Celebrating Graduate Research at WPI

Finals:
The GRADUATE RESEARCH INNOVATION EXCHANGE (GRIE)

Tuesday, April 6, 2021

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WPI

Celebrating Graduate Research at WPI

Graduate Research Innovation Exchange (GRIE) Finals

The annual graduate research competition finals will include 62 MS and Ph.D. finalists from GRIE's initial competition round in March. Students will present live via Zoom for judges, who will decide which students will receive cash prizes.

GRIE is a celebration and competition highlighting the breadth, diversity, and quality of the research undertaken by WPI's graduate students. It began in March 2021, with an open virtual session that more than 180 students participated in. Judges selected 62 finalists among seven categories:

- Business and Social Science
- Mathematical, Chemical, and Physical Sciences
- Life Sciences and Bioengineering
- Chemical Engineering and Materials Science
- Robotics Engineering, Cyberphysical Systems, and Electrical and Computer Engineering
- Data Science, Cybersecurity, and Computer Science
- Aerospace Engineering, Manufacturing Engineering, Mechanical Engineering, Civil and Environmental Engineering, and Fire-Protection Engineering

Data Science Graduate Qualifying Project teams who have been working on their research throughout this academic year will present on May 7 from 11am -1:15pm.

The information presented in the sessions or contained in the abstracts for the individual presentations is provided solely for the purposes of the Graduate Research Innovation Exchange event and is not intended for general public release.

Sponsored by the Office of the Provost and the Office of Graduate Studies

AGENDA

April 6, 2021

Data Science, Cybersecurity, and Computer Science	9:00am - 12:00pm
Aerospace Engineering, Manufacturing Engineering, Mechanical Engineering, Civil and Environmental Engineering, Fire-Protection Engineering	9:00am - 10:30am
Robotics Engineering, Cyberphysical Systems, Electrical and Computer Engineering	10:30am - 12:00 pm
Business and Social Science	1:00pm - 1:45pm
Mathematical, Chemical, and Physical Sciences	1:00pm - 1:45pm
Chemical Engineering and Materials Science	1:40pm - 3:00pm
Life Sciences and Bioengineering	1:45pm - 2:50pm

May 7, 2021

Data Science Graduate Qualifying Project Teams	11:00am - 1:15 pm

Presentations will take place live via Zoom at the times noted above. For Zoom links, click here.

Acknowledgements

Special thanks to…

- Our esteemed panel of volunteer judges comprised of faculty members, alumni, and business experts across a wide range of specialties and fields

- Our hardworking student support team

- The following offices and their staff for their continued support and efforts in making this program run successfully:

  Marketing and Communications
  Events
  Academic Technology Center
  Network Operations
  Graduate Studies Academic Departments

- The GRIE Planning Committee:

  Terri Anne Camesano, Professor and Dean of Graduate Studies
  Rory Flinn, Office of Graduate Studies
  Rachel Roy, Office of the Provost
  Deborah Baron, Office of Graduate Studies

- Faculty Lead Judges:

Danielle Cote	Michael Demetriou	Zhi (Jane) Li
Bengisu Tulu	Aaron Deskins	Randy Paffenroth
Andrew Teixeira	Craig Wills	Jie Fu
Yihao Zheng	Nikhil Karanjgaokar	Elke Rudensteiner
Christopher Larsen	Eric Young	Albert Simeoni
Jing Xiao	Jagan Srinivasan	Catherine Whittington

…and, especially, our Graduate Students!

Aerospace Engineering, Manufacturing Engineering, Mechanical Engineering, Civil and Environmental Engineering, Fire-Protection Engineering
9:00 - 10:30am

1. Alexander Castaneda
Experimental Study of Flexible Electrohydrodynamic Conduction Pumping for Electronics Cooling
Department: Mechanical Engineering
Advisor: Jamal Yagoobi
Degree Level: Ph.D.
Keywords: Electrohydrodynamics, Fluid Mechanics, Flexible, Electronics Cooling, Conduction Pumping
Description: Modern electronics continue to develop and evolve as society shifts their focus towards more complex technologies, including small electronics for space applications. In turn, the thermal management systems of these modern electronics must adapt. Electrohydrodynamic conduction pumping presents a unique solution that is characterized by simplicity, low power, and a novel flexible design.

2. Li Chang
Nucleate Boiling Enhanced Pool Burning in Turbulence
Department: Fire Protection Engineering
Advisor: Ali Rangwala
Degree Level: Ph.D.
Keywords: Nucleate boiling, Pool burning, Bubble observation, Mass transfer
Description: Boiling is an effective way for both mass and heat transfer, which can be applied to improve the clean up efficiency of an oil spill burning process. The bubble carries a heavy role for the enhancement and this study explores the bubble behavior that couples to the combustion phenomena.

3. Andrei Koch
Pulsed Surface Plasma Source (PSPS) Design for Experimental Investigation of Flashover Plasmas
Department: Aerospace Engineering
Advisor: Nikolaos Gatsonis
Degree Level: Ph.D.
Keywords: Plasma, Spacecraft, Charging, Flashover
Description: Due to the charging environment spacecraft experience, electrical discharges known as flashover events have been observed to occur and pose significant risk of failure. While direct diagnostics techniques for these plasmas are being developed to better understand the plasma generated in these events as part of this research, repeatable generation of typical plasmas and environments typical of these flashovers must also be pursued. As part of this research, the development of a repeatable use, tunable plasma source capable of generating the plasma conditions and environmental interactions typical in space has been undertaken to allow for laboratory experimentation of these events.

4. Zahra Noori
Study of the Effect of Ultrasound Mechanism on Paper Drying
Department: Mechanical Engineering
Advisor: Jamal Yagoobi
Degree Level: Ph.D.
Keywords: Drying, Energy Efficiency, Ultrasound
Description: Drying consumes a large portion of energy in industry, about 16 % of total energy. Therefore, reducing the energy consumption and increasing the drying rate is very essential. In this research, a novel technique for drying, ultrasound drying, is introduced and the feasibility of that for paper drying has been investigated.

5. Yao Shen
Fiber-Based Optical Trapping for Physical and Biological Study in Liquid and Gas Environments
Department: Mechanical Engineering
Advisor: Yuxiang Liu
Degree Level: Ph.D.
Keywords: optical trapping, optical tweezers, airborne particles, cancer cell
Description: Optical trapping, also called optical tweezers, is a tractor beam in real life that can trap nano/microscale particles without physical contact. Different from most existing optical tweezers that are based on objective lenses and confined in research labs, we use optical fibers to realize small and portable optical trapping systems that can potentially enable new applications in the field. We have experimentally demonstrated the differentiation of human breast cancerous cells from normal ones in the water, with the particle temperature and mass measurements of airborne carbon particles underway, indicating the potential applications in early-stage cancer diagnosis, environmental monitoring, and manufacturing process monitoring.

6. John Trainor
Microgravity Combustion Experiment
Department: Aerospace Engineering
Advisor: Jagannath Jayachandran
Degree Level: Master's
Keywords: Combustion, Refrigerants, Microgravity, Compact Design
Description: The goal of this experiment is to create microgravity conditions in a lab to measure flame speeds. Large drop towers provide several seconds of microgravity at the expense of being very large, costly, and permanent structures. Our experiment will be compact enough to fit in a lab, while providing 0.5 seconds of microgravity for necessary measurements.

7. Zhiying Xiao
a novel thermo-optical PCM film system for building enclosures
Department: Civil Engineering
Advisor: Mingjiang Tao
Degree Level: Ph.D.
Keywords: Phase change materials, Transparency shift, building energy
Description: In order to save energy for heating and cooling, a novel thermo-optical based solid-solid phase change material (SS-PCM) film system is developed to take advantage of solar radiation.

8. Mengqiao Yang
Enhancement of Drying Rate of Moist Porous Media with Electric Field
Department: Mechanical Engineering
Advisor: Jamal Yagoobi
Degree Level: Ph.D.
Keywords: Drying, Electric field, Evaporation, Energy efficient
Description: Drying of moist porous media, such as food or pulp and paper, is an energy-intensive process. In this presentation, a new drying technology making use of the Dielectrophoresis (DEP) mechanism is introduced to enhance the drying process of a moist porous medium. An experimental setup is built up and the corresponding experimental tests are performed. The results show a significant impact of the DEP force on the temperature profile and drying rate of the sample. The experimental work provides a basic understanding of this novel technology to enhance the drying process in various industry sectors, such as forest products, food, pharmaceuticals, and chemicals.

9. Nathaniel O'Connor
Thermal Analysis of Electrically-Driven Liquid Film Boiling in Microgravity
Department: Mechanical Engineering
Advisor: Jamal Yagoobi
Degree Level: Ph.D.
Keywords: Electrohydrodynamics, 113, Microgravity, Numerical Simulation
Description: One of the major concerns for future spacecraft and space communications systems is cooling of electronics, where microgravity poses a significant challenge to typical two-phase thermal management. Electrohydrodynamics is being explored as an innovative way to solve these challenges and to enable the future of electronics in space. This numerical work was developed to answer design questions and safety considerations for an upcoming experiment on the International Space Station testing this new technology.

10. Mucheng Li
Optical Fiber Sensors for Relative Humidity and Moisture Content Measurement
Department: Mechanical Engineering
Advisor: Yuxiang Liu
Degree Level: Ph.D.
Keywords: fiber optics, humidity sensor, moisture sensor, vibration-insensitive
Description: In this work, we are developing a vibration-insensitive fiber optical sensor based on lossy-mode resonances for measuring both relative humidity (RH) in air and moisture content in foods in order to address the urgent need for in-situ humidity and moisture content monitoring of food/pulp paper samples during the industry-scale drying process. Our optical sensor has a smaller size, faster response time, higher resolution, and better compatibility with the microwave dryer than the commercial electrical sensors. We have experimentally demonstrated the motion-insensitive RH measurement, indicating potential applications in the manufacturing process control in the food and pulp&paper industry to improve product quality and safety.

Data Science, Cybersecurity, Computer Science
9:00 - 10:30am, 11-20
10:30am – 12:00pm, 21-29

11. Geri Dimas
Modeling The United States Defensive Asylum Process
Department: Data Science
Advisor: Andrew Trapp
Degree Level: Ph.D.
Keywords: Data Science, Modeling, Social Good, Immigration,
Description: We explore the intricacies of the United States immigration court system, specifically looking at the defensive asylum process. Through the application of data science methodologies, we determine key factors related to the defensive asylum process and create a model to help represent an asylees' journey through this complex system.

12. Jason King
ASSISTments Automatic Reassessment and Relearning System UI Design
Department: Computer Science
Advisor: Neil Heffernan
Degree Level: Master's
Keywords: ASSISTments, User Interface, Data Visualization
Description: ASSISTments is an education tool designed to provide feedback assistance to students and assessment data to teachers. A prominent feature within ASSISTments is the Automatic Reassessment and Relearning System (ARRS), which helps students retain skills be repeatedly re-evaluating them. I am working alongside other students to develop and modernize the ARRS user interface to better visualize the data teachers and students have access to.

13. Anand Ramakrishnan
Harnessing Emotions to Improve Face Recognition
Department: Computer Science
Advisor: Jacob Whitehill
Degree Level: Ph.D.
Keywords: Deep Learning, One Shot Learning, Embedding Spaces, Geometric constraints, Face Recognition
Description: We explore the utility of harnessing auxiliary labels (e.g., facial expression) to impose geometric structure when training embedding models for one-shot learning (e.g., for face verification). We introduce novel geometric constraints on the embedding space learned by a deep model using either manually annotated or automatically detected auxiliary labels. We contrast their performances (AUC) on four different face datasets (CK+, VGGFace-2, Tufts Face, and PubFig). Due to the additional structure encoded in the embedding space, our methods provide a higher verification accuracy (99.7, 86.2, 99.4, and 79.3% with our proposed TL+PDP+FBV loss, versus 97.5, 72.6, 93.1, and 70.5% using a standard Triplet Loss on the four datasets, respectively). The embedding vectors also retain more information about the auxiliary labels than with a standard triplet loss. Our method is implemented purely in terms of the loss function. It does not require any changes to the backbone of the embedding functions.

14. Jean-Baptiste Truong
Confidential and Private Deep Learning
Department: Computer Science
Advisor: Robert Walls
Degree Level: Master's
Keywords: Cybersecurity, Machine Learning, Privacy, Confidentiality
Description: My work focuses on making machine learning algorithms confidential and private. Confidential, as the algorithm itself holds a great value to the provider. Private, because the end-user may want to maintain their personal data privacy.

15. Kai Yan
Live Coding in Virtual Worlds
Department: Interactive Media & Game Development
Advisor: Charles Roberts
Degree Level: Master's
Keywords: Virtual Reality, Live Coding, Voice Recognition Application, Graphics
Description: Our research examines live coding virtual worlds using specialized virtual reality equipment. We have created an immersive environment where programmers combine voice commands and gesture recognition to create content in a more embodied fashion than traditional programming systems.

16. Biao Yin
Corrosion Domain Adaptation: How to extend lab-based corrosion to real-world corrosion?
Department: Data Science
Advisor: Elke Rundensteiner
Degree Level: Ph.D.
Keywords: Corrosion, Domain Adaptation, Computer vision, Deep Learning
Description: In this project, we present research in collaboration with material scientists at the Army Research Lab on analyzing experimental data in the form of images of panels treated with different material coatings. This unique experimental image data set contains images subjected to indoor, rapid and artificial laboratory experiments and outdoor, long-scale natural environment experiments. We designed and experimented with domain adaptation methods to answer questions such as: to what extent can indoor corrosion assessment be used to predict outdoor corrosion assessment? These deep learning methods are aimed to accelerate corrosion science exploration.

17. Xin Zhang
***f*-GAIL: Learning *f*-Divergence for Generative Adversarial Imitation Learning**
Department: Data Science
Advisor: Yanhua Li
Degree Level: Ph.D.
Keywords: Imitation Learning, Generative Models, *f*-Divergence
Description: Imitation learning (IL) aims to learn a policy from expert demonstrations that minimizes the discrepancy between the learner and expert behaviors. Various imitation learning algorithms have been proposed with different pre-determined divergences to quantify the discrepancy. This naturally gives rise to the following question: Given a set of expert demonstrations, which divergence can recover the expert policy more accurately with higher data efficiency? In this work, we propose *f*-GAIL, a new generative adversarial imitation learning (GAIL) model, that automatically learns a discrepancy measure from the *f*-divergence family as well as a policy capable of producing expert-like behaviors. Compared with IL baselines with various predefined divergence measures, *f*-GAIL learns better policies with higher data efficiency in six physics-based control tasks.

18. Yiqin Zhao
Practical 3D Lighting Estimation for Mobile Augmented Reality
Department: Computer Science
Advisor: Tian Guo
Degree Level: Master's
Keywords: Lighting Estimation, Mobile AR, Computer System
Description: Lighting estimation is an essential task for realistic 3D augmented reality, as the visual coherent between visual and physical world heavily depends on whether the virtual objects are rendered with realistic lighting. In this work, we provide a practical edge-assisted framework to perform spatially variant lighting estimation efficiently.

19. Aaron Alphonsus
Feedback Recommendation System for Student Problem Solving Action Data
Department: Computer Science
Advisor: Neil Heffernan
Degree Level: Masters
Keywords: Feedback, Human-in-the-loop AI, Recommendation Systems, NLP, Time Series
Description: Computer-based systems have the unique advantage of being able to collect action-by-action reports of how a student reached an answer, the time it took to do so, and a wealth of other data. It is difficult for teachers to analyze data in this level of detail but it presents us with an opportunity to distill information from it. We take on student problem-solving action data so that we can provide teachers with recommendations to give feedback that will help students improve their study habits.

20. Prathyush Parvatharaju
Neural Time Series Explainer
Department: Data Science
Advisor: Elke Rundensteiner
Degree Level: Master's
Keywords: Explainable AI, XAI, Timeseries Explanation, Guided Perturbations
Description: Deep neural networks are being used to build autonomous systems that will perceive, learn, decide, and act on their own. However, their decision-making process is opaque and it is difficult to explain to the end-users. Our aim is to address the problem of Explainable AI for deep neural classifiers that take time-series as input and output influential timesteps for the network's decision in classification.

21. Apiwat Ditthapron
Speech-based Traumatic Brain Injury (TBI) assessment using deep learning methods with limited labeled data
Department: Computer Science
Advisor: Emmanuel Agu
Degree Level: Master's
Keywords: Traumatic Brain Injury (TBI) assessment, Speech assessment, Deep learning, Smartphones
Description: People afflicted with Traumatic Brain Injury (TBI) experience long-term impairments, which require follow-up assessments or rehospitalization in some cases. To promote recovery, we propose a Deep Neural Network (DNN) system for non-invasive, speech-based assessment of long-term impairments following TBI that runs passively on smartphones with the main focus on a limited data problem that frequently arises in automatic health assessment.

22. Walter Gerych
Maximizing Subset Accuracy with Incomplete Labels
Department: Data Science
Advisor: Elke Rundensteiner
Degree Level: Ph.D.
Keywords: multilabel learning, incomplete labels, semisupervised learning, machine learning, deep learning
Description: Multi-label classification corresponds to the task of predicting multiple targets given a single input (i.e., identifying all of the objects in an image). Unfortunately, the performance of state-of-the-art multi-label classification algorithms suffer when trained on data with incomplete labels (i.e., not every object in the image is labeled during training). We address this challenge by proposing SAIL, a method for training multi-label classifiers given incomplete labels by successfully modeling the correlations between labels.

23. Guin Gilman
Efficient Contention-Aware Scheduling Policies for General Purpose GPUs
Department: Computer Science
Advisor: Robert Walls
Degree Level: Ph.D.
Keywords: GPGPUs, scheduling algorithms, systems architecture
Description: Running multiple applications on one GPU concurrently has numerous advantages for deep learning inference server providers in terms of cost efficiency and resource utilization. However, current hardware does not support the efficient scheduling of multiple deep learning training and inference tasks. This work seeks to provide a domain-specific scheduling policy for such use cases which mitigates the effects due to contention while achieving acceptable turnaround time, utilization, and predictability.

24. Shengmei Liu
The impact of latency on player performance
Department: Computer Science
Advisor: Mark Claypool
Degree Level: Ph.D.
Keywords: latency, human computer interaction, Gaming, Player performance, QoE
Description: The impact of low range latency on player performance and quality of experience

25. Yu Liu
Community Cleanup: Incentivizing Network Hygiene via Distributed Attack Reporting
Department: Computer Science
Advisor: Craig Shue
Degree Level: Ph.D.
Keywords: Software-defined networking, Residential network security, Distributed denial-of-service attack
Description: This research designs a protocol that combining SDN techniques with prior work on collaborative DDoS reporting to identify residential network compromises. This combination provides incentives for end-users to deploy the technique, including rapid notification of compromises on their own devices and reduced upstream bandwidth consumption, while incurring minimal performance overheads.

26. Harsh Nilesh Pathak
Non-convex Optimization Using Parameter Continuation Methods for Deep Neural Networks
Department: Data Science
Advisor: Randy Paffenroth
Degree Level: Ph.D.
Keywords: deep learning, curriculum learning, neural network, optimization, bifurcation
Description: We propose a novel training method for deep neural networks based on the ideas from parameter continuation methods and compare them with widely practiced methods such as Stochastic Gradient Descent (SGD), AdaGrad, RMSProp and ADAM. For an unsupervised learning problem, we show our method converges much faster, consistent and generalizes better than other conventional methods.

27. Jidapa Thadajarassiri
Semi-Supervised Knowledge Amalgamation for Sequence Classification
Department: Data Science
Advisor: Elke rundensteiner
Degree Level: Ph.D.
Keywords: Knowledge Amagamation, Teacher-Student Model, Semi Supervised Method, Sequence Classification,
Description: We propose a Teacher Coordinator (TC) to amalgamate the knowledge of multiple pre-trained teacher models into a single student model that becomes an expert over all teacher tasks. Our study emphasizes a setting for sequential data with limited labeling.

28. Peter VanNostrand
Leveraging Labeled Examples for Robust Deep Anomaly Detection
Department: Data Science
Advisor: Elke Rundensteiner
Degree Level: Ph.D.
Keywords: Anomaly Detection, Outlier Detection, Deep Learning, Semi-Supervised Learning
Description: Anomaly detection, the process of identifying abnormal data samples, is a challenge due to the lack of large-scale labeled datasets. As human data labeling is prohibitively expensive, it is common to have a large, unlabeled dataset consisting of mostly normal data with only a small number of explicitly labeled samples. We propose a method for using these labeled samples as examples to guide the learning of anomaly detection methods and prevent a loss of performance due to unlabeled anomalies present in the training data.

29. Xiaokun Xu
A First Look at the Network Turbulence for Google Stadia Cloud-based Game Streaming
Department: Computer Science
Advisor: Mark Claypool
Degree Level: Ph.D.
Keywords: Measurement, Monitoring and telemetry, Cloud-based, Streaming, QoE/QoS Assurance
Description: While there have been network studies of traditional network games and streaming video, there is less work measuring cloud-based game streaming traffic and none on Google's Stadia. We present experiments that provide a first look, measure Stadia game traffic for several games, analyzing the bitrates, packet sizes and inter-packet times, and comparing the results to other applications. Results indicate Stadia, unlike traditional network game systems, rapidly sends large packets downstream and small packets upstream, similar to but still significantly different than video and at much higher rates than previous cloud-based game systems or video.

Robotics Engineering, Cyberphysical Systems, Electrical and Computer Engineering
10:30am – 12:00pm

30. Fadi Alladkani
Ensemble Learning Methods for Robot Grasping
Department: Robotics Engineering
Advisor: Berk Calli
Degree Level: Ph.D.
Keywords: ensemble learning, neural networks, robot grasping, computer vision, machine learning
Description: There are different expert neural networks used in robot grasping, each with their pros and cons. The ensemble method developed combines them and weights their opinions. The overall performance of the ensemble method provides a superior grasp for the object.

31. Ashay Aswale
Imitating Human Body Motions With Humanoid Robot
Department: Robotics Engineering
Advisor: Michael Gennert
Degree Level: Ph.D.
Keywords: Humanoid Robots, Teleoperation, Whole-body imitation, Atlas Robot
Description: The goal of this research is enable a humanoid robot to learn to perform human tasks by copying an operator's motions. We have developed a system that imitates both the upper and lower body motion while keeping the robot stable. Using this architecture, the robot can even walk, stand on one foot, or grab objects by imitating the operator.

32. Albert Enyedy
Visual Feedback-Based Arm Motion for Atlas Robot in Simulation
Department: Robotics Engineering
Advisor: Michael Gennert
Degree Level: Ph.D.
Keywords: robotics, humanoid, vision, motion
Description: In order for robots to operate effectively in real-time in the real world, they must be able to act and react quickly, without pausing to compute. We propose a novel method for controlling arm movement on WPI's Atlas robot in simulation by using visual feedback. The resulting increased calculation speed presents the opportunity for applications such as showing a humanoid robot how to complete a task via mirroring a human participant's motions.

33. Katie Gandomi
Closed Loop Conformal Ultrasound Ablation for Brain Cancer Intervention
Department: Robotics Engineering
Advisor: Gregory Fischer
Degree Level: Ph.D.
Keywords: Interstitial Ultrasound Ablation, Conformal Tumor Ablation, MRI Compatible Surgical Robotics, MR-Thermometry based Feedback, Brain Cancer Interventions
Description: The primary objective of cancer intervention is the selective removal of malignant cells while conserving surrounding healthy tissues. However, achieving appropriate margins can be difficult especially in soft delicate structures such as the brain. In this work, we propose the development of a robot actuated closed loop controller that uses high intensity interstitial ultrasound to closely ablate tumor boundaries using MR-thermometry based feedback.

34. Fnu Raghav
Automatic Rectification of Perspective and ScaleDistortion from a Wound Image using Deep SpatialTransformation Network
Department: Robotics Engineering
Advisor: Emmanuel Agu
Degree Level: Master's
Keywords: Distortion Removal, Image Perspective, Deep Learning, Spatial Transformation Network, Computer Vision
Description: The image captured using a digital camera is utilizes perspective projection in which parallel lines converge to a vanishing point, which suffers from geometric and scale distortion due to non-standard camera angles and orientations. The proposed method automatically remove perspective and scale distortion to produce an orthogonal image. The orthogonal image is free from perspective and scale distortions and facilitates more accurate feature extraction for medical images.

35. Brianna Raphino
Intuitive Probe Motion Guidance for Teleultrasound
Department: Mechanical Engineering
Advisor: Yihao Zheng
Degree Level: Ph.D.
Keywords: Teleultrasound, Intuitive Guidance, Motion Guidance
Description: The objective is to create an intuitive guidance method that accurately guides inexperienced individuals to position and manipulate a probe in order to produce a successful ultrasound scan. The scans would be monitored in real-time by a trained healthcare professional at a remote location.

36. Alp Sahin
Planning for Within-Hand Manipulation using a Robotic Gripper
Department: Robotics Engineering
Advisor: Berk Calli
Degree Level: Master's
Keywords: robotics, gripper, manipulation, motion planning, optimization
Description: To begin writing, humans usually pick up a pen and then reposition it within their hands. Similarly, robots need to reposition tools within grasp prior to a robotic task. In this work, we break down the repositioning process into simple actions and present a method that plans for a sequence of actions to reach desired grasps on different types of objects.

37. Yinan Sun
Salamanderbot: A Flexible Continuum Mobile Robot
Department: Robotics Engineering
Advisor: Cagdas Onal
Degree Level: Ph.D.
Keywords: Soft Robotics, Mobile Robot, Motion Control, Motion Planning
Description: In this work, we introduce a new mobile robot with a continuously deformable slender body structure, the SalamanderBot, which combines the flexibility and maneuverability of soft robots, with the speed and power of traditional mobile.

38. Alex Tacescu
Development of a Customizable Bio-Mechanical Actuated Knee Joint for Exoskeleton
Department: Robotics Engineering
Advisor: Gregory Fischer
Degree Level: Masters
Keywords: Exoskeleton, Bio-Mechanical Adaptive Knee, MRI Processing

39. Tuna Tufan
A Wearable Transcutaneous Carbon Dioxide Sensor
Department: Electrical & Computer Engineering
Advisor: Ulkuhan Guler
Degree Level: Ph.D.
Keywords: Transcutaneous CO2, Smart and connected health, Wearable, IR absorption, Thermopile sensor
Description: The partial pressure of arterial carbon dioxide (PaCO2) is an important arterial blood gas that provides significant clinical information about the respiratory and metabolic condition of a patient (such as arterial oxygenation, ventilation, and acid-base status). PaCO2 can be extracted from the partial pressure of carbon dioxide (PtcCO2), which is the measurement of CO2 molecules diffusing from the skin. This project aims to noninvasively monitor the PtcCO2 levels with a wearable sensor attached to the human body. The proposed sensor relies on the principle of CO2 absorption of infrared(IR) light at a specific wavelength.

63. Jakub Tomasz Kaminski
The UltrasoundRobot: a portable robotic arm for a safe COVID-19 lung ultrasound screening
Department: Robotics Engineering
Advisor: Haichong Zhang
Degree Level: Master's
Keywords: COVID-19, Medical Robotics, Autonomous Systems, Ultrasonography, Medical Imaging
Description: The diagnostic lung ultrasound makes a COVID-19 patient treatment planning more effective, but is rarely done due to a high infection risk in a prolonged, direct patient-sonographer contact. We propose the UltrasoundRobot.com project, a novel robot arm which allows for a teleoperated lung ultrasound. The device improves the front-line workers safety and gives the clinical insights on the patient status, being at the same time intrinsically-safe, versatile and easily adaptable in the clinical workflow. With versatility and cost-effectiveness in mind, the robot could also serve patients in the remote and resource-limited locations.

Business and Social Science
1:00 – 1:45pm

40. Avery Harrison Closser
Monkey See or Monkey Do? The Effects of Worked Example Presentations on Student Learning
Department: Learning Sciences & Technologies
Advisor: Erin Ottmar
Degree Level: Ph.D.
Keywords: online learning, worked examples, algebra, embodied cognition,
Description: With online learning becoming increasingly central to K-12 education, it is critical to provide effective instructional support for students in online learning environments. Worked examples, or step-by-step solutions to a given problem, are an effective type of instructional support; however, little research has explored how different presentations of worked examples may impact student learning in online environments. This project examines the impact of 1) self-explanation prompts and 2) student action in worked examples on student learning to provide recommendations for online learning technologies.

41. Haadi Mombini
Machine Learning-based Explanation Facility for Chronic Wound Management
Department: Business Administration
Advisor: Bengisu Tulu
Degree Level: Ph.D.
Keywords: Chronic wounds, Interpretable machine learning, Prediction explanations, Actionable care decisions, Decision support systems
Description: Each year chronic wounds affect 6.5 million Americans and cost $28-$32 billion. Clinical guidelines provide non-specialist care providers (visiting, community and registered nurses) narrative explanations and generalized recommendations to treat wound patients, but their use is limited for personalized and actionable wound care decisions in remote areas. This study proposes a wound care decision support solution that uses (a) machine learning (ML) to predict care decisions based on wound images taken using a smartphone camera and (b) explanation techniques to interpret predictions.

42. Lidan Zhang
A review of smartphone interventions for post incarceration
Department: Information Technology
Advisor: Bengisu Tulu
Degree Level: Ph.D.
Keywords: Post-incarceration, Smartphone, Substance Use Disorder, Intervention, Mobile app
Description: In the US, up to 90% of incarcerated individuals have substance use disorder (SUD) or mental health disorders, but programs and services to help them with their reentry are scarce. Since smartphones are widely available, utilizing digital health technology as a support tool to equip justice-involved individuals is increasingly prevailing. The purpose of this study is to review smartphone interventions that help justice-involved individuals with SUD and their reentry into communities.

43. Kathryn Drzewiecki

What Teachers Don't Know Can't Help Them: Identifying Evidence-Based Metrics for Learning

Department: Learning Sciences & Technologies

Advisor: Erin Ottmar

Degree Level: Master's

Keywords: Educational technology, Mathematics education, Data visualization

Description: When students use educational technologies there is a lot of data that is collected about when, how, and what students are doing while using the program, however, not a lot of research has been conducted on how to best get that data to teachers in a usable way. This research aims to investigate that data and figure out what metrics best predict learning.

Mathematical, Chemical, and Physical Sciences
1:00 – 1:45pm

44. Teagan Bate
Self-organization and mixing of microtubule-kinesin active fluid in an activity gradient
Department: Physics
Advisor: Kun-Ta Wu
Degree Level: Ph.D.
Keywords: microtubule-kinesin active fluid, self-organization, activity gradient, mixing
Description: Active fluid, composed of kinesin-driven extensile bundles of microtubules, consumes ATP locally to create a self-mixing flow. Mean speed of microtubule-kinesin active fluid was shown to be tunable by varying its components' concentrations. Such tunability demonstrated the controllability of active fluid with uniform activity. However, how active fluid self-organizes when its activity is non-uniform remains poorly understood. Here, we characterized active fluid behavior and its associated mixing performance in an activity gradient. The activity gradient was created by imposing a temperature gradient because our previous work showed that microtubule-kinesin active fluid exhibited an Arrhenius response to temperature: Increasing temperature sped up active fluid flow, and thus, along a temperature gradient, active fluid flowed faster on one side and slower on the other, forming an activity gradient. We characterized how such a gradient influenced the mixing performance of active fluid in terms of mixing efficiency, stretching rate, and mean squared displacement, comparing with an activity-uniform sample. Our work suggests that applying an activity gradient can serve as a new in-situ method for controlling self-organization and mixing performance of microtubule-kinesin active fluid.

45. Lyric Liu
Bayesian Inference for Big Data: Combining Probability Sample and Non-probability
Department: Other
Advisor: Balgobin Nandram
Degree Level: Ph.D.
Keywords: Missing at random, Non-probability sample, Regression modeling, Propensity score, Variance estimation
Description: Big Data often presents as massive non-probability samples (nps). Unlike the probability samples (ps), there are no selection probabilities or weights in the nps. Integrating ps and nps is becoming a very important topic. We will illustrate a model to meet this purpose.

46. Elisa Negrini
System Identification Through Lipschitz Regularized Deep Neural Networks
Department: Applied Mathematics
Advisor: Luca Capogna
Degree Level: Ph.D.
Keywords: Deep Learning, System Identification, Ordinary Differential Equations, Network Regularization, Generalization
Description: In this work we use neural networks to learn governing equations from data. Specifically we reconstruct the right-hand side of a system of ODEs $x'(t) = f(t, x(t))$ directly from observed uniformly time-sampled data using a neural network. In contrast with other neural network-based approaches to this problem, we add a Lipschitz regularization term to our loss function. In the synthetic examples we show empirically that this regularization results in a smoother approximating function and better generalization properties when compared with non-regularized models, both on trajectory and non-trajectory data, especially in presence of noise.

47. Megan Varney

Characterizing mixing dynamics and efficiency of microtubule-based active fluids

Department: Physics

Advisor: Kun-Ta Wu

Degree Level: Master's

Keywords: soft matter, active matter, mixing, microtubules,

Description: Passive mixing efficiency is related to flow rate and geometry, causing passive mixing to be inefficient or impossible at high viscosities and low volumes. In this project, we investigate active mixing at low Reynolds numbers by characterizing the active mixing efficiency and dynamics of microtubule-based active gels. Characterizing mixing in the low Reynolds number regime is critical for studying fields such as microfluidics, bioassays, and materials synthesis.

Chemical Engineering and Materials Science
1:40 – 3:00pm

48. Cameron Armstrong
Reactor Dynamics: Thermal Oscillations and Catalytic Enhancements
Department: Chemical Engineering
Advisor: Andrew Teixeira
Degree Level: Ph.D.
Keywords: Catalysis, Dynamics, Microreactor
Description: Reactions over heterogeneous catalysts have been studied for centuries, but their kinetic rates have always been constrained due to thermodynamically induced maxima. Reaction dynamics introduces an alternative to the traditionally static reactions and potentially unlock exciting new catalytic pathways which lead to massive rate enhancements. A microreactor system was constructed capable of inducing thermal oscillations on the order of catalytic turnover to observe these rate enhancements.

49. Elizabeth Belden
Shipboard conversion of plastics to fuel for self-powered ocean cleanup
Department: Chemical Engineering
Advisor: Michael Timko
Degree Level: Ph.D.
Keywords: Marine Plastic, Thermodynamics, Probabilistic Analysis, Waste Fuels
Description: My poster shows a two part study about the feasibility of using shipborne hydrothermal liquefaction to convert ocean plastics into marine fuels. The first part of the study aims to understand the thermodynamic feasibility of such a project. The second part studies the implications of such a system in terms of how long it would take to clean the ocean using such a process.

50. Jacob Crislip
Isolating the role of heat transfer in sol-gel synthesis of LTA by microdroplet crystallization
Department: Chemical Engineering
Advisor: Andrew Teixeira
Degree Level: Ph.D.
Keywords: Zeolites, Reactive Crystallization, Heat Transfer, Microfluidics, Intrinsic Kinetics
Description: Are observed crystallization rates the result of slow transport or intrinsic kinetics? Zeolite crystallization in microdroplets answers this question by strategically tuning heat and mass transfer rates. Impacts on nucleation and growth are measured using kinetic models and particle size distributions.

51. Christian Faria
High-Efficiency High Power Density Direct Carbon Fuel Cell
Department: Materials Science & Engineering
Advisor: Adam Powell
Degree Level: Master's
Keywords: direct carbon fuel cell, solid oxide fuel cell, CALPHAD
Description: This talk will present a novel power generation device which harnesses energy produced by the chemical reaction of carbon with oxygen. It will cover forecasted thermal and electrical performance obtained by computer modeling, as well as experimental results from a proof of concept apparatus. Anticipated cost, efficiency, and net emissions of this device will be compared to conventional methods of power generation.

52. Heather LeClerc
Understanding the fate of nitrogen in hydrothermal liquefaction
Department: Chemical Engineering
Advisor: Andrew Teixeira
Degree Level: Ph.D.
Keywords: biomass, energy, waste, bio-oil
Description: The prevalence of waste in society is a detrimental issue to our future along with current world reliance on fossil fuels. In order to combat both of these problems, I propose valorizing waste feeds into bio-oil using hydrothermal liquefaction. Due to the high presence of nitrogen and oxygen in wastes, it is important to work to understand how to tune the fate of these molecules to reduce the need for costly upgrading.

53. Patryck Michalik
Correlating Staphylococcus epidermidis Biofilm pH Gradients with Local Biofilm Mechanical Properties
Department: Chemical Engineering
Advisor: Elizabeth Stewart
Degree Level: Ph.D.
Keywords: Biofilms, Microrheology, pH Gradients, Biofilm Lifecycle, Biofilm Disassembly
Description: Staphylococcus epidermidis frequently causes hospital related and medical device infections, placing a heavy burden on our medical system. Here we assess the relationship between local pH and mechanical properties in Staphylococcus epidermidis biofilms to mechanistically understand how these biofilms breakdown. This study will inform the development of matrix targeted biofilm control strategies which will reduce biofilm infection rates.

54. Panawan Vanaphuti
Enhanced Electrochemical Performance of Lithium, Manganese-Rich Layered Oxide Cathode for Lithium-ion Batteries
Department: Materials Science & Engineering
Advisor: Yan Wang
Degree Level: Ph.D.
Keywords: Layered Oxide Cathode, Lithium-ion Batteries, Crystal Lattice Doping, Energy Storage,
Description: Regardless of the successful commercialization of Lithium-ion cathodes used in electronic devices and electric vehicles nowadays, researchers are focusing on higher energy cathode materials than conventional ones to meet the ever-increasing market demands in which Lithium-Manganese-rich layered oxide cathode (LMR) is of great interest due to its high energy density and low cost. This presentation will mainly focus on improving the performance of LMR via doping impurity ions into its crystal structure. The experimental procedures, material characterizations and electrochemical results will be presented.

55. Ziqi Wei
Characterization of LL37 Binding to Collagen through Collagen-Binding Domains (CBDs)
Department: Chemical Engineering
Advisor: Terri Camesano
Degree Level: Ph.D.
Keywords: Biomaterials, Collagen, Antimicrobial peptides
Description: Recent work from our lab has demonstrated that collagen binding of antimicrobial peptides (AMPs) using collagen binding domains (CBDs) has potential in delivering novel, non-cytotoxic, antimicrobial, and pro-healing therapies to chronic wounds and will not promote bacterial resistance. The goal of this project is to study collagen film deposition as AMPs delivery platform, to quantify CBD-LL37 binding, and to understand the mechanism of CBD-mediated LL37 binding to collagen films.

Life Sciences and Bioengineering
1:45 – 2:50pm

56. Elizabeth DiLoreto
Can infection change the brain's wiring?
Department: Biology & Biotechnology
Advisor: Jagan Srinivasan
Degree Level: Ph.D.
Keywords: Caenorhabditis elegans, Infection, Staphylococcus aureus, Neuroimmunology, Gut Microbiome
Description: Staph infection effects a worm's gut but it is unknown how it is first detected in the brain. This project aims to identify what neural mechanisms are involved in first sensing the infection and signalling the body to mount an immune response.

57. Edward Jarvis
Confinement-induced flow patterns in microtubule-based active fluids
Department: Physics
Advisor: Kun-Ta Wu
Degree Level: Ph.D.
Keywords: Complex fluids, Geometric boundary conditions, Uniform temperature convection, Moffat eddies
Description: Boundary conditions influence the outcome of fluid dynamics in conventional passive fluid systems. Such an influence also extends to active fluid systems where fluid can flow by itself without an external driving force. For example, an active fluid that is confined in a thin cylinder can self-organize into a circulation along the central axis of the cylinder but thinning the cylinder to a disk-like geometry suppresses the formation of circulation. These phenomena demonstrated the role of confinement geometry on flow patterns of active fluid. Here, we demonstrate two flow patterns induced by confinement. First, we will show that active fluid can convect within a trapezoidal confinement. Such convection was in a temperature-uniform system, in contrast to Rayleigh-Bénard convection which is induced by a temperature gradient. This result suggested the feasibility of developing convection in a temperature-homogeneous system. Second, we demonstrate a confinement-induced stationary vortex near a corner of confinement whose corner angle is below a critical value. This is similar to conventional Moffatt eddies, except the fluid is internally driven. Our work paves the path to controlling self-organization of active fluid using confinement.

58. Andre Figueroa Milla
Cell-only 3D Bioprinting for Vascular Tissue Engineering
Department: Biomedical Engineering
Advisor: Marsha Rolle
Degree Level: Ph.D.
Keywords: Bioprinting, Tissue Engineering, Vascular, 3D, Patient-specific
Description: My research is focused on improving the way we use tissue engineering to generate human blood vessels in a lab. I am developing a 3D bioprinting method that uses only cells to engineer tissues that simulate blood vessel structure and function. Bioprinting cells only, without a supporting printing material or “bioink”could enable us to create characteristics of living tissues that are unique to patient anatomy and physiology, and better predict how drugs will perform when treating diseases.

59. Caroline Muirhead
Multisensory Integration in C. elegans
Department: Biology & Biotechnology
Advisor: Jagan Srinivasan
Degree Level: Ph.D.
Keywords: Decision-making, C. elegans, Multisensory
Description: Multisensory integration (MSI), the process by which the brain synthesizes competing information, is necessary for all animals to function normally. C. elegans offer a viable model to study the neural networks governing MSI, allowing researchers to elucidate how the brain processes conflicting stimuli.

60. Oleksandr Narykov
Integrative modeling of SARS-COV-2 virion
Department: Computer Science
Advisor: Dmitry Korkin
Degree Level: Ph.D.
Keywords: Molecular Dynamics, Structural Biology, High-Performance Computing, Mesoscale system
Description: The year 2020 brought forth the largest pandemic of the past century, caused by the SARS-CoV-2 virus. Even though a large part of its structural proteins was experimentally resolved, designing efficient antiviral drugs require better understanding of the SARS-CoV-2 surface. We present a physically tractable mesoscale system of viral envelope that amalgamates the most recent information on viral envelope (protein structures, stoichiometry, and geometry) and corresponding molecular dynamics simulations of its behavior in solvent. These results would identify new antiviral drug targets, e.g., membrane proteins, for SARS-COV-2 and provide foundation for studying other Coronaviridae.

61. Huaming Sun
Using machine learning to understand the determinants of mRNA stability in mycobacteria
Department: Bioinformatics & Computational Biology
Advisor: Scarlet Shell
Degree Level: Ph.D.
Keywords: Machine Learning, mRNA, Degradation, Determinants
Description: We applied both unsupervised and supervised machine learning to study the mRNA degradation patterns and their determinants in mycobacteria.

62. Andrew Wilzman
Mechanical risk factors for predicting stress fracture in elite runners
Department: Biomedical Engineering
Advisor: Karen Troy
Degree Level: Ph.D.
Keywords: biomechanics, running, fracture, sports
Description: Bone stress injuries (BSI) are common in elite cross-country runners, and our goal is to find a biomechanical measurement that can predict the future occurrence of a BSI. In forty collegiate runners, foot pressure data were gathered during walking and athletic movements such as running and jumping. These athletes were then followed through their collegiate running career and all BSI incidents were recorded to study the correlations between the data gathered and which of the athletes developed BSIs, and which bones were injured.

Friday, May 7, 2021

Data Science Graduate Qualifying Project
11:00am – 12:00pm, 1-8
12:15 – 1:15pm, 9-16

1. Amorn Chokchaisiripakdee, Jinyang Wang, Vishaal Prabhakar, Varun Eranki, Amorn Chokchaisiripakdee
Transfer Learning for Event Extraction
Sponsor: Basis Technology
Lead Project Coordinator: Chun-Kit Ngan
Industry Mentor(s): Kfir Bar, Gil Irizarry
Keywords: Event Extraction, Data Science, Natural Language Processing, Transfer Learning, Deep Learning
Description: In this project, we will examine or implement present event extraction models and try to improve the performance of those in event extraction tasks. An event is a specific occurrence of something that happens in a certain time and a certain place involving one or more participants. Event extraction, as an important task of natural language processing, is to extract structured representation of events from sentences or paragraphs.

2. Oscar Garcia, Naisargi Dave, Qie Tang, Josvin John
Predictive Model for Patent Classification
Sponsor: Dr. Reza Mollaaghababa
Lead Project Coordinator: Reza Mollaaghababa
Industry Mentor(s): Reza Mollaaghababa
Keywords: Natural Language Processing, Patents, Classification, Text, Documents
Description: A Natural Language Processing model is trained to predict if a patent application will be accepted or rejected by the Patent Office. Different approaches to process the patent applications text are presented and compared along with different models.

3. Jannik Haas, Pascal Bakker, Qiaochu Song, Xinyuan Yang, Jannik Haas
Catalyst Descriptor Identification with Machine Learning
Sponsor: Aramco Americas
Lead Project Coordinator: Chun-Kit Ngan
Industry Mentor(s): Sibo Lin, Yagnaseni Ghosh
Keywords: Machine Learning, QSAR/QSPR, Molecular Chemistry, Petrochemical, Downstream Oil and Gas
Description: In the Petrochemical industry, the product selectivity of molecular reactions is crucial in creating usable end products. We aim to produce a machine learning model that accurately predicts the product selectivity of different catalysts for ethylene trimerization and tetramerization while also extracting important molecular features that will allow us to maximize the desired products and minimize undesired products.

4. Lyzanne Dsouza, Manyang Sun, Yueqin Liang, Vamsi Bhargav Sukamanchi, Yiqing Zhang, Caleb J Ralphs
Identification of Diagnostic Biomarkers of Neurodegenerative Disorders by Application of AI on Brain MRIs
Sponsor: Takeda Pharmaceutical Company Ltd
Lead Project Coordinator: Chun-Kit Ngan
Industry Mentor(s): Neda Hassanpour, Rajesh Mikkilineni
Keywords: Diagnostic Biomarkers of Neurodegenerative Disorders, Application of AI on Brain MRIs, Predicting Biological Age, PAD (Predicted Age Difference), Machine Learning and Deep Learning
Description: This poster describes our capstone Graduate Qualifying Project work in which we try to explore Machine Learning and Deep Learning capabilities for improving automated diagnosis for cognitive disorders that degrade cognitive working memory. We also predict the biological age given that PAD (Predicted Age Difference) has a significant structural impact on the brain.

5. Shijing Yang, Baoxin Liu, Jack Charbonneau, Priyanka Phadnis
Transitioning Homegrown CORE package to H2O
Sponsor: Homesite Insurance
Lead Project Coordinator: Jane Chen
Industry Mentor(s): Jane Chen, Tanner Kulbashian
Keywords: Insurance, Rating, Programming, Data, Prediction
Description: Homesite uses machine learning models to help determine the premium that it will offer to customers based on their perceived risk. Improving these models is fundamental to Homesite staying competitive within its industry, as accurate models allow them to offer good rates without overexposing themselves. The purpose of this project is to update Homesite's existing machine learning models to us H2O, a scalable machine learning platform that allows for rapid model adjustments with high interpretability.

6. Donghyuk Kim, Donghyuk Kim, Aishwarya Ramakrishnan, Noah Capucilli-Shatan, Beichen Xing
Effective Collection and Analysis of Corrosion Data - Army Research Lab
Sponsor: Army Research Laboratory
Lead Project Coordinator: Chun-Kit Ngan
Industry Mentor(s): Thomas Considine, Robert Jensen
Keywords: corrosion, materials, visualization, assessment, experimentation
Description: Our goal is to effectively collect, manage, model, and show long-term corrosion experimental data to prevent material degradation across army assets.
We are building an iOS app that utilizes deep learning models to efficiently collect data from experiments, as well as a web dashboard to visualize the collected data.

7. Ln Zhang, Joseph Caltabiano, Kodzo Agbobli, Daojun Liang, Lin Zhang, Prathyush SP
Army Research Lab Adhesives Project
Sponsor: Army Research Laboratory
Lead Project Coordinator: Robert Jensen
Keywords: visualization, data analysis, web development, workflow improvement, software engineering
Description: Data analysis and sharing is vital to testing adhesive performance. We developed interactive visualizations and implemented improvements to an adhesives data dashboard.

8. Yanzhao Wang, Yanzhao Wang, Mario Arduz, Fan Gong, Shundong Li,
ARL3 STABAS project
Sponsor: US Army, Army Research Laboratory
Lead Project Coordinator: Robert Jensen
Industry Mentor(s): Robert Jensen,
Keywords: advanced data visualization, generalized linear regression, experimental design recommendation, frontend development, backend development
Description: This project aims to analyze the initial limited data from experiments. From the statistical inference, a new experiment design from the statistical point of view will be suggested to experimentalists. With their domain knowledge to adjust the real-life practicality, accommodated experiment strategy will be conducted in the loop to get more data. The entire cycle will be implemented in the dashboard.

9. Min Huang, Vandana Anand, Kratika Agrawal, Jing Yu, Soumya Joshi, Xinlu He
Entity Linking WPI-Basis Technology Project
Sponsor: Basis Technology
Lead Project Coordinator: Chun-kit (Ben) Ngan
Industry Mentor(s): Gil Irizarry, Kfir Bar
Keywords: Entity Linking, Natural Language Processing, Deep Learning, Latent Relations, Knowledge Base
Description: Entity Linking is the task of assigning a unique identity to entities (e.g.famous people, locations, organizations) mentioned in texts. For example, given "WPI is located in Worcester, MA" the idea is to determine that "Worcester" here refers to a city in the US, not the one in the UK. Our goal is to improve the performance of the company's current entity linking tool by applying advanced deep learning models.

10. Sayali Shelke, Sayali Shelke, Anthony Topper, Kashyap Bhuva, Manasi Shrotri, Xaiosong Wen
Predictive model for evaluation of patent claims
Sponsor: Dr Reza Mollaaghababa
Lead Project Coordinator: Fatemeh Emdad
Industry Mentor(s): Reza Mollaaghababa,
Keywords: Natural Language Processing, Word2Vec, Doc2Vec, BERT, Cosine Similarity
Description: This project focused on building a natural language processing classification model to determine whether the USPTO will Accept or Reject a submitted Patent claim, and if the patent is rejected, whether it will be Affirmed or Reversed if appealed.

11. Aishwarya Ramakrishnan, Lyzanne Dsouza, Akshay Sadanandan, Somesh R Patel
Interpretability of Time Series Models
Sponsor: Findability Sciences
Lead Project Coordinator: Chun-Kit Ngan
Industry Mentor(s): Suresh Shakkarwar, Adarsh Jaiswal
Keywords: Interpretation, Time Series Forecasting, Model Agnostic, Prediction Explanation, Python and R
Description: This poster describes our Graduate Qualifying Project which mainly focuses on interpreting several time series models and explaining the predictions produced by the system. We have tried to address all the different problem statements in a generalized manner to provide scope for further expansion of interpretation.

12. Janet Carpenter, Brent Gilmore, Priyanka Phadnis, Arjun Rao, Merve Turgut,
Nameplate Data Extraction and Linking
Sponsor: National Fire Protection Association
Lead Project Coordinator: Joe Gochal
Industry Mentor(s): Joseph Gochal, Mohammed Ayub
Keywords: computer vision, optical character recognition, natural language processing, BERT, GCN
Description: The goal of the project was to create a prototype application for users to take pictures of electrical equipment nameplates and receive accurately categorized data for use in arc flash risk assessments. We collected images, evaluated OCR tools, conducted pre-processing to improve OCR performance, determined appropriate methods, and conducted initial training and testing of models using our nameplate data and an analogous dataset of receipts images. Based on this work, we developed an application to capture images and return recognized and categorized text results.

13. Jianbing Yang, Lidian Lin, Vinay Nair
ARL Corrosion
Sponsor: Army Research Laboratory
Lead Project Coordinator: Chun-kit Nyan
Industry Mentor(s): Thomas Considine, Robert Jensen
Keywords: Material Corrosion Data, iOS Development, Web Development, Software Engineering, Database Management
Description: Our ARL Corrosion project mainly focuses on iOS app and web development. For the iOS app which is used for corrosion data collection, we developed new features and fixed legacy issues to improve user experience. For the website, we retrieved corrosion data from database and used various graphs and plots to present them.

14. Edward Carlson, Revant Mahajan, Geng Zhao, Tai Zhou, Prathyush Parvatharaju,
ARL Adhesives Dashboard
Sponsor: Army Research Lab
Lead Project Coordinator: Robert Jensen
Industry Mentor(s): Robert Jensen,
Keywords: Data pipeline, Fullstack, Excel, Web Platform, Python
Description: We created an online dashboard that makes it easier for experimentalists to upload, analyze, and share experiment results. We did this by creating a standardized format for the experiment data and cutting down on repetitive data entry while also making it flow well with the existing practices that the experimentalists use.

15. Prakhar Srivastava, Prakhar Srivastava, Prathyush SP, Biao Yin
Surface Tolerant Adhesives for Bonded Airframe Structures
Sponsor: Army Research Laboratory
Lead Project Coordinator: Fatemeh Emdad
Industry Mentor(s): Robert Jensen,
Keywords: Optimization, Visualization, Recommendation, Prescriptive, Analytics
Description: Given limited time and resources, it is difficult to conduct the entirety of combinations of experiments. I present how to go about optimizing them, and cover the visualization tool built and development of the algorithm that powers the recommendations.

16. Truman Larson, Truman Larson, Mircalin Samedy, Joseph Caltabiano
Cold Spray Data Analysis
Sponsor: DEVCOM Army Research Lab
Lead Project Coordinator: Fatemeh Emdad
Industry Mentor(s): Robert Jensen,
Keywords: Cold Spray, Machine Learning, Computer Vision, Exploratory Data Analysis, Additive Manufacturing
Description: Analysis of cold spray additive manufacturing data is vital to predict performance and optimize its potential. Using machine learning and computer vision techniques, we can find important insights about this data to improve future experiments.