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SfS^2
SECURE for Student Success

11SEP24

USU Northridge Center
1:15 PM

SfS^2 1ST Annual *Undergraduate* RESEARCH SYMPOSIUM

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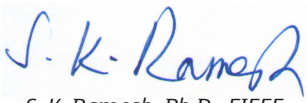
18111 Nordhoff Street • Northridge • California 91330-8295
https://www.ecs.csun.edu/sfs2

SfS² Director *Message*

Greetings,

Welcome to the 1st Undergraduate Research Symposium hosted by the SfS² program (SECURE for Student Success). We believe that creating a sense of belonging through "community" is fundamental to holistic student success. Our summer undergraduate research program engages students in active project-based learning activities and gives them the opportunity to work closely with dedicated faculty mentors. We have been busy since we learned of our successful DHSI (Developing Hispanic Serving Institutions) grant proposal to the US Department of Education in October 2023. The undergraduate research program, led by Prof. Silvia Carpitella from our team, launched in the spring with a call for research projects from interested faculty. Eleven projects were selected and widely advertised to students from CSUN and our partner community colleges. Students had the option to select all the projects of interest to them. Following review and ranking by the faculty mentors we selected a cohort of 35 students to participate in summer research projects. Most students got to work on their first-choice projects and five students in the cohort were given the opportunity to work on two projects. Students and their faculty mentors were supported with stipends for their participation.

Our students are preparing to enter a rapidly changing world where the only constant is change. Gen AI, Robotics and smart interconnected devices are ubiquitous impacting the way we live, learn, work and play. Cognitive skills are important and need to be complemented with emotional intelligence and social skills to be successful. Systems thinking, strong interpersonal communications, and working in diverse teams to solve problems are some of the critical skill sets that are needed for jobs of the future. The symposium is an opportunity for our students in the summer 2024 research program to demonstrate these skills and proudly share their work through posters and oral presentations in a professional conference like setting. On behalf of all of us on the SfS² team we invite you to join us, engage, learn and be inspired by our outstanding summer 2024 research cohort. See you all on September 11th at the USU Northridge Center.



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


Smart Spenders
Spring 2014

SfS^2

SECURE for
Student Success

SECURE for Student Success (SfS^2), stands for "Strengthening Equitable Culturally Responsive Environments (SECURE) for Student Success": Using a Servingness Model to support Hispanic and Underrepresented Students.

This multi-institutional project is 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.

SfS^2 Faculty and Staff

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SfS^2 External Advisory Committee meeting

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California State University, Northridge
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DANIELLE SPRATT
Director
Community Engagement
California State University, Northridge

SfS^2 Extended Advisory Team meeting

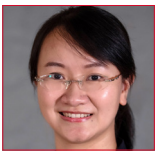
Faculty Mentors

SEPIDEH ABOLGHASEM Ph.D.
Manufacturing Systems Engineering and Management

MD SAHABUL ALAM Ph.D.
Electrical and Computer Engineering

VARTENIE ARAMALI Ph.D.
Civil Engineering and Construction Management

SILVIA CARPITELLA Ph.D.
Manufacturing Systems Engineering and Management



XUNFEI JIANG Ph.D.
Computer Science

RASOUL NARIMANI Ph.D.
Electrical and Computer Engineering

YANG PENG Ph.D.
Physics and Astronomy

RICARDO MEDINA Ph.D.
Civil Engineering and Construction Management

C. SHAWN SUN Ph.D.
Civil Engineering and Construction Management

Project Staff

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SFS^2 Assessment and Evaluation

JOSEFINA GUDINO
SfS^2 Peer Mentoring, Undergraduate Research

VANESSA HERNANDEZ
SfS^2 Student Workshops, Faculty Community of Practice

KATHLEEN POHL
SfS^2 Project Administrative Support

SPENCER J. H. YANG
SfS^2 Project Webmaster

SfS² FIRST ANNUAL
UNDERGRADUATE RESEARCH SYMPOSIUM

- POSTER SESSION: 1:15 – 2:15 PM
- ORAL PRESENTATIONS:
  Session 1: 2:30 – 4:00 PM
  Break: 4:00 – 4:30 PM
  Session 2: 4:30 – 5:45 PM

Session 1

2:30 PM - 2:45 PM

- **Time-dependent Working Stress Analysis of Precast Prestressed Ultra-high Performance Concrete Bridge Girders**
  Faculty Mentor: Dr. C. Shawn Sun
  Research Interns: Haik Aslanyan, Alex Mendoza, Jose M. Valencia, Leonardo Graciano

2:45 PM - 3:00 PM

- **A data-driven framework for automated classification of machining manufacturing processes**
  Faculty Mentor: Dr. Sepideh Abolghasem
  Research Interns: Carlo Loui Dela Cruz, Jose Escobar, Elijah Garcia, Jesus Garcia, Ulises Garcia

3:00 PM - 3:15 PM

- **How CE "Lit" became easy to read**
  Faculty Mentor: Dr. Vartenie Aramali
  Research Interns: Malcolm Lovelace, Fernando Ramirez, Brenda Zaragoza

3:15 PM - 3:30 PM

- **Coding a procedure to prioritize key factors in an IT company**
  Faculty Mentor: Dr. Silvia Carpitella
  Research Interns: Jordan Aviles, Brandon Sani

3:30 PM - 3:45 PM

- **Machine Learning-based GPU Energy Prediction for Workload Management in Datacenters**
  Faculty Mentor: Dr. Xunfei Jiang
  Research Interns: Matthew Smith, Brandon Ismalej

Session 1 continued...

3:45 PM - 4:00 PM

- **Solving nonlinear differential equation with neural networks**
  Faculty Mentor: Dr. Yang Peng
  Research Interns: Stepan Karapetyan, Brandon Ismalej, Juan Rodriguez, Davit Gasparyan

Session 2

4:30 PM - 4:45 PM

- **How to improve organizational aspects in the restaurant business**
  Faculty Mentor: Dr. Silvia Carpitella
  Research Interns: Cass Bigler, Pauline Tran

4:45 PM - 5:00 PM

- **Investigating the Impact of Electric Vehicle Charging Loads on CSUN's Electric Grid**
  Faculty Mentor: Dr. Mohammad Rasoul Narimani
  Research Interns: Daniel Garcia Aguilar, Logan DeHay, Jahn Aquino, Erik Jensen, Juan Rodriguez

5:00 PM - 5:15 PM

- **3D Vehicle Detection and Classification for Roadside Traffic Flow Monitoring**
  Faculty Mentor: Dr. Xunfei Jiang
  Research Interns: Jimwell Castillo, Luis Cedeno, Teo Dominguez

5:15 PM - 5:30 PM

- **Developing and Testing of an Arduino-Based Electrical Resistivity Tomography Apparatus**
  Faculty Mentor: Dr. Ricardo Medina
  Research Interns: Chris Christopher Henry, Shari Salas, Brandon Sani, Katsuki Yasuda

5:30 PM - 5:45 PM

- **Optimizing Inter-Satellite Optical Communication System Through the Integration of Channel Coding**
  Faculty Mentor: Dr. Md Sahabul Alam
  Research Interns: Francisco Hernandez, Justin Canas, Christopher Henry, Daniel Garcia Aguilar, Martha Jauregui


GILSON

FACULTY MENTOR

Dr. C. Shawn Sun

Civil Engineering and Construction Mgmt

RESEARCH INTERNS

Haik Aslanyan
Leonardo Graciano
Alex Mendoza
Jose Valencia-Cardoza

Time-Dependent Working Stress Analysis of Precast Prestressed Ultra-High Performance Concrete Bridge Girders

Project Description: The deterioration of U.S. infrastructure due to concrete degradation and steel reinforcement corrosion incurs billions in annual costs. Ultra-high performance concrete (UHPC) emerges as a revolutionary material with exceptional strength and superior resistance to deterioration, promising more sustainable infrastructure. Yet, the absence of design specifications for UHPC bridge girders hinders its application in bridge engineering. This project aims to bridge this gap by conducting numerical analysis of precast prestressed UHPC bridge I-girders, focusing on time-dependent working stress analysis under various loads, including dead and live loads. Completing this project will yield finite element models that effectively incorporate the time-dependent properties of UHPC, such as shrinkage and creep, offering bridge engineers valuable guidelines for modeling precast prestressed UHPC girders and promoting UHPC's use in highway bridges. By leveraging advanced simulation tools and a rigorous engineering approach, the research team aims to contribute to the development of more durable, sustainable, and economically viable bridge structures for the future.

FACULTY MENTOR

Dr. Sepideh Abolghasem
Manufacturing Systems Engineering and Mgmt

RESEARCH INTERNS

Carlo Loui Dela Cruz
Jose Escobar
Elijah Garcia
Jesus Garcia
Ulises Garcia

A Data-Driven Framework for Automated Classification of Machining Manufacturing Processes

Project Description: This project aims to classify traditional manufacturing processes like turning and/or milling based on part quality and geometry using data-driven techniques. It targets a fundamental yet timely issue relevant to producing modern performance-critical parts in sectors such as bio-medical, naval/marine, and aerospace. These parts rely on specific geometries, quality, and microstructures to fulfill functions like light-weighting, strength, and biocompatibility. The research will be conducted by a team of undergraduate students, leveraging a large repository of information on turned and/or milled part geometries and quality, particularly focusing on commercially pure Cu. The project's innovation lies in its approach to encode part geometry and quality in a numerically tractable way whereas current manufacturability estimates focus on only one of these features (e.g. geometry alone), neglecting their interaction effects. The potential of this project is significant, aiming to revolutionize manufacturing process classification for part fabrication, emphasizing achieving specific qualities, and geometries. It acknowledges the interdependence of these factors, which traditional approaches, focusing solely on geometry, fail to consider.

FACULTY MENTOR

Dr. Vartenie Aramali

Civil Engineering and Construction Mgmt

RESEARCH INTERNS

Malcolm Lovelace
Fernando Ramirez
Brenda Zaragoza

How CE "Lit" Became Easy to Read

Project Description: The primary goal of this project is to support three undergraduate students in developing essential literature review and research skills within the fields of Civil Engineering and Construction Management. Specifically, the project focuses on teaching students how to find and read the right literature (referred to as "Lit" by the student research INTERNS), evaluate and review research papers, identify overarching problems and research avenues in recent studies, and recognize gaps in the existing knowledge that need future attention. The objectives include assessing the current state of knowledge, narrowing it down to a specific and relevant theme, critically analyzing scholarly articles, and research papers, and compiling a comprehensive database of literature resources. Students will participate in regular meetings with faculty to collaboratively select a significant and timely topic, ensuring consensus on their preferred focus area or theme. The project emphasizes high-quality literature analysis, thorough documentation of findings and resources, and trend analysis. Through this experience, students will refine their ability to process quality scholarly papers, enhance their understanding of key theories and current research trends, deepen their recognition that the industry field and academic research in the selected topics are interconnected, and develop critical thinking skills. Additionally, they will gain competencies in time management, organization, documentation, and teamwork, all of which are essential for their academic and professional growth in the Civil and Construction Engineering fields (referred to as "CE" in the project title).

FACULTY MENTOR

Dr. Silvia Carpitella

Manufacturing Systems Engineering and Mgmt

RESEARCH INTERNS

Jordan Aviles
Brandon Sani

Coding a Procedure To Prioritize Key Factors in an IT Company

Project Description: In the fast paced world of IT companies, businesses face various challenges, with the balance between human skills and technology becoming increasingly important. A key factor in this balance is the value of human capital, especially as companies adopt new technologies and undergo digital changes. This project examines how IT companies are tackling the challenges of integrating people and technology by focusing on the essential role of their workforce. Understanding that innovation involves both risks and opportunities, this project aims to incorporate practical strategies that enhance the integration of human and technological elements into business practices. The main goal is to create flexible solutions for addressing complex decisions, particularly in the area of technology implementation, within the broader context of Industry 4.0.

FACULTY MENTOR

Dr. Xunfei Jiang
Computer Science

RESEARCH INTERNS

Matthew Smith
Brandon Ismalej

Machine Learning-Based GPU Energy Prediction for Workload Management in Datacenters

Project Description: Data centers (DCs) have become a vital component of a digital economy, accounting for approximately 1% of worldwide energy consumption, as the reliance on cloud services and GPU hardware increases for high-performance computing (HPC) tasks. Despite various strategies for improving energy efficiency, there is a lack of research integrating real-world workload traces into the prediction of GPU power consumption due to the lack of publicly available data. This research addresses this gap by utilizing synthetic data generated to mimic the GPU intensity of real-world workload characteristics and developing GPU power prediction models for integration into the GPUCloudSim Plus simulator. We conducted a statistical analysis of Alibaba and Helios workload traces and ran experiments with diverse GPU-intensive tasks to emulate real-world workloads. Using task-average metrics, we trained four machine learning (ML) models to predict GPU power consumption, with the best performing XGBoost model yielding an RMSE of 1.217. We propose this modeling design to integrate a GPU power prediction model into the GPUCloudSim Plus simulator. Energy-aware simulations for GPU-intensive workloads could be verified on workloads from real data centers, advancing the study of workload management.

FACULTY MENTOR

Dr. Yang Peng

Physics and Astronomy

RESEARCH INTERNS

Davit Gasparyan
Brandon Ismalej
Stepan Karapetyan

Solving Nonlinear Differential Equation With Neural Networks

Project Description: Deep learning based on neural networks (NN) has revealed a remarkable potential in solving a wide variety of complex problems. A Physics-Informed Neural Network (PINN) is a type of neural network architecture designed to incorporate physical principles or equations into the learning process. It combines deep learning techniques with domain-specific knowledge, making it particularly suitable for problems governed by physics. In this project, students will learn to implement the PINNs in Pytorch to solve various equations (diffusion equations, wave equations etc.) from different areas of physics.

FACULTY MENTOR

Dr. Silvia Carpitella

Manufacturing Systems Engineering and Mgmt

RESEARCH INTERNS

Cass Bigler
Pauline Tran

How to Improve Organizational Aspects in the Restaurant Business

Project Description: Business companies are increasingly challenged to integrate their workforce with new technology. This is especially true in complex organizational contexts like the restaurant business, where the adoption of technology can significantly impact the effectiveness of operations. This project focuses on how restaurants are dealing with these challenges by emphasizing the crucial role of their workforce in the successful implementation of new technologies. Recognizing that technological progress comes with its own set of risks, this work develops a case study highlighting the importance of integrating adaptable strategies that help restaurants seamlessly blend human expertise with technological advancements, ensuring smooth operations and improved decision-making in a rapidly evolving industry.

FACULTY MENTOR

Dr. Rasoul Narimani

Electrical and Computer Engineering

RESEARCH INTERNS

Jahn Aquino
Logan DeHay
Daniel Garcia Aguilar
Erik Jensen

Investigating the Impact of Electric Vehicle Charging Loads on CSUN's Electric Grid

Project Description: During the summer research program, participants achieved outcomes aligned with the project's goals. Students developed technical skills in modeling Electric Vehicles and distribution systems using PowerWorld software. They analyzed the impact of Electric Vehicles on power distribution performance, focusing on voltage profiles, power losses, and line congestion. Additionally, participants solved challenges related to Electric Vehicle integration, such as load balancing and grid stability. They enhanced research, documentation, and communication skills through report writing and presentations, gaining a comprehensive understanding of the Electric Vehicles' role in sustainable energy and power distribution.

FACULTY MENTOR

Dr. Xunfei Jiang
Computer Science

RESEARCH INTERNS

Jimwell Castillo
Luis Cedeno
Teo Dominguez

3D Vehicle Detection and Classification for Roadside Traffic Flow Monitoring

Project Description: Traffic has been a long problem in Southern California, and the situation in Los Angeles is even worse. According to a report from INRIX, the Los Angeles urban area was the sixth most congested area in the United States in 2021. Intelligent Transport System (ITS) provides support for transportation departments to make planning for traffic management based on traffic flow data. 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 3D vehicle detection. In this project, we improved a Complex-YOLO model for 3D vehicle detection and classification of roadside traffic data. Using our own dataset, we achieved a precision of 89.84% and recall of 85.94% for the 'Sedan' class. We also developed data visualization modules to present historical traffic flow statistical data (including the number of vehicles, vehicle types, traffic flow speed, density of vehicles, etc.). Sample data were generated, processed, and visualized for traffic flow data analysis with different time intervals (per day, per week, per month, and per year).

FACULTY MENTOR

Dr. Ricardo Medina

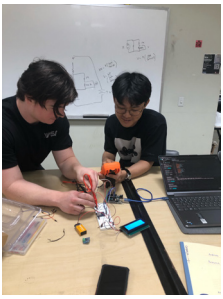
Civil Engineering and Construction Mgmt

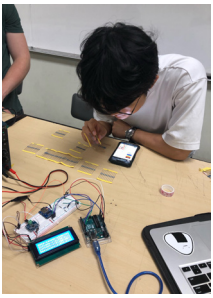
RESEARCH INTERNS

Christopher Henry
Shari Salas
Brandon Sanai
Katsuki Yasuda

Developing Low-Cost Geophysics-Based Instruments

Project Description: The objective of this project is to design, manufacture, test, and validate groundwater flow and 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. Arduino is a brand of open-source microcontroller boards with their own processor and memory. Arduino boards are commonly referred to as I/O devices due to their ability to simultaneously act as input devices (i.e. receiving, detecting or measuring electronic signals or voltage levels) and output devices (i.e. sending electronic signals or varying output voltage levels). The I/O capability allows the Arduino microcontrollers to communicate with some electronic devices such as environmental sensors, data loggers, cameras, and other sensors or electronic components. Such components can be controlled or programmed using Arduino code.





FACULTY MENTOR

Dr. Md Sahabul Alam

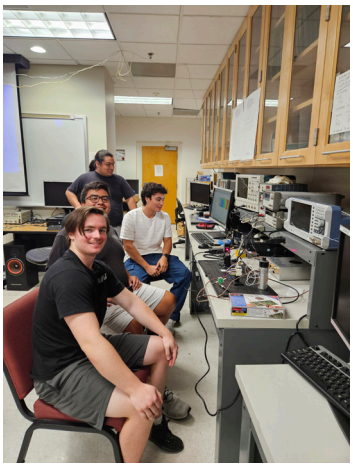
Electrical and Computer Engineering

RESEARCH INTERNS

Justin Canas
Daniel Garcia Aguilar
Christopher Henry
Francisco Hernandez
Martha Jauregui

Optimizing Inter-Satellite Optical Communication System Through the Integration of Channel Coding

Project Description: An Inter-Satellite Optical Communication (ISOC) system refers to the use of an optical communication link between satellites to facilitate data transfer. This system is crucial for satellite constellations, where multiple satellites work in tandem to provide comprehensive coverage and data networking. The ISOC system faces several challenges including potential disruption from interference and noise. Error correction coding is a method used in communication system to detect and correct errors in data transmission. The ISOC system currently utilizes Reed-Solomon error correction method. While Reed-Solomon is effective for burst errors, it is less optimal for other types of noises impact the optical link. Therefore, to enhance the performance of the considered ISOC system, in this project, Turbo codes is proposed. Turbo codes, a forward error correction method, aim to improve the reliability of signal transmission within the optical communication system.



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