Civil | Construction | Nuclear
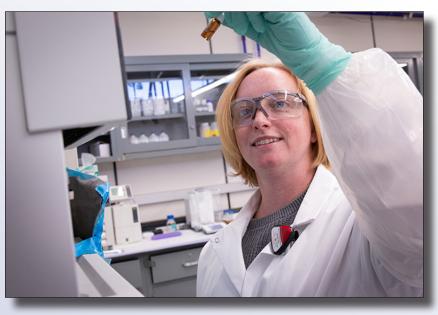# Fall 2021

TARA MASTREN

Tara Mastren, an assistant professor with the Department of Civil and Environmental Engineering, was one of only 83 scientists awarded a U.S. Department of Energy Early Career Research Award for her research focusing on the development of better radionuclide generator systems that provide short-lived alpha emitting radionuclides for the use in cancer therapies. Mastren will receive a total of $750,000 over five years to support her research.

Mastren's research will focus on developing better radionuclide generator systems that provide short-lived alpha emitting radionuclides to use in cancer therapies. Targeted alpha therapy (TAT) is a growing method of cancer treatment where alpha emitting radionuclides are attached to a molecule that delivers the dose directly to the diseased cells. Alpha decay works by emitting alpha particles in the short range, which allows for maximum damage to targeted cancer cells with minimum damage to the healthy tissue surrounding the cancer.

"This work seeks to develop methods to increase the supply of these valuable radionuclides allowing for more patients to have access to targeted alpha therapy for cancer treatment," Mastren said.

XIANFENG (TERRY) YANG

Civil and environmental engineering assistant professor, Xianfeng (Terry) Yang was awarded a National Science Foundation Early Career Grant for his proposal on machine learning in transportation. His project "Physics Regularized Machine Learning Theory: Modeling Stochastic Traffic Flow Patterns for Smart Mobility Systems" will focus on contributing fundamental theories and set of markedly improved algorithms to modeling done on traffic flow.

The goal of the project is mitigating traffic congestions, improving transportation safety, and reducing vehicle emissions. In order to reach these goals, the project will create a foundation of machine learning and traffic flow patterns to create models of mobility patterns. The method being used will train the process of machine learning by using transportation domain knowledge. In the end, this will enhance the effectiveness of the smart mobility applications on a variety of scales.

Yang will include outreach and education activities during his research, including developing a virtual computing lab to facilitate student educations, researcher engagement, government employee training, and industry collaboration; modernizing the transportation curriculum with research outcomes; and broadening the participation of K-12 students in the annual summer "Transportation Camps" as well as underrepresented students in the Artificial Intelligence club of a minority-serving institution.

The model proposed by Yang can resolve issues with data sparsity and noise, as well as facilitate a variety of smart-mobility applications. To support the streaming data, the project will create a novel physics regularized streaming learning that will have the ability to update the model performance in real time.

The result of this project will be to connect traditional transportation methods and approaches driven by data.
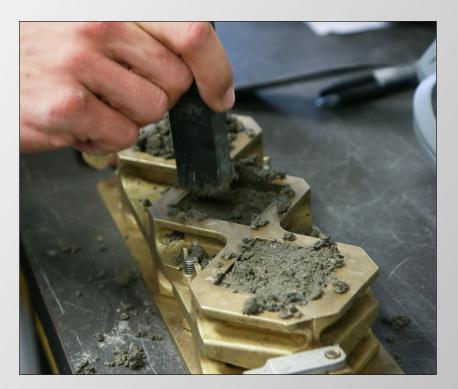
This new model can efficiently resolve the common data sparsity and noise issues and facilitate various smart-mobility applications. To accommodate streaming data, this project will also develop a novel physics regularized streaming learning framework that can efficiently improve the model performances in real-time. When dealing with big data, this project can further synergize data of different resolutions, fidelities, and sources to enable sparse Gaussian process and Bayesian committee machine for fast learning. This foundational research can enormously promote machine-learning applications in smart-mobility systems and contribute to formulating sustainable, scalable, and robust traffic flow models. This project will bridge the gap between classical transportation methods and data-driven approaches.

REIMAGANING UNDERGRADUATE TEACHING LABORATORIES

In 1892, the University of Utah's civil engineering program was the first engineering program established at the University of Utah. Over the past 130 years, it has expanded and evolved into what it is today. Now, the Department of Civil and Environmental Engineering, along with the College of Engineering, will expand and update student spaces in the HEDCO building. The demand to upgrade facilities to include hands-on application in virtual and augmented reality, structural health monitoring, remote sensing, smart parts, and drones became apparent as our program grows to accommodate the rapid move towards cyberinfrastructure.

The department identified 5,000 square feet between two floors in the building that will be renovated to house the core laboratories for civil and environmental engineering students. Currently, the HEDCO building hosts the Materials, Geotechnical and Environmental engineering teaching labs. In proposal, the Materials Engineering lab will be upgraded, and additional spaces to support students will be added.

First, a Cyber Infrastructure Lab will be added to support the development of a new integrated curriculum that will propel the area of sustainability engineering via technology. This lab will allow the department to expand the teachings offered and establish a new set of technical electives that enables CvEEN students to explore an emphasis in cybertechnology and how that can be applied in sustainable infrastructure. Courses in this area will provide students with knowledge in how smart infrastructure will be able to evaluate the quality of bridges, buildings, roads and more. In addition, students will learn how to provide emergency assessments after natural disasters or hazard events, identify alternate routes during emergencies, and prevent tragedies.

Next, the HEDCO building will house a new Maker Space. This space will allow our Introduction to Civil Engineering course to get hands on with different civil engineering concepts. In addition, the Makers Space will provide an area for groups and organizations to come in and learn more about civil and construction engineering concepts and take part in hands-on demonstrations. Instructors can develop novel experiments to aid with explaining the fundamentals of the core civil engineering concepts, such as statics, materials, water resources, environmental processes and cyber infrastructure. The lab will be equipped with 3D printers, laser cutters and other equipment. Office space for

SECOND FLOOR HALLWAY

a technician will be adjacent to the space, allowing students to work in between classes while providing supervision and someone who can assist them.

Third, the Hydraulics Laboratory will also be moved from its current location in the Merrill Engineering Building to a new space designed for CvEEN. This move will consolidate all four of the department's teaching labs into one building. By doing this, we can enhance the student experience. The Hydraulics Laboratory teaches how the movement of water in pipes, canals and rivers is necessary for designing systems for drinking and wastewater systems, as well as, protecting the ecosystem. The lab is a critical component of our water resources engineering program in CvEEN.

Lastly, the current Materials Engineering lab will be upgraded. As the department invested in the latest technology, modifications are required to ensure student safety and to allow for better access to the equipment used in the lab. The new lab also provides spaces for student groups to use, such as the ASCE concrete canoe project. In this space, students explore how materials, such as concrete and asphalt, are used and how these materials can be improved in our infrastructure.

The renovation is estimated to cost about $4 million, reflecting the need for upgrades due to the age of the building and for seismic upgrades and other structural elements. Construction is beginning in Fall 2021 and

estimated to be completed in time for Fall 2022. Private support is critical to the success of the HEDCO renovation project, and donations of $1,000 or more will be recognized on a display near the entrance. Naming opportunities are available from $10,000 and up. The work areas can be named for a donation of $50,000 or more, and the laboratory itself is available for $1 million. The major naming opportunities may be pledged over several years. To inquire about naming opportunities or for additional information, contact Josh Grant at josh.grant@utah.edu.

MAKER'S LAB

CONCRETE LAB

MEET OUR NEW FACULTY

CVEEN HIRES THREE NEW FACULTY FOR THE 2021 - 2022 YEAR

EMILY MARRON

Emily Marron joined the environmental engineering team as an assistant professor at CvEEN. her research and teaching interests are centered around environmental engineering, with a focus on contaminants in urban water systems. In particular, she is interested in evaluating the formation and fate of chemical compounds during drinking water treatment and advanced wastewater treatment for potable water reuse, with the goal of optimizing contaminant removal. Through her research, Emily Marron aims to protect the health of humans and the environment, and to better manage water resources in the face of climate change.

KAMI MOHAMMADI

Kami Mohammadi is an assistant professor of geotechnical engineering in the Department of Civil and Environmental Engineering. His research interests include the interface of computational geomechanics and dynamics, engineering seismology, and geo-data analytics. He applies his research in hazard assessment and mitigation, analysis and design of major infrastructure, non-invasive subsurface characterization, and large-scale monitoring of geo-structures. Kami teaches courses in mechanics and dynamics of geo-materials, computational geomechanics, and wave propagation in heterogeneous media.

SHAHRZAD ROSANKHAH

Shahrzad Roshankhah is an assistant professor of Geotechnical Engineering at the Department of Civil and Environmental Engineering. Her research interests include the evolution in the physical properties of natural and engineered porous materials upon heat and mass exchange, particularly, under extreme conditions (e.g., high stress, high fluid pressure, and high temperature). Shahrzad studies the involved multi-physics and multi-scale phenomena through laboratory experimental and numerical modeling, where she utilizes state-of-the-art laboratory monitoring and numerical simulation techniques. Her objective is to design sustainable geo-energy and geo-environmental infrastructure, such as enhanced geothermal energy, unconventional fossil energy, and thermal energy geo-storage systems.

STUDENTS HELPING STUDENTS
CVEEN STUDENTS RUNNING DEPARTMENT TUTORING CENTER

Engineering is known to be a highly technical field for students to go through, so the University of Utah's Department of Civil and Environmental Engineering created a student-based tutoring program to provide an additional resource to help students succeed.

As a department, the technical courses students go through in their junior year are usually the most challenging. Three courses – Statics, Strengths of Materials, and Structural Analysis – are historically difficult courses within the CvEEN program. In order to promote success, a free tutoring center was developed where students who already passed the courses are hired to help students going through the classes. This student-helping-student model is beneficial for both the tutor and student being tutored.

"The tutoring center has helped me to see that students are willing to take responsibility for their learning," Braden Miles, one of the tutors and junior CvEEN student, said. "It's also helped me solidify the concepts for myself. Tutoring students forced me to explain difficult concepts in simple ways."

Fall 2021 is the first semester the tutoring center is in-person and has been a wonderful resource for students going through the CvEEN program to get help outside of class and faculty office hours. The tutoring center is open Monday through Friday for drop-in tutoring. The central location of the tutoring room makes it easy for students to stop by and get help while they study.

Not only do the students being tutored get help, but the tutors themselves gain professional development skills to help them with their career. "Tutors receive professional development in their role which includes monthly trainings through the Learning Center," CvEEN Academic Advisor Olivia Calvillo said. "These trainings are based on the College Reading and Learning Association tutor training curriculum and provide great experience for our students!"

FIRST CONSTRUCTION ENGINEERING GRADUATE

The Department of Civil and Environmental Engineering graduated the first Construction Engineering Student in May 2021. The University of Utah is the only university in the state of Utah that offers a degree in Construction Engineering. Through the program, students learn principals of both Civil Engineering and Construction Management, which allows graduates to apply unique perspectives in the industry.

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