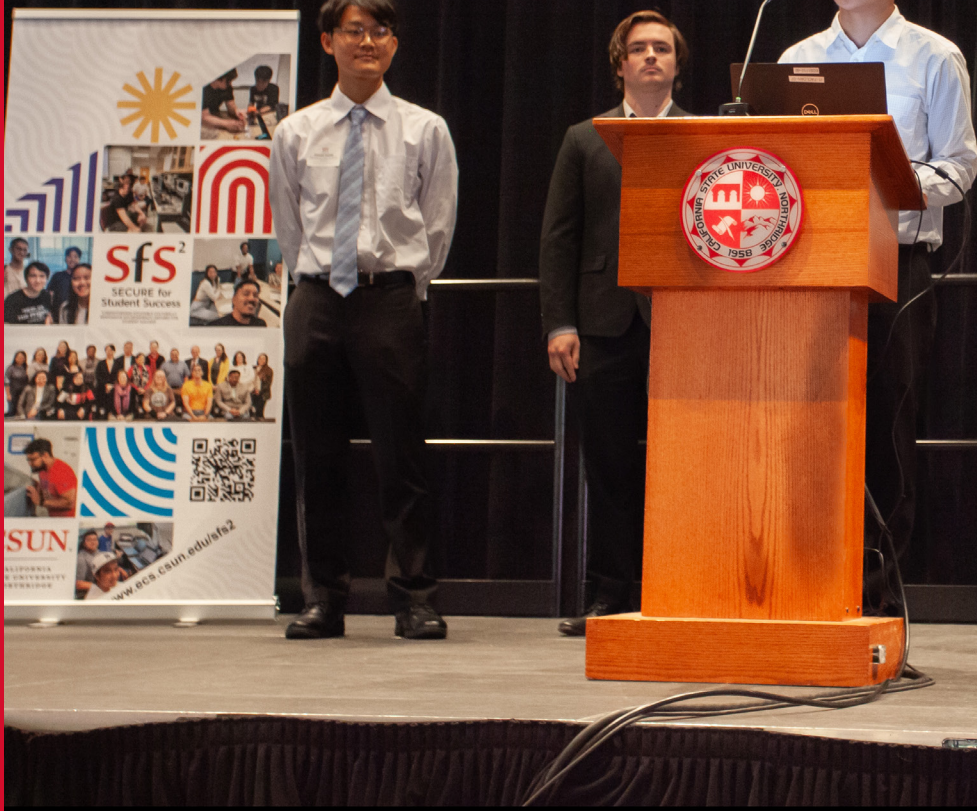
2025

SfS²
SECURE for
Student Success

2nd Annual Undergraduate
RESEARCH SYMPOSIUM

SEPTEMBER 26, 2025
Orchard Conference Center
1:15 PM



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https://www.ecs.csun.edu/sfs2

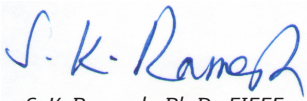
SfS² Director *Message*

Greetings,

Welcome to the 2nd Annual Undergraduate Research Symposium hosted by the SfS² program (SECURE for Student Success). The program has grown by leaps and bounds since our inaugural edition in summer 2024 with a 42 % increase in the number of applications from 55 to 78. Thanks to the grant, we continue to support students and their faculty mentors with stipends for their participation. This summer's cohort includes 44 students working on 12 fascinating research projects, including 8 students who were selected to work on two projects each. Compared to a year ago that represents a 33 % increase in the number of participating students!

But the numbers don't tell you the whole story. When you read the comments from students last year you begin to understand the impact of this program on student success. About opening doors and imagining what is possible. "It made me realize the vast field that I can go into", "Opened my horizons and introduced me to higher level course work. I now know what to expect from graduate courses and their rigor", were some of the many positive comments from students. The results from our Undergraduate Research Student Self-Assessment (URSSA) survey show that 100 % of the respondents agreed or strongly agreed that doing research confirmed their interest in their field of study, and 94 % felt that it facilitated access to early-career opportunities.

A special thank you to Prof. Silvia Carpitella for her astute stewardship as the Faculty Lead for the undergraduate research program and all our dedicated faculty mentors for their passion and commitment to engage our students in meaningful research projects. The symposium on September 26th represents the culmination of these efforts with posters and presentations by our outstanding students. Seeing is believing. Come join us at the Orchard Center and prepare to be inspired!



S. K. Ramesh, Ph.D., FIEEE
Director SfS² Program and
Professor of Electrical and Computer Engineering

2024 SfS² Undergraduate Research Symposium

SfS^2

SECURE for
Student Success

SECURE for Student Success (SfS^2), is a multi-institutional project supported by a five-year Title V grant from the US Department of Education's Developing Hispanic Serving Institutions program. Our partners in this exciting project include Los Angeles Pierce College and College of the Canyons. Closely aligned with CSUN's Road Ahead long-term strategic plan, SECURE for Student Success (SfS^2) includes a strong multi-disciplinary team from Art, Health, Sciences, Engineering, and Computer Science and is projected to positively impact the lives and careers of over 6,000 students. Our Peer mentoring, Undergraduate research, and Student workshop programs are engaging students and faculty in many meaningful ways, while our Faculty Community of Practice is digging into classroom pedagogies that demonstrate "Servingness". Visit our website at https://www.ecs.csun.edu/sfs2 to learn more about this exciting project.

Disclaimer: The contents of this brochure were developed with support from a United States Department of Education FY 2023 Title V, Part A, Developing Hispanic-Serving Institutions (DHSI) Program five-year grant, Award Number P031S230232, CFDA Number 84.031S. However, the contents do not necessarily represent the views of the US Department of Education, and you should not assume endorsement by the Federal Government

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SfS^2 External Advisory Committee meeting

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The University Corporation

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Director
Community Engagement
California State University, Northridge

SfS^2 Extended Advisory Team meeting

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Manufacturing Systems Engineering and Management

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Health Sciences

MD SAHABUL ALAM Ph.D.
Electrical and Computer Engineering

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Manufacturing Systems Engineering and Management

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Undergraduate Research

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SfS^2 Student Workshops,
Faculty Community of Practice

KATHLEEN POHL
SfS^2 Project Administrative
Support

SfS²
SECURE for Student Success

SECOND ANNUAL
UNDERGRADUATE RESEARCH SYMPOSIUM

ORAL PRESENTATIONS

POSTER SESSION	SESSION 1	BREAK	SESSION 2
1:15 – 2:15 PM	2:30 – 4:00 PM	4:00 – 4:30 PM	4:30 – 6:00 PM

POSTER SESSION - 1:15 – 2:15 PM

Faculty Mentor: Sepideh Abolghasem
Group: Owen Douphner, Jose Escobar, Elijah Garcia, Ulises Garcia, Elina Hossain
Prediction of Part Manufacturing Costs Using Machine Learning in Machining Processes

Faculty Mentor: Doris Abrishami
Group: Aaliyah Burney Mohammed, Anusika Jegatheeswaran, Karla Roman, Jennifer Bahena
The Effects of Occupational Dose on Radiographers During Portable Examinations

Faculty Mentor: Md Sahabul Alam
Group: Antonio Anzora Jr., Bian Paul Paraguya, Amaury Morales
Design and Testing of a Simple Digital Communication System using Software-Defined Radio (SDR) N210

Faculty Mentor: Marjan Asadinia
Individual: Anthony Taylor
Regression-Based Write Energy Estimation for Phase-Change Memory

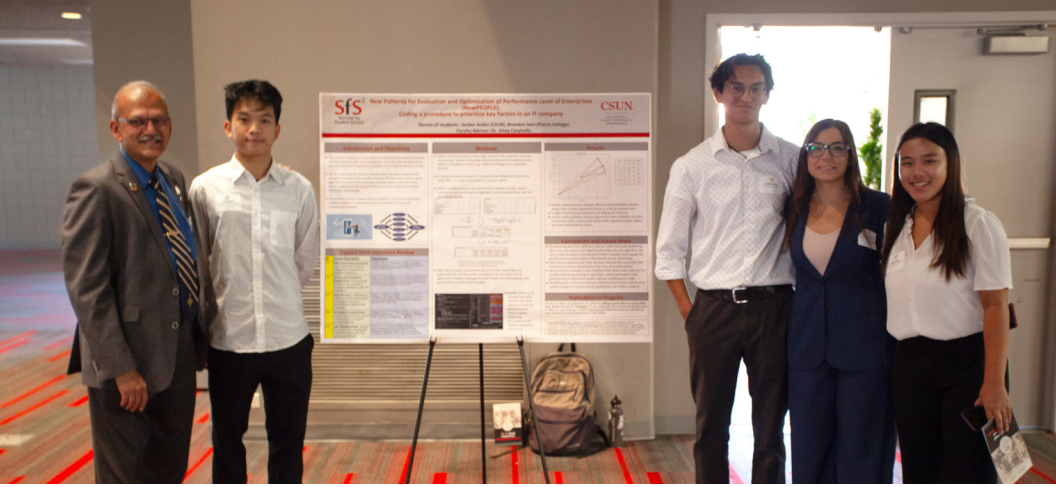
Individual: Jesus Alvarez C
Intelligent Data Partitioning for Write Minimization

Individual: Joshua Drye
Machine Learning-Based Prediction of Bit-Flip Errors in Multi-Level Cell PCM

Individual: Bashar Zaher
Interpretable Machine Learning for Phase-Change Memory Health Classification

Individual: Yanilette Montano
CARE-PCM: Classification and Analysis of Reliability with Efficient Models for PCM

Faculty Mentor: Silvia Carpitella
Group: Jordan Aviles, Anita Jalili, Macy Varga, Kimberly Aracena
Reaching Consensus in Group Decision-Making for Collaborative Agreement in Business and Academic Environments



Faculty Mentor: Rashida Hasan
Group: Jose Manuel Villalobos Carrillo, Diego Arteaga, Serineh Megerdichian, Andrew Boghosian, Angelica Marie Ignacio
Towards Secure Healthcare IoT Networks: Anomaly Detection Framework for Safeguarding Medical Devices and Patient Information

Faculty Mentor: Xunfei Jiang
Group: Henry Locke, Josh Penaojas
Energy-Efficient Thermal-Aware Workload Scheduling in Datacenters

Faculty Mentor: Xunfei Jiang
Group: Jose Manuel Villalobos Garcia, Jordan Freedman, Ivan Estrada
Point-Based Approach for 3D Vehicle Detection and Classification for Roadside for Traffic Flow

Faculty Mentor: Ricardo Medina
Group: Victor Baron, Antonio Anzora Jr, Elina Hossain
Testing and Improving Low-Cost Electrical Resistivity Tomography (ERT) System

Faculty Mentor: Rasoul Narimani
Group: Marcus Grijalva, Melanie Torres, Abelardo Cuadra Rojas, Angelica Marie Ignacio
Building an Automated Framework for Analyzing Different Electric Vehicle Load Profiles on Power Electric Grid

Faculty Mentor: Tohid Sardarmehni
Group: Anita Jalili, Macy Varga, Samar Kimiagar, Alexander Leontiev
Obstacle Detection, Classification, and Localization Using Deep Learning and Convolutional Neural Networks (CNN)

Faculty Mentor: C. Shawn Sun
Group: Alex Mendoza, Jesus Vergara, Veronia Nassif, Efren Vazquez, Eleen Gregoryona
Comparative Study of Precast Pretensioned and Post-Tensioned Concrete Girders for Highway Bridge

SESSION 1

2:30 PM - 2:45 PM

- **Improving Durability and Reliability in Phase-Change Memories Using Machine Learning Algorithms**
  Faculty Mentor: Dr. Marjan Asadinia
  Research Interns: Anthony Taylor, Jesus Alvarez C, Joshua Drye, Bashar Zaher, Yanilette Montano

2:45 PM - 3:00 PM

- **Building an Automated Framework for Analyzing Different Electric Vehicle Load Profiles on Power Electric Grid**
  Faculty Mentor: Dr. Rasoul Narimani
  Research Interns: Marcus Grijalva, Melanie Torres, Abelardo Cuadra Rojas, Angelica Marie Ignacio

3:00 PM - 3:15 PM

- **The Effects of Occupational Dose on Radiographers During Portable Examinations**
  Faculty Mentor: Dr. Doris Abrishami
  Research Interns: Aaliyah Burney Mohammed, Anusika Jegatheeswaran, Karla Roman, Jennifer Bahena

3:15 PM - 3:30 PM

- **Energy-Efficient Thermal-Aware Workload Scheduling in Datacenters**
  Faculty Mentor: Dr. Xunfei Jiang
  Research Interns: Henry Locke, Josh Penaojas

3:30 PM - 3:45 PM

- **Reaching Consensus in Group Decision-Making for Collaborative Agreement in Business and Academic Environments**
  Faculty Mentor: Dr. Silvia Carpitella
  Research Interns: Jordan Aviles, Anita Jalili, Macy Varga, Kimberly Aracena

3:45 PM - 4:00 PM

- **Testing & Improving Low-Cost Electrical Resistivity Tomography (ERT) System**
  Faculty Mentor: Dr. Ricardo Medina
  Research Interns: Victor Baron, Antonio Anzora Jr., Elina Hossain

SESSION 2

4:30 PM - 4:45 PM

- **Obstacle Detection, Classification, and Localization Using Deep Learning and Convolutional Neural Networks (CNN)**
  Faculty Mentor: Dr. Tohid Sardarmehni
  Research Interns: Anita Jalili, Macy Varga, Samar Kimiagar, Alexander Leontiev

4:45 PM - 5:00 PM

- **Towards Secure Healthcare IoT Networks: Anomaly Detection Framework for Safeguarding Medical Devices and Patient Information**
  Faculty Mentor: Dr. Rashida Hasan
  Research Interns: Jose Manuel Villalobos Carrillo, Diego Arteaga, Serineh Megerdichian, Andrew Boghosian, Angelica Marie Ignacio

5:00 PM - 5:15 PM

- **Design and Testing of a Simple Digital Communication System using Software-Defined Radio (SDR) N210**
  Faculty Mentor: Dr. Md Sahabul Alam
  Research Interns: Antonio Anzora Jr, Bian Paul Paraguya, Amaury Morales

5:15 PM - 5:30 PM

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- **Point-based Approach for 3D Vehicle Detection and Classification for Roadside for Traffic Flow**
  Faculty Mentor: Dr. Xunfei Jiang
  Research Interns: Jose Manuel Villalobos Garcia, Jordan Freedman, Ivan Estrada

SfS² 2025 Cohort at the Spring Student Orientation

SfS² 2024 Cohort at the 1st Annual 2024 Undergraduate Research Symposium

RESEARCH PROJECTS

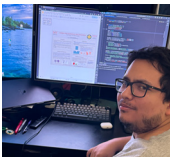
FACULTY MENTOR

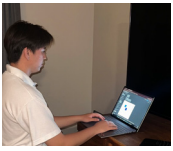
Dr. Marjan Asadinia
Computer Science

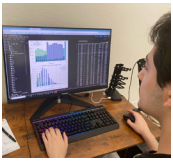
RESEARCH INTERNS

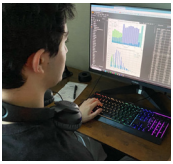
Jesus Alvarez C.
Joshua Drye
Yanilette Montano
Anthony Taylor
Bashar Zaher

Improving Durability and Reliability in Phase-Change Memories Using Machine Learning Algorithms



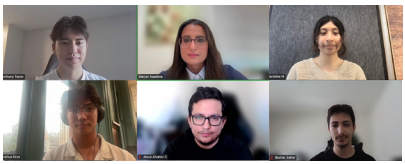






Project Description: As dynamic random-access memory (DRAM) and other current transistor-based memories approach their scalability limits, the search for alternative storage methods becomes increasingly urgent. Phase-change memory (PCM) emerges as a promising candidate due to its scalability, fast access time, and zero leakage power compared to many existing memory technologies. Despite its potential, there are several research challenges that need to be addressed to make PCM a viable option for widespread use. These include Write Energy, Write Endurance, Reliability and Error Correction. This project includes two main goals to address these challenges: 1) Propose an adaptive learning algorithm for enhanced durability in Phase Change Memory, and 2) Propose energy-efficient and reliable error correction codes for MLC PCM using machine learning-based algorithms.

By participating in this project, students can gain hands-on experience in machine learning, working with full-system simulators, data analysis, and system development, while also contributing to advancements in error correction mechanisms for MLC PCM technology. Additionally, they can develop critical thinking skills and problem-solving abilities by tackling challenges related to optimizing write processes in next-generation memory systems. Furthermore, they have the potential to author or co-author research papers and presentations, thereby enhancing their academic and professional portfolios.



FACULTY MENTOR

Dr. Rasoul Narimani

Electrical and Computer Engineering

Building an Automated Framework for Analyzing Different Electric Vehicle Load Profiles on Power Electric Grid

RESEARCH INTERNS

Marcus Grijalva
Melanie Torres
Abelardo Cuadra Rojas
Angelica Marie Ignacio

Project Description: This project builds upon the 2024 foundational model of CSUN's electric grid in PowerWorld to develop a dynamic and automated framework for analyzing the impact of Electric Vehicles (EVs) on the power distribution system. Students will gain technical and analytical skills aligned with the project's advanced goals, particularly through automating and extending the model for time-varying scenarios. The overarching objective is to create an automated tool that seamlessly integrates EV load data, allowing for dynamic analysis of various load conditions. By linking PowerWorld with Python via Simulator Automation Server (SimAuto), students will learn to automate parameter adjustments, run simulations across multiple intervals, and assess the grid's response to EV loads, identifying weaknesses and proposing system enhancements.

This project extends well beyond conventional power system analysis, providing students with practical experience in dynamic modeling, programming, and time-series analysis. By automating parameters with SimAuto and PowerWorld, students will acquire skills essential for modern power system studies.

FACULTY MENTOR

Dr. Doris Abrishami
Health Sciences

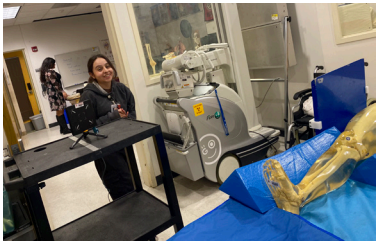
RESEARCH INTERNS

Aaliyah Burney Mohammed
Anusika Jegatheeswaran
Karla Roman
Jennifer Bahena

The Effects of Occupational Dose on Radiographers During Portable Examinations

Project Description: The students will be conducting research about the amount of occupational dose/ radiation that the technologists are receiving each time they perform a portable examination. Students will also investigate methods that can be used to minimize the radiation to technologists and other health care providers during portable exams.

This research is extremely useful to the practice of Radiography because portable exams are being performed hourly and requests for them are always in influx at the radiology departments. Knowledge of radiation protection in this area not only helps the radiologic technologists performing the exam, but also surrounding occupational workers and the general public who are ignorant to the effects of radiology and how to protect themselves. We expect that students can gather sufficient data with this research to help radiology departments' administrators and managers establish better/safer radiation safety protocols for the technologists and general public during portable examinations.



FACULTY MENTOR

Dr. Xunfei Jiang
Computer Science

RESEARCH INTERNS

Henry Locke
Josh Penaojas

Energy-Efficient Thermal-Aware Workload Scheduling in Datacenters

Project Description: Various strategies have been proposed to reduce the computing cost (electrical energy consumption of servers) of computer servers in data centers, while the cooling cost (energy consumption of cooling systems) has not been fully investigated. Predicting the cooling cost is a challenge because it is affected by not only the utilization of computer servers, but also by the temperature distribution of cluster systems. This project is part of an ongoing project to develop energy-efficient workload management for cluster systems in datacenters. In summer 2024, we developed an energy prediction model to estimate the energy consumption of GPU under different workload, and modified the GPU CloudSim Plus simulator to incorporate real-world datacenter workload traces as input and produce summary of energy consumption for applying different scheduling algorithms.

The summer 2025 project will develop energy-efficient workload scheduling strategies based on energy consumption models that simulate the energy cost of components in a cluster system. In this program, students will apply thermal and energy machine learning models to evaluate various workload scheduling strategies on a datacenter simulator, and propose new strategies to reduce the energy consumption for GPU intensive workload. Real-world workload traces will be used as input for running simulations, and experiments will be conducted for evaluating workload scheduling strategies. Students will gain immerse research experience on problem-solving through analyzing existing research on workload scheduling for datacenters, designing and conducting experiments, and applying DS in data collection, data processing, and data analysis to evaluate different workload scheduling algorithms.

FACULTY MENTOR

Dr. Silvia Carpitella

Manufacturing Systems Engineering and Management

RESEARCH INTERNS

Jordan Aviles
Anita Jalili
Macy Varga
Kimberly Aracena

Reaching Consensus in Group Decision-Making for Collaborative Agreement in Business and Academic Environments

Project Description: Learning to work in teams is essential for students, as most real-life decisions require collaboration and input from multiple people. Developing the ability to understand different opinions and learn from each other is crucial in these environments, where resolving conflicts and reaching consensus are key to success. Group decision-making brings together diverse perspectives, and decisions can greatly benefit from integrating these different points of view, though reaching consensus can be challenging when opinions differ. In this context, structured approaches for achieving collaborative agreement help teams make informed decisions by promoting open discussions, reducing conflicts, and ensuring that goals are aligned. This project develops a strategy to facilitate consensus-building in group decision-making, emphasizing collaboration and practical solutions in real-world business and academic contexts.

The objective of this project is to equip students with the skills and knowledge needed to effectively engage in group decision-making in several contexts. By the end of the project, students will also have the opportunity to compile their findings into a formal research paper, with the (tentative) goal of submitting it to an academic conference.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FACULTY MENTOR

Dr. Ricardo Medina

Civil Engineering and Construction Management

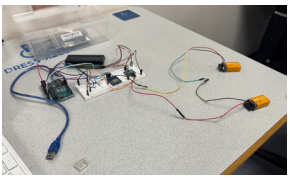
Testing and Improving Low-Cost Electrical Resistivity Tomography (ERT) System

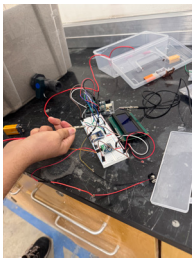
RESEARCH INTERNS

Victor Baron
Antonio Anzora Jr.
Elina Hossain

Project Description: The objective of this project is to design, manufacture, test, and validate small-scale geophysics instruments. This project will develop small-scale instruments with off- the shelf CPU boards and circuit boards, design of specialized boards, and use of commercial circuit boards such as Arduino. While these systems will be tested on small-scale systems (bench-scale or local on-campus system), these systems can be refined and used in future field- based research projects.

The specific objective of this project is to test and improve the Arduino-based electrical resistivity tomography (ERT) system developed by the undergraduate research group in the summer of 2024. Students in the SfS2 2024 Summer Research Program developed, built, and coded an ERT system that takes one measurement at a time, and any additional measurements (in space, e.g., different electrical terminals) need to made manually. For the 2025 Summer Research Program, students will make improvements on the system by (1) improving the accuracy of the 2024 system; (2) testing the 2024/2025 system in different environmental conditions, (3) developing a system that does multiple automatic measurements (as opposed to a single manual measurement).





FACULTY MENTOR

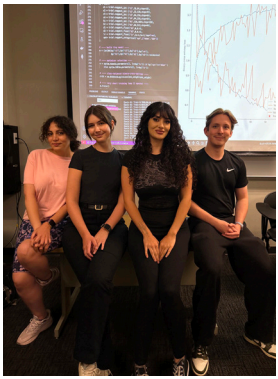
Dr. Tohid Sardarmehni
Mechanical Engineering

Obstacle detection, classification, and localization using deep learning and Convolutional Neural Networks (CNN)

RESEARCH INTERNS

Anita Jalili
Macy Varga
Samar Kimiagar
Alexander Leontiev

Project Description: In this project, the students will learn the fundamentals of deep learning, convolutional neural networks, multiclass classification, and localization in machine vision and robotics. To begin with students will learn how to use Machine Learning frameworks to train, validate, and test fully connected neural networks. In the next phase students learn how to structure machine learning projects. This is followed by learning about convolutional neural networks and how to structure them in TensorFlow. Finally, students will train a MobileNet to detect, classify, and localize objects from a video they take from the CSUN campus.



We rely on labeled data from Visdrone, a GitHub repository with labeled data for training patterns. The students will also be provided access to a unique computation capacity at the Advanced System Lab located in JD 1123A. Finally, the students will be paired with existing graduate students at the Advanced System Lab to improve their sense of belonging and explore possible opportunities to conduct research at CSUN.

FACULTY MENTOR

Dr. Rashida Hasan

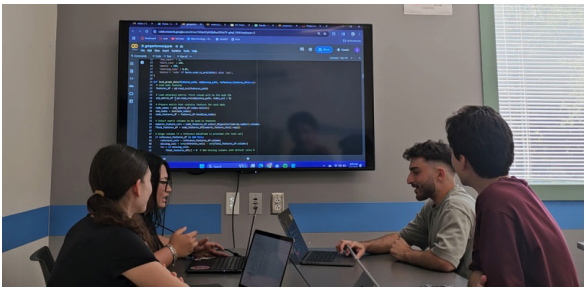
Computer Science

RESEARCH INTERNS

Jose M. Villalobos Carrillo
Diego Arteaga
Serineh Megerdichian
Andrew Boghosian
Angelica Marie Ignacio

Towards Secure Healthcare IoT Networks: Anomaly Detection Framework for Safeguarding Medical Devices and Patient Information

Project Description: The integration of Internet of Things (IoT) technology in healthcare has significantly improved patient monitoring, diagnostics, and overall healthcare delivery. In healthcare, IoT enables the use of wearable devices that continuously collect vital data from patients, including measurements such as oxygen levels, blood pressure, blood sugar, and heart rates. However, this increased reliance on interconnected medical devices poses significant security challenges, as cyber threats, unauthorized access, and data breaches can compromise sensitive patient information and endanger patient safety. Students working in this project will develop a robust anomaly detection framework utilizing advanced machine learning algorithms to enhance the security of healthcare IoT networks. This framework will utilize machine learning algorithms to identify anomalous behaviors in medical devices and network traffic, ultimately safeguarding sensitive patient information and ensuring the uninterrupted operation of healthcare services. By identifying deviations from normal operational patterns in device behavior and network traffic, this framework aims to safeguard medical devices and ensure the confidentiality, integrity, and availability of patient data. The primary outcome from this project is a fully functional anomaly detection framework that significantly enhances the security of healthcare IoT networks.



FACULTY MENTOR

Dr. Md Sahabul Alam

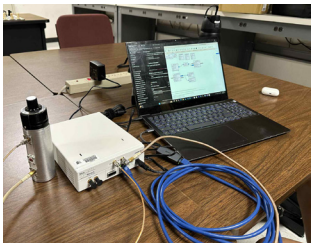
Electrical and Computer Engineering

RESEARCH INTERNS

Antonio Anzora Jr.
Bian Paul Paraguya
Amaury Morales

Design and Testing of a Simple Digital Communication System using Software-Defined Radio (SDR) N210

Project Description: Software-Defined Radio (SDR) is a radio communication system where traditional hardware components (like filters, amplifiers, modulators/demodulators) are replaced by software. SDR enables the testing of digital communication protocols and modulation schemes which can improve data transfer efficiency. SDRs are used in cellular networks, military communications, emergency services, satellite communications, and more. For example, in cellular communications, base stations can use SDR to support multiple standards (like 3G, 4G, 5G). The objective of this project is to create a basic digital communication system and test its performance under various modulation schemes (e.g., Binary Phase Shift Keying - BPSK or Quadrature Phase Shift Keying - QPSK modulation). The anticipated outcome of this project is performance evaluation of the SDR N210 system across different modulation schemes. Projects using the SDR N210 allow students to gain practical skills in digital signal processing, radio frequency (RF) communication, and software development, bridging the gap between theory and application. It provides foundational knowledge in digital communication and practical experience with modulation and demodulation.



FACULTY MENTOR

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Comparative Study of Precast Pretensioned and Post-Tensioned Concrete Girders for Highway Bridges

Project Description: The use of precast prestressed concrete girders is common for highway bridges in the United States. These girders can be fabricated using either pretensioned or post-tensioned methods. It is crucial for students to understand the differences between these two types of prestressing in terms of fabrication, construction, analysis, and design. Specifically, they should grasp the structural behavior of both pretensioned and post-tensioned concrete girders. This project aims to highlight these differences through numerical analysis of a simple-span bridge.

The goals of this project are to: 1) train students in the basic concepts of highway bridge analysis and design; 2) provide students with knowledge of both pretensioned and post-tensioned concrete girders; and 3) teach students the fundamentals of finite element analysis tools.

Students will learn the fundamentals of bridge analysis and design, with a focus on prestressed concrete design concepts and practices. This project expands on the work from the SfS2 summer research program in 2024, which centers on developing a finite element model for precast pretensioned concrete girders while accounting for time-dependent effects such as shrinkage and creep. The summer 2025 project will provide students with a comprehensive understanding of the fabrication, construction, analysis, and design of both pretensioned and post-tensioned concrete girders for highway bridges. Students will compare the structural behavior of these two prestressing methods through working stress designs to learn about their differences. By gaining hands-on experience with state-of-the-art analysis tools, students will be well-prepared for their future careers.

FACULTY MENTOR

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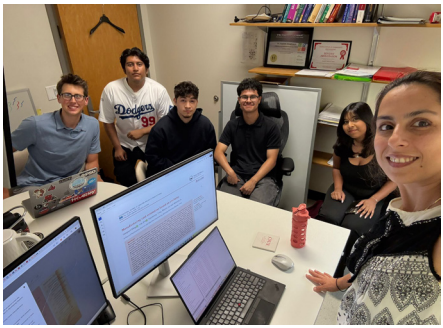
Prediction of Part Manufacturing Costs Using Machine Learning in Machining Processes

Project Description: In modern manufacturing, accurately predicting the cost of producing a part based on its geometry is essential for efficient resource allocation, pricing strategies, and improving overall manufacturing processes. Traditional methods for cost estimation are often time-consuming, labor-intensive, and subject to human error. By leveraging machine learning, such as 3D convolutional neural networks (CNNs), the project aims to automate and improve the precision of cost classification. This automation will significantly streamline the cost estimation process, leading to more consistent and reliable predictions, reducing both lead times and production costs. The model can be scaled for various materials and machining processes, providing a versatile tool for industry-wide application. Additionally, the collaboration with machine shop technicians ensures real-world relevance and applicability, while contributing to the academic field by exploring the use of machine learning in manufacturing cost estimation.



Students will gain hands-on experience in data collection, preparation, and machine learning model development. They will work with real-world datasets of part geometries, learning to structure large datasets and train ML models. Additionally, students will engage in model validation and optimization, gaining practical insights into how machine learning can solve real-world manufacturing challenges. This blend of technical, practical, and analytical skills will prepare students for careers in engineering, data science, or manufacturing, while giving them valuable experience in writing capstone reports and presenting findings.

FACULTY MENTOR

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RESEARCH INTERNS

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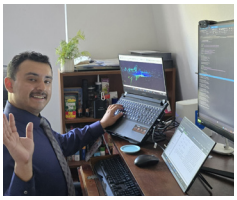
Point-based Approach for 3D Vehicle Detection and Classification for Roadside for Traffic Flow

Project Description: Traffic has been a long problem in Southern California, and the situation in Los Angeles is even worse. Intelligent Transport System (ITS) improves traffic efficiency because it enables users to know information about real-time traffic flow and also provides support for transportation departments to make planning for traffic management. Object detection technologies provide fundamental support for ITS systems in traffic monitoring to assistant the understanding of traffic conditions (such as speed, density, and prediction). Machine Learning technology has been increasingly used for vehicle detection, and adverse weather conditions prove to be challenging for 2D vehicle detection. Using a 3D LiDAR camera, vehicles in traffic are captured in the form of point clouds, which are more resistant to adverse weather conditions. 3D LiDAR vehicle detection has been widely used in autonomous driving, but there is a lack of research on roadside vehicle detection using 3D LiDAR point clouds.



This project is part of an ongoing project to build a real-time traffic monitoring system. In summer 2024 we investigated the projection based approach for 3D vehicle detection and classification using Complex-YOLO algorithm, implemented the Complex-YOLO model through transfer learning and normalization in handling and aligning the dataset for effective learning, and extended the object classification from 3 types to 9 types. In this research, we will investigate roadside vehicle detection and classification for 3D LiDAR point cloud data collected from traffic flow in Southern California. New LiDAR point cloud datasets will be collected and labeled, and processed for vehicle detection and classification. Point-based approaches for 3D vehicle detection will be investigated, and the models will be trained and tested on the new labeled datasets. Detection results generated from the trained machine learning model will be processed, and analysis will be conducted for the collected traffic flow datasets.

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