

21st Annual TLSAMP Undergraduate Research Conference

March 1, 2024

Oral Presentation Abstracts Engineering and Computer Science

(listed in alphabetical order)

1. Zackee Dosky

Senior

Mechanical & Manufacturing Engineering

Tennessee State University

Dr. Muhammad Akbar

Oral

Computational Fluid Dynamics (CFD) Study of Boeing 737-800 Propulsion System

This research aims to study the propulsion system of a Boeing 737-800 aircraft by using the Computational Fluid Dynamics (CFD) model to accurately assess its performance. The initial use of SolidWorks is to create an underlying concept of manufacturing and the development of the current features of the propulsion system. The modeling is done based on the known dimensions that are readily available in the open literature. The setup and analysis of the research is done using multiple tools such as SolidWorks, ANSYS, and MATLAB. In the present study, SolidWorks will be used for the geometry and CAD model of the Boeing 737-800. Then the CAD will be used in ANSYS to simulate combustion and compressible fluid flow through the propulsion system. The ultimate goal is to understand how the propulsion system contributes to the thrust and aerodynamics of the Boeing 737-800 aircraft.

2. Sona Javadi

Junior

Computer Science

Vanderbilt University

Dr. Maizie (Xin) Zhou

Oral

Autoencoder with Differentially Expressed Genes and Imputation for a Robust Spatial Transcriptomics Clustering

Recent advancements in spatial transcriptomics (ST) sequencing technology have enabled a more in-depth understanding of tissue by allowing the measurement of gene expression among spots in tissue along with the spatial location of spots. There are multiple studies that have worked on further understanding the variation of gene expression in tissue, but most of the literature have utilized tools that were developed for single-cell RNA sequencing (scRNA-seq), only using the gene expression values of spots. However as stated, ST datasets also contain the spatial location of spots and often contain high-resolution histology images. These are very important aspects of the data which can allow a better understanding of tissue; however, they are seldom exploited thoroughly. In this study, we will discuss a novel graph-based multi-stage deep clustering method which integrates differentially expressed gene selection and imputation modules to refine clustering results.

3. Elise Russ

Senior

Civil Engineering

Tennessee State University

Dr. Shihui Liu

Oral

The Benefits and Construction Advances of Hempcrete

Hempcrete is an important construction industry advancement that focuses on replacing current non-bearing construction materials that negatively impact the environment. Hempcrete provides an alternative to costly materials and negative environmental factors, the typical cost of concrete is between \$110 and \$165 per cubic yard. Concrete contributes to negative environmental effects which include soil erosion, water pollution, and flooding. In the research methodology used, I have tested the compressive strength of hempcrete to identify its longevity and use in the field. The compressive strength of the samples is tested after 28 days with the relative humidity for the curing environment is 95%. It is important to identify various building materials as our world is evolving and we are looking to improve the environmental conditions around us.

4. Jymon T. Scott

Senior

Electrical Engineering

Tennessee Technological University

Dr. Charles Van Neste

Oral

Cost Effective Analysis and Experimental Design for an Axial Flux Motor Core Assembly

The objective of this research experiment is to understand the efficiency difference between an axial flux motor with a steel core and one with a core made up of magnetic PLA. Along with efficiency, cost is also analyzed to find out if magnetic PLA could ever be a successful alternative solution. For this experiment, an axial flux motor core was constructed and assembled based on the blueprints provided by Dr. Charles Van Neste titled, "Null Field Gen. V3". Two cores were produced; One being made of steel and the other magnetic PLA. After tedious coil winding, we hope to find and a difference in each of the mutual inductances with however still being able to output an efficient power and induced voltage.

5. Pierre Zakaria

Junior

Biomedical Engineering

Vanderbilt University

Dr. Justin Baba

Oral

Peripheral Artery Disease Detection with Thermographic Imaging

Peripheral artery disease (PAD), a cardinal manifestation of atherosclerosis, affects 8.5 million Americans and causes significant ambulatory impairment, accelerated functional decline, and enhanced loss of mobility that is resistant to medical therapy. Calf skeletal muscle perfusion better predicts limb function than the severity of limb atherosclerosis or whole limb blood flow. For this reason, a sphygmomanometer cuff occlusion will be conducted on the patient's lower leg. Simultaneously, thermographic imaging via skin thermography will also be conducted while the occlusion is in progress. The results of thermographic imaging consist of pairs of pictures: a VIS (optical) image and an IR (infrared) image. After image pair registration and segmentation, each image pair is separated into two segments: the foot and the lower leg. An analysis is then performed on the segmented data, quantifying the average temperature of each segment, and finding the temperature difference between the two segments. The result of the analysis is a graph showing the difference in the average temperature of the segments over time. The characteristics of the graph, especially around the time when the cuff pressure is released and circulation begins to return to a normal state, are used to identify whether a patient has PAD or not.