silva of the Animal and Veterinary Sciences Department to understand the factors and attributes of producers that expresses interest in the Climate-Smart commodities partnership as well as develop educational resources and support the Extension program by contributing to existing programming activities.

Student Involvement:

The interns will work with Dr. Thayer to prepare relevant comparisons, figures and visualizations. The interns will work with Dr. Silva for hands on activities including but not limited on preparing handouts and material for Extension events or demonstrations in the field, develop relevant educational materials, and interact with Extension agents and producers.

Required Skills or Equipment:

It is preferred that students possess knowledge of Microsoft Excel, Word and PowerPoint.

Expected Outcomes:

Students will be able to co-authors publications, blog posts, and outreach material (handouts) upon completion of the program.

Future Opportunities:

There is potential for students to continue to work on the project after the end of EUREKA!, pending availability of resources (assistantship, etc.).

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Project Title: Artificial Intelligence for Intelligent Vehicle Driving Safety
Mentor: Bing Li, Assistant Professor
Department: Automotive Engineering

Project Description:

The interns will explore Artificial Intelligence existing technologies for intelligent vehicle driving safety.

Student Involvement:

The interns will conduct surveys, might run programs, and write reports to further our project.

Required Skills or Equipment:

Python programming skills are preferred.

Expected Outcomes:

After the project, the students will create a presentation, report, and have the potential for software development.

Future Opportunities:

Students will be able to publish their results upon completion of the project.

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Project Title: Machine Learning-based Online Abuse Detection

Mentor: Long Cheng, Assistant Professor

Department: Computing

Project Description:

Online abuse (such as cyberharassment, cyberbullying, online extremism, and disinformation) is identified as a pressing social problem since it has the potential to negatively impact the safety and psychological well-being of targeted groups, radicalize people and incite violence, and manipulate public opinion. Artificial intelligence (AI) has immense potential for automatic detection of online abuse. In this project, we will apply AI techniques to detect different types of online abuse in online social media such as Twitter.

Student Involvement:

The interns will work with PhD students tol learn data collection from Twitter using existing tools (e.g., Tweepy and Snscrape), data annotation, state-of-the-art machine learning-based online abuse detectors. Students will also learn the main evaluation metrics of a machine learning-based classifier, such as false positives, false negatives, precision, recall, and F1 score.

Required Skills or Equipment:

Basic Python programming skills are required.

Expected Outcomes:

In addition to learning about AI models and evaluation metrics, the students will also create a poster presentation about the research work.

Future Opportunities:

Students may continue with this research project funded by the NSF REU program.

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Project Title: Ensuring Privacy and Policy Compliance in Smart Speaker Systems

Mentor: Long Cheng, Assistant Professor

Department: Computing

Project Description:

Voice personal assistants (VPAs) such as Amazon Alexa and Google Assistant are rapidly gaining in both domestic and business popularity. Despite the many convenient features, concerns have been raised about the security risks (in particular privacy and content safety) to VPA users. In this project, we will design a dynamic analysis framework to evaluate how existing voice-applications conform to various policy requirements and measure potential social bias issues in mainstream VPA platforms.

Student Involvement:

Students will work with a PhD student in this project to learn Privacy and Policy requirements such as Children's Online Privacy Protection Act (COPPA) and General Data Protection Regulation (GDPR). The constrained interfaces on Smart Speaker devices pose a challenge to effective privacy notices. Privacy policies are only available on the store's webpages, and thus they are inaccessible to users who only use Smart Speaker services through the conversational interface. This, in particular, creates a challenge for visually impaired users to make informed privacy decisions considering Smart Speaker's use by people with special needs is growing. Students will be involved in designing and developing an inclusive and effective privacy notice mechanism for smart speaker users.

Required Skills or Equipment:

Students should be familiar with Python programming.

Expected Outcomes:

The expected outcomes include a poster presentation about the research work.

Future Opportunities:

Students may continue doing the research after the EUREKA! program.

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Project Title: Machine Learning in Recommendation System
Mentor: Kai Liu, Assistant Professor
Department: Computing

Project Description:

How do you recommend movies to those who may have interest? One of the most widely used methods in practice is via Matrix Factorization, which usually involves with Singular Value Decomposition (SVD). However, when the data is in large scale, SVD becomes impractical due to its heavy computation demand. In this project, we are going to investigate an SVD-free algorithm, and conduct experiments on Movie Lens dataset (or any other datasets if applicable) and evaluate the performance of the algorithm including accuracy and speed.

Student Involvement:

Students will collect dataset they are interested in (not limited to movie review data), write the proposed algorithm with codes and conduct experiments to evaluate the performance of our proposed algorithm.

Required Skills or Equipment:

Students should have experience with Matlab/Python, linear algebra, and matrix analysis.

Expected Outcomes:

If possible, we expect this experiment to be part of a paper we submit to a top-tier Machine Learning/Data Mining conference such as the International Conference on Data Mining.

Future Opportunities:

Students will have the opportunity to publish a paper, which will be extremely helpful if they are going to apply for graduate school.

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Project Title: Responsibility Analysis on AI Applications

Mentor: Yongkai Wu, Assistant Professor

Department: Electrical and Computer Engineering

Project Description:

AI has been widely used in the real world to make high-stakes decisions. However, there are some concerns about whether AI respect human ethics. This project focuses on quantifying and identifying adverse prejudice in AI applications. After identifying adverse bias, mitigation solutions will be studied to enhance the AI's capability to meet social responsibility requirements.

Student Involvement:

This is an individual project where students will start by running a few common machine learning algorithms, then implement several measurement algorithms to quantify prejudice. Finally, students are expected to modify the conventional machine learning algorithms to promote their responsibility.

Required Skills or Equipment:

Students should have experience with Python programming.

Expected Outcomes:

Students will be exposed to machine learning as well as AI ethics.

Future Opportunities:

The results will be organized and submitted to AI conferences where students can present their findings.

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Project Title: Understanding the Experiences of Neurodivergent Learners in Higher Education

Mentor: Matthew Boyer, Research Associate Professor

Department: Engineering & Science Education

Project Description:

Neurodivergent individuals are those who have atypical neurological development, including but not limited to autism, ADHD, dyslexia, and other conditions. While the number of neurodivergent students in higher education is increasing, there is a lack of research on how the university environment impacts their experiences. The goal of this project is to develop a deeper understanding of the experiences of neurodivergent learners in higher education by exploring the following research questions:

What are the challenges that neurodivergent learners face in higher education, and how do they impact their academic performance? What are the strategies that neurodivergent learners use to overcome these challenges and succeed academically? What kind of support do neurodivergent learners receive from the university, and how effective is it in helping them succeed? To answer these questions, the project will use a mixed-methods approach that includes both quantitative and qualitative data. The research methods that will be used include surveys, interviews, and focus groups. The surveys will be used to collect quantitative data on the challenges that neurodivergent learners face and the support they receive. The interviews and focus groups will be used to collect qualitative data on the experiences of neurodivergent learners. This research project will provide a valuable opportunity for the student interns to learn research methods and develop skills in data collection, analysis, and presentation.

Student Involvement:

The research intern(s) will play an essential role in the research project and will be involved in various stages of the research process, specifically:

Literature Review: The research intern(s) will work closely with the project supervisor to conduct a comprehensive review of the existing literature on neurodivergent learners in higher education. This will include searching relevant academic databases, reading and summarizing research articles, and identifying research gaps.

Data Collection: The research intern(s) will assist in the data collection process, which will involve preparing survey questionnaires, conducting interviews, and organizing focus groups. They will also help in the recruitment of participants and scheduling of data collection sessions.

Data Analysis: The research intern(s) will assist in the analysis of both the quantitative and qualitative data. This will involve organizing and cleaning data, running statistical tests, and analyzing the themes and patterns that emerge from the qualitative data.
Poster Presentation: The research intern(s) will work with the project supervisor to develop a poster that summarizes the research findings. They will be responsible for designing the poster layout and contributing to the development of the content.
Overall, the research intern(s) will have the opportunity to develop skills in research methods, data collection, analysis, and presentation. They will receive guidance and support throughout the research process and will be encouraged to participate in regular team meetings to discuss their progress, ask questions, and provide feedback. By the end of the project, the research intern(s) will have gained valuable experience in conducting research and presenting findings at a poster forum.

Required Skills or Equipment:

Strong communication skills: The intern(s) should have excellent oral and written communication skills to communicate effectively with research participants, supervisors, and team members.
Attention to detail: The intern(s) should have excellent attention to detail to ensure that data collection is accurate and complete.
Organizational skills: The intern(s) should have strong organizational skills to manage and prioritize tasks and meet project deadlines.
Proficiency in Microsoft Office and/or Google Apps.
Interest in neurodiversity: The intern(s) should have an interest in neurodiversity and a desire to learn more about the experiences of neurodivergent learners in higher education.
While it is not necessary for the intern(s) to have previous research experience, they should have an interest in research and be willing to learn new skills and techniques throughout the project.

Expected Outcomes:

After the project, the intern(s) will have a deeper understanding of the experiences of neurodivergent learners in higher education. The research findings will contribute to our understanding of the challenges that neurodivergent learners face in higher education and the strategies they use to overcome them. Additionally, the research will provide insight into the kind of support that universities can provide to better meet the needs of neurodivergent learners. The research intern(s) will have the opportunity to develop skills in presenting research findings by creating a poster that summarizes the project's key

findings. They will also have the opportunity to present the poster at a poster forum, where they can share their work with other researchers and university community members. The research intern(s) will have the opportunity to gain experience in research methods, including literature reviews, data collection, data analysis, and presentation development. They will also gain exposure to various research techniques, such as surveys, interviews, and focus groups. The research intern(s) will also have the opportunity to work collaboratively with their supervisor and other team members, allowing them to develop teamwork and collaboration skills.

Future Opportunities:

Future opportunities for collaboration with Dr. Boyer and his graduate students on this line of research and development will be available to students after completion of the project. Participating in a research experience is an impressive addition to any resume, as it demonstrates the student's dedication to their field and ability to conduct independent research. Research experiences provide opportunities for students to network with other researchers, professors, and professionals in their field. These connections can be valuable for career development and may lead to future research opportunities. If the research findings are significant, students may have opportunities to publish their work in academic journals or present at conferences. This can be a valuable addition to their resume and help them establish themselves as emerging experts in their field. Research experiences also require students to analyze complex data and draw conclusions based on evidence. This can help students develop critical thinking and problem-solving skills that are valuable in any career path.

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Project Title: Metabolism and Cyst Formation in the Human Pathogen Entamoeba histolytica

Mentor: Cheryl Ingram-Smith, Associate Professor

Department: Genetics and Biochemistry

Project Description:

Entamoeba histolytica is an intestinal parasite that infects 500 million to 1 billion people each year, of which ~10% develop amoebic dysentery characterized by severe bloody diarrhea lasting several weeks. Little is known about why some infections lead to illness but others remain asymptomatic. E. histolytica assumes two forms, trophozoites and cysts. Trophozoites are the form that lives in the human body and causes illness, and cysts are a dormant form surrounded by a protective shell that is found in the environment. Infection occurs by consuming food and water contaminated with these cysts. The cysts pass through the stomach and revert to the trophozoite form in the small intestine, and then pass to the large intestine where they remain to continue growing and dividing. A subpopulation of trophozoites in the large intestine will convert to the cyst form to be passed to the environment and continue the infection cycle.

Our lab is studying the changes in metabolism that E. histolytica undergoes between the small and large intestines, which are very different environments in terms of the nutrients available. We are also investigating what factors signal E. histolytica to convert from the trophozoite form to the cyst form. This aspect is all the more interesting in that only a subset of the population converts. The rest of the population continues growing and dividing in the large intestine even as cysts are expelled daily into the environment in feces.

In this project, we will focus on the changes in gene expression that occur during initiation of encystation. We will use E. histolytica transcriptome data (which shows the expression level of all genes under a given condition) as well as data published in the scientific literature to examine the transcriptional changes in E. histolytica gene expression at the beginning of encystation. We will also use data from the related species Entamoeba invadens, a reptile pathogen that has been a model for studying cyst formation. The goal of the project is to identify genes that play a role in sensing and responding to environmental signals in order to regulate encystation. These target genes can then be investigated through generation of mutants to examine the effect on growth and encystation.

Student Involvement:

The interns will use computational/bioinformatics approaches to analyze experimental RNAseq data and identify target genes for study. We expect to have RNAseq transcriptome data from E. histolytica from the early stages of encystation and there is also a body of transcriptome data from E. invadens during encystation. EUREKA! interns will use this data to identify genes that may play a role in sensing and responding to environmental signals for these changes. They will then delve into the scientific literature to determine what is known about the function of the genes they have identified. Literature investigations performed by students will extend beyond Entamoeba into Giardia and other parasites. Published data regarding Giardia may be of particular interest due to similarities between it and Entamoeba.

Required Skills or Equipment:

A basic knowledge and interest in biology are the only requirements. All other skills needed will be taught as the project progresses.

Expected Outcomes:

EUREKA! interns will gain experience using AmoebaDB (a database of amoeba informatics resources including genome and transcriptome data), BLAST (gene/protein alignment software), and other bioinformatics software.

Future Opportunities:

EUREKA! interns in life science majors may be invited to continue their research in the lab. This would likely be in-person wet-lab research or a continuation of the bioinformatics project begun online and could begin immediately in the fall or at a later date depending on the student's schedule and space in the lab.

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Project Title: Biotechnology - Crop Genetic Engineering for Enhanced Agriculral Production

Mentor: Hong Luo, Professor

Department: Genetics and Biochemistry

Project Description:

Environmental stress is one of the most important factors impacting agriculture production. Plant genetic engineering using molecular cloning and transgenic approaches has been playing an increasingly important role in modern agriculture. Development of novel molecular strategies to genetically engineer important crops will lead to new cultivars with beneficial new traits, enhancing crop yield. This project focuses on manipulation of expression of several stress-related candidate genes in transgenic rice and turfgrass plants to achieve enhanced plant performance under adverse environmental conditions such as drought and salt stress, improving agriculture production and economy. For those participating in the proposed project online, a series of online PowerPoint presentations and literature reading and discussion sessions will be organized thoroughly introducing to the students the principles of gene cloning, biotechnology approaches for plant genetic engineering and transgenic analysis to evaluate improved crop performance under adverse environmental conditions. Those participating in the proposed project in-person will work with graduate students to learn and gain hands-on experience in gene cloning, chimeric gene construction, plant genetic transformation and transgenic analysis.

Student Involvement:

The students participating in the project online will read and discuss related research papers on plant molecular biology, plant genetic engineering and molecular mechanisms of plant-environment interaction. They will participate in all the online presentations and discussions, and actively interact with myself, graduate students and the post-doc researcher to become familiar with the basics about scientific research, gene cloning, gene functional characterization and chimeric gene construction as well as plant genetic transformation and transgenic analysis. The students participating in the proposed project in-person will work with graduate students to learn and gain hands-on experience in gene cloning, chimeric gene construction, plant genetic transformation and transgenic analysis.

Required Skills or Equipment:

No specific skills are required for the students to be involved in this project. Knowledge learned from high school biology courses will be enough to participate in the project. The students will be trained to learn basic molecular and cell biology

techniques including DNA and RNA extraction, DNA cloning, plasmid construction, PCR, plant tissue culture and plant genetic transformation.

Expected Outcomes:

The project would allow students to become familiar with the basics about scientific research, gene cloning, gene functional characterization and chimeric gene construction as well as plant genetic transformation and transgenic analysis. They will also be trained to read scientific literature as well as to prepare, present, communicate and discuss scientific data to their peers and general public.

Future Opportunities:

The students could continue their research in the lab and gain more hands-on research experience and have opportunities to present research data in professional meetings and publish their discoveries. This experience has been very helpful for many students in their application for graduate school, medical school and other professional opportunities.

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Project Title: Role of Carbon Metabolism in Fungal Pathogenesis
Mentor: Kerry Smith, Professor
Department: Genetics and Biochemistry

Project Description:

Invasive fungal infections cause nearly one and a half million deaths annually, accounting for nearly 50% of all AIDS-related deaths. Cryptococcus neoformans, an invasive opportunistic pathogen of the central nervous system, is the most frequent cause of fungal meningitis. The CDC estimates the yearly burden of cryptococcal meningitis to be nearly one million cases with greater than 190,000 deaths. AIDS is a major risk factor and mortality rates in AIDS patients range from 55-70% in Latin America and sub-Saharan Africa. Exposure to Cryptococcus is common, as it is an environmental fungus found in the soil that can enter the lungs through inhalation and disseminate to the central nervous system in susceptible individuals. An increased rate of infection occurs in individuals with impaired immunity, particularly those with AIDS and recipients of immunosuppressive therapy. The widespread availability of antiretroviral therapy in developed countries has helped improve the immune systems of many HIV patients to decrease their susceptibility to infection. However, cryptococcal meningitis is still a major problem in resource-limited regions of the world such as sub-Saharan Africa where HIV prevalence is high and access to healthcare is limited. Despite the global significance of cryptococcal meningitis, current treatments are inadequate as the gold standard therapy is based on half century old drugs that have a wide range of liabilities and shortcomings.

Metabolic adaptability and flexibility are important attributes for fungal pathogens to successfully infect and cause disease. Although carbon metabolism is critical for virulence in Cryptococcus, very little is known about which carbon sources are utilized during infection. Our long-term goal is to provide a better understanding of how Cryptococcus can adapt its metabolism to survive in the changing environments encountered during infection.

Student Involvement:

The EUREKA! student will utilize computational approaches to analyze data from genomics, transcriptomics, proteomics, and metabolomics experiments to make new discoveries in Cryptococcus biology and carbon metabolism. Possible projects could include computational approaches in: (1) the identification of novel virulence factors, (2) the characterization of the interplay between metabolic pathways during virulence, (3) the identification and characterization of genes necessary for acetate utilization, (4) the identification of important protein modifications, etc.

Required Skills or Equipment:

Students must possess enthusiasm for research, basic biology and chemistry knowledge, and general computer knowledge.

Expected Outcomes:

The goal of the EUREKA! internship in the Smith laboratory is to result in an increased interest for research. The expected outcome is that the intern will present their research to the scientific community. First, the intern will have the opportunity to present (talk or poster) their research at national scientific conferences such as the annual Cellular Biology of Eukaryotic Pathogens held at Clemson in October. Second, the expectation is that the intern's research will be published on its own or as part of a greater study. These opportunities will help the student as s/he pursues a career in research and/or medicine. Finally, the student's research will also assist my laboratory in gaining and/or sustaining federal research funds.

Future Opportunities:

Following the EUREKA! internship, the student will have the opportunity to continue research in the lab. This wet lab opportunity would provide the student with experience in a variety of genetic, biochemical, and molecular and cellular techniques that can be utilized to study the discoveries that were made during the EUREKA! internship. Hopefully, the student will enjoy their summer experience and will want to perform their Departmental Honors research in the lab.

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Project Title: AI in Biomedicine: Prediction of Novel Human Disease Genes by Genomic Data Mining

Mentor: Liangjiang (LJ) Wang, Associate Professor

Department: Genetics and Biochemistry

Project Description:

In the human genome, most genes actually do not encode proteins; they are non-coding RNA genes. The largest class of non-coding genes is known as long non-coding RNAs (lncRNAs), which are transcripts greater in length than 200 nucleotides, but with no protein-coding capacity. While some lncRNAs have been demonstrated to be key regulators of gene expression and 3D genome organization, most lncRNAs are still uncharacterized. We have thus been developing artificial intelligence (AI) and machine learning approaches for the functional annotation of human lncRNAs through mining the vast amount of genetic and genomic data ("biological big data"). Our recent studies demonstrate that genomic data mining can give insights into RNA functions and provide valuable information for experimental studies of candidate lncRNAs.

This research project will focus on the identification and functional analysis of novel candidate lncRNAs associated with human diseases, including autism spectrum disorders (ASD) and intellectual disability (ID). ASD and ID are clinically and genetically heterogeneous complex disorders, affecting up to 1% and 3% of the human population, respectively. ASD is characterized by impaired social communications and restrictive or repetitive behavior, whereas ID is recognized by diminished intellectual capacity and adaptive reasoning. Both disorders originate in early childhood, and involve a large number of genes essential for normal brain development and function. However, in most cases of ASD or ID, the specific genetic factors of the disorders are still unable to be determined. Until recently, only protein-coding genes were studied for their involvement in ASD and ID. It is thus likely that many of these disease-causing genetic factors may reside in lncRNAs, which are enriched in the brain. The research interns will learn how to build machine learning models for candidate disease gene prediction, and then utilize publicly available genetic and genomic data to further characterize and prioritize the candidate lncRNAs. The high-priority candidates identified in this project can not only provide new insight into the roles of lncRNAs in genetic brain disorders, but may also be further developed as biomarkers.

Student Involvement:

Research interns will be directly involved in the project. Each intern student, under the supervision of a graduate student, will learn how to build a machine learning model for candidate disease gene prediction and prioritization. They will also contribute to the further evaluation and curation of novel candidate lncRNAs associated with genetic brain disorders.

Required Skills or Equipment:

Research interns are expected to have good computer skills and understand the basic concepts of genetics. Although prior experience with computational research is not required, the interns are expected to be willing to learn basic AI/machine learning concepts and computer programming skills for genomic data mining.

Expected Outcomes:

The project will generate a prioritized list of candidate lncRNAs associated with genetic brain disorders. The findings can be used for presentations and journal publications. The intern students will also learn large-scale genomic data analysis and use of AI/machine learning techniques in biomedical research.

Future Opportunities:

The data analysis skills learned through this project can be useful for future careers in biomedical data science, bioinformatics, genomics, human genetics, and precision medicine.

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Project Title: Influence of Race, Ethnicity and Socail Determinants of Health on Sudden Cardiac Arrest Outcomes in High School and College Student-Athletes in the USA

Mentor: Arantza Gil Recalde, Lecturer

Department: Languages

Project Description:

African American and other minorities student-athletes have a lower survival rate from sudden cardiac arrest (SCA) than non-minority student-athletes. This study will examine the relationship between indicators of socioeconomic status, race and ethnicity and survival in student-athletes with exercise-related SCA

Student Involvement:

The students will conduct an exhaustive research about the rates of survival in student-athletes after suffering a SCA, the access to CPR in situ and in hospitals, the barriers of access to CPR and good health practices in general. They will also explore how the race, ethnicity and socio economic status influences the outcome after a SCA and see the CPR training disparities in different communities.

Required Skills or Equipment:

The student should be able to understand and collect data from different resources.

Expected Outcomes:

Our research team will share the paper, poster and brochure with the community and a local non profit called Nolanetwork.com.

Future Opportunities:

After the program, we will try to keep working on this cause and contribute to this public health campaign in local school districts, Recreational Centers, and YMCAs.

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Project Title: Religion and the Republic in Contemporary France

Mentor: Eric Touya, Professor

Department: Languages

Project Description:

The student will explore the tension that exists between the religious and political realms in France today. The topic is explored through the relation between Christianity, Islam, and Judaism and the secular values of the French Republic.

Student Involvement:

The student will be provided questions and specific guidelines that will enable her/him to write a 7-8 pages paper and create a poster on the subject.

Required Skills or Equipment:

No specific skills are required other than an interest in politics and/or religion in France ad Western Europe.

Expected Outcomes:

The intern will write a 7-8 pages paper and create a poster on the subject.

Future Opportunities:

The student might have the opportunity to present her/his paper at a conference.

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Project Title: Extreme Value Analysis of World Swimming Records

Mentor: Qiong Zhang, Assistant Professor

Department: Mathematical and Statistical Sciences

Project Description:

The research team will use statistical extreme value analysis to find the most unbreakable world swimming record.

Student Involvement:

The intern will collect world swimming records from online information, organize data into the desired format and learn and understand the results of this analysis.

Required Skills or Equipment:

Students should be familiar with Excel and using spreadsheets. They should also have programming experience and completed AP statistics courses.

Expected Outcomes:

By the completion of the project, the students will be encouraged to attend and present at undergraduate research competitions and virtual conferences hosted by the American Statistical Association.

Future Opportunities:

Students may continue working with our team next summer through undergraduate directed study.

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Project Title: Not All Cellulose is Made the Same... Plant Cellulose vs. Bacterial Cellulose, Which One is More Sustainable?

Mentor: Rodrigo Martinez-Duarte, Associate Professor

Department: Mechanical Engineering

Project Description:

Bacterial cellulose (BC) is a fantastic biomaterial that is rapidly gaining ground as an engineering material. BC can be grown pure in a bioreactor and features better mechanical properties than cellulose purified from plants. Indeed, BC shows much potential as is, forming composites, or serving as a precursor for carbon-based materials. As such, examples of application range from wound healing to carbonaceous electrodes in energy components. While BC does not require forest management and the purification of cellulose from lignin and hemicellulose, it does require controlled conditions in a bioreactor and specific growth media. This project is about comparing the sustainability of cellulose derived from bacteria and that derived from plants. There are multiple ways to produce one or the other and you and your team will be first assessing these to compare them later. To this end, you will be using SimaPro, a commercial software, to analyze the life cycle of both kinds of cellulose. The hypothesis is that BC compares advantageously to plant cellulose in terms of energy required and environmental impact, and that is what we will start testing. In collaboration, we will be exploring the context of this problem and framing the important questions that further enable the understanding of the true cost and impact of growing BC compared to harvesting plant cellulose.

Student Involvement:

You will be working in a team-oriented lab environment that includes both undergraduate and graduate researchers. The lab is goal oriented and as such you will be given a goal to accomplish by the end of your tenure (comparing the life cycle analysis of both types of cellulose). In collaboration with the principal investigator (PI), you will learn to break up the project into smaller goals to be accomplished each week and confirmed during the weekly meeting with the PI.

Required Skills or Equipment:

You must be curious, comfortable with ill-defined problems, and strongly willing to pull threads in multiple areas. Above all, you must be excited to come to work and craving to engage with the team. Experience analyzing scientific literature is desired but not required. The license to SimaPro will be provided. Students must have VPN installed if not on-campus.

Expected Outcomes:

You will learn how to do a life cycle analysis of a product and its process. You will also learn how to develop a research plan with a goal in mind. At the very least, an abstract should be submitted to a conference. A manuscript to be sent for publication would be ideal. Most importantly, this project will enable the student to get a significant head start on the research opportunities available in the group.

Future Opportunities:

The lab has a strong record of undergraduate research that brings diverse majors together in a team within the Creative Inquiry framework. Creative Inquiry and Honors research opportunities will be available.

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Project Title: Computational Cardiovascular Research

Mentor: Ethan Kung, Associate Professor

Department: Mechanical Engineering and Bioengineering

Project Description:

In this project, students will use computational methods to help solve clinical problems related to the cardiovascular field. This may include simulations to model the cardiovascular system, potentially constructing patient-specific models, and analysis of clinical database to identify trends and regression models. The project may extend to computational modeling of related medical devices. For Summer 2023, the research will involve building 3D anatomic models and performing computational fluid dynamic simulations of carotid bifurcation from patient imaging data.

Student Involvement:

Students will learn how to use new software to perform computer simulations and data analyses to answer scientific or clinical questions. This Summer the research will be addressing the particular question "How do we determine whether a patient with asymptomatic carotid stenosis needs to be treated?" The computational models that we employ will be 3D finite element models, and Excel or Matlab based data analysis and regression modeling.

Required Skills or Equipment:

Students must have the ability to learn to use new engineering software and hardware as well as be able to learn basic data processing and coding in Matlab. The ability to grasp new scientific concepts is also helpful.

Expected Outcomes:

Students will learn how to construct 3D geometric models from patient imaging data, setup computational fluid dynamic simulations, and perform statistical data analysis such as T-test and regression.

Future Opportunities:

After the program, students will have the opportunity to continue related research in Creative Inquiry or summer research.

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Project Title: Project SUNDAYS: Engaging Rural African American Religious and Spiritual Leaders on Advance Care Planning

Mentor: Tracy Fasolino, Professor

Department: Nursing

Project Description:

Project SUNDAYS focuses on the rural minority disparities of Black/African American (AA) seriously ill patients. Our three measurable goals are: 1) assessing the religious/spiritual beliefs, values, and preferences toward advance care planning (ACP) conversations and directives by Christian Black/AA faith leader(s) serving in rural South Carolina (SC), 2) creating an evaluation tool to assess current ACP training modules (two modules and resources available through the Center to Advance Palliative Care - CAPC), and 3) evaluating current ACP training modules to determine how they align with beliefs of Christian Black/AA faith leader(s). The outcomes of Phase I include a holistic understanding of rural Christian Black/AA faith leader(s) position on ACP conversations, including the current barriers and facilitators as well as theological underpinning.

Student Involvement:

By the beginning of EUREKA!, the existing research team will have completed a number of the 12 interviews planned with faith leaders in rural communities. Several of these transcripts will need to be reviewed, edited to remove any identifying information, and cleaned for robust data analysis (Estimated 10 hours of transcripts). With this activity, the students will learn about the importance of interviewing techniques, the value of rich narrative stories, and the impact of faith leaders on advance care planning/serious illness conversations. We will work collectively to load the transcripts into NVivo (qualitative data analysis computer software package produced by QSR International). The students will learn how to use this software to process qualitative data to discover common themes, etc.

Required Skills or Equipment:

Students posing a sense of curiosity would be ideal for this project. We are focusing on Christian theology and faith (Judaism) so students would want to be comfortable with this religious focus. We have much to learn about the impact of our religious/spiritual leaders in rural AA/Black communities on serious illness conversations. Students should be comfortable with Microsoft software (Word, PowerPoint, and Publisher). Student should also be comfortable learning of and talking about Christian faith.

Expected Outcomes:

An expected outcome of this project is designing, creating, and disseminating a scholarly podium presentation/poster to be delivered to the current Project SUNDAYS research team. The students will gain experience working with transcripts (qualitative data) and the use of program software (NVivo) to organize, analyze, and find insights into unstructured data. Additionally, they will gain experience working in an interdisciplinary team of researchers, educators, and clinicians.

Future Opportunities:

Students will have the opportunity to share their work at regional and state level proceedings. For example, the South Carolina Society of Chaplains have quarterly meetings so students could present the findings from the qualitative analysis. As the project moves forward, students will have the option of joining a Creative Inquiry team to continue working on the project. Ultimately, the goal will be for students to participant in scholarly writing for a journal article in the American Journal of Hospice & Palliative Care. Impact Factor: 2.090 / 5-Year Impact Factor: 2.379.

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Project Title: The Effects of Mediterranean Herb Extracts on Breast Cancer Cells and Assessment of their Metabolic Profiles

Mentor: Diana Ivankovic, Professor

Department: Nursing

Project Description:

We use a specific method, called microwave extraction, to obtain Mediterranean herb compounds. We then expose primary and metastatic breast cancer cells to them. We perform a live/dead assay, called MTS, to assess their viability, and the anticarcinogenic potential of these extracts. Lastly, we use the Biolog machines to assess their metabolic profiles.

Student Involvement:

We will train our research students in person, as well as provide safety courses online. The students will first shadow us, and then, slowly, we will let them do hands-on activities such as feeding, splitting, and counting cells. Students will also be exposed to various herbal extracts and learn to analyze their metabolic activity over time.

Required Skills or Equipment:

The interns just need to be attentive, take good notes, and learn from their mistakes. No specific knowledge is needed, coming into our lab.

Expected Outcomes:

They will present their findings in a poster format. If they so proficiency at research, we will offer them a position to continue conducting research in our lab. In doing so, the students will get published and go to conferences with us. Two of our EUREKA! students form last year are going to the Ernest Just Symposium with us at MUSC. All of our EUREKA! students from last year chose to stay with us and they have now been doing research in our lab for two semesters.

Future Opportunities:

The students might get chosen to stay in our lab, and continue doing research and get credit hours.

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Project Title: Facilitators and Barriers to Using Telepresence Robots in Healthcare Settings

Mentor: Janice Lanham, Principal Lecturer

Department: Nursing

Project Description:

The use of robotic assistance may help enhance the delivery of quality patient care. Although telepresence robots have been used in healthcare settings, a comprehensive review of studies focusing on their use requires further investigation. This project will focus on the use of telepresence robots to support and facilitate patient care in acute care settings. Project results will provide a summary of evidence about the facilitators and barriers to the use of telepresence robots in healthcare.

Student Involvement:

The students will assist with research including conducting a comprehensive literature review using the following databases: MEDLINE (Ovid), CINAHL, PsycINFO (EBSCO), Web of Science and ProQuest Dissertations & Theses Global. Google and Google Scholar will be used to search for additional literature. A handsearch will be conducted using the reference lists of included studies to identify additional relevant articles.

Required Skills or Equipment:

None

Expected Outcomes:

Upon project completion, the student intern will be able to outline steps in the research process and become familiar with the Double (Telepresence) Robot, e.g. operations, features, tech specifications, etc.

Future Opportunities:

Students will be able to continue this work as a Creative Inquiry for academic credit. They will also be able to create a poster or oral presentations at local, state, regional or national conferences.

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Project Title: The Use of Artificial Intelligence Techniques by and for Older Adults

Mentor: Zahra Rahemi, Assistant Professor

Department: Nursing

Project Description:

The aging population is growing due to fast-paced public health and medical advancements. A report from United Nations indicates that the population of older adults (=65 years old) will be about 2 billion by 2050, which means there will be new challenges for both the older adult population and the healthcare system. Most older adults prefer to live in their places; however, facing cognitive impairments, chronic diseases, and visual and hearing impairments due to aging may negatively affect their ability to live independently in their own homes. Utilizing artificial intelligence (AI) can be an efficient and cost-effective solution to facilitate aging in place. New AI technologies, such as smart home apps and wearable sensors, have improved remote monitoring, real-time tracking, and abnormal behavior (e.g., falling) prediction.

Student Involvement:

The present systematic review aims to assess AI applications in monitoring, predicting, and managing the independent lives of older adults with Alzheimer's disease and related dementia (ADRD). We will use the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) as a systematic review methodology. The searched databases will include PubMed, Web of Science, PsychInfo, and CINAHL. All databases will be searched using keywords for each concept. Four concepts have been identified for this systematic review: Cognitive Impairment, Artificial Intelligence, Aging in Place, and Assisted living. For example, for the Concept of Cognitive Impairment, identified keywords include "Alzheimer's," "cognitive dysfunction," "cognitive impairment," and "cognition." The results will show the implication of AI technologies in older adults with Alzheimer's life compared to those who live in assisted living facilities. The findings can improve the knowledge base regarding the application of AI technologies for older adults and aging in place.

Required Skills or Equipment:

Students need to be enthusiastic about a review study, have basic computer skills, and have skills for retrieving scientific articles through Clemson library.

Expected Outcomes:

The minimal outcome will be the EUREKA! poster presentation and the maximum will be an additional co-authorship in a publication, depending on their collaboration, interest, and productivity.

Future Opportunities:

They can continue their work to publish it in a peer-reviewed journal or present at a national or international conference. It will be an excellent take-away for those students who are interested in academia as their future career.

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