

utah

ENGINEERING



TRAIN OF THOUGHT

CATHY LIU STUDIES PUBLIC TRANSIT AND TRAFFIC

PLAYING IN TRAFFIC

University of Utah civil and environmental engineering assistant professor Xiaoyue Cathy Liu feels your pain.

She knows that for many people there are two times of the day they dread — the morning and afternoon commute. Blame the rise in traffic. Since 1990, the number of miles Americans drove each year increased more than 46 percent, according to the U.S. Dept. of Transportation. Liu has devoted her career to taking the sting out of driving in congested traffic by researching both how cars get backed up on the freeways and how we can improve public transportation to make it more attractive for commuters.

“This career can actually make a difference in people’s lives,” she says about her work in transportation engineering.

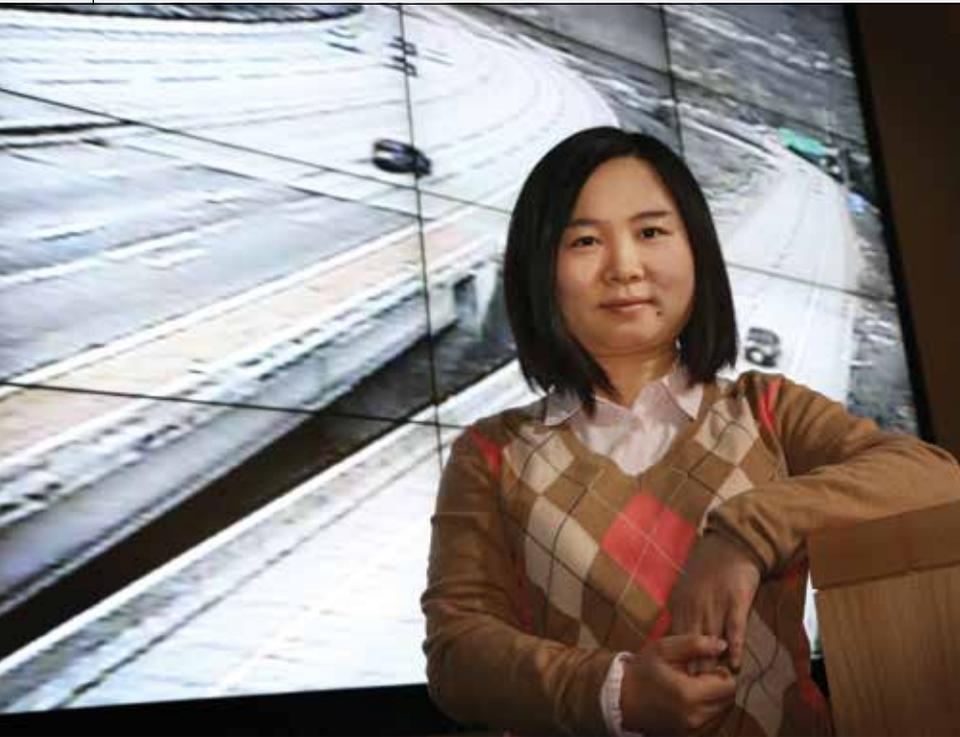
Liu’s research is divided into two areas: analyzing all sorts of traffic data, and determining the best ways to get people to use public transportation such as subways, buses and commuter trains.

FREEWAY FACTS

Liu’s data-driven research involves coming up with an algorithm to determine how and why traffic slows to a crawl under certain circumstances, known as “incident-induced delay.” She is examining how space between cars and time is affected due to minor occurrences or obstacles, such as curves or hills in a freeway that cause traffic to slow down.

“What we are trying to find out upon the occurrence of an incident is what is its impact to traffic? How would you quantify the delay? What kind of delay would each and every vehicle experience?” says Liu, who is using traffic data from Interstate 15 along the Salt Lake Valley for her research. “As long as you have the incident data and traffic-flow for any corridor or network, we can adopt that algorithm to that particular roadway segment to determine what is the impact of each and every road incident.”

While this research is in its early stages, so far her traffic analysis has been published in the latest edition of the National Academy of Sciences’ Highway Capacity Manual, the guide transportation managers and engineers use.



Another data-based research Liu is working on involves cataloging the condition of roadway infrastructure such as road signs. In all, her research will look at 16 factors that affect roadway conditions, including vegetation obstruction, littering, guardrail conditions and painted markings on the road. This is a project she is developing for the Utah Department of Transportation's (UDOT) maintenance division.

Her results from the project will be implemented in a future update to the maintenance Management Quality Assurance Plus Program, which evaluates and reports the effectiveness of the state's maintenance activities.

ALL ABOARD

Meanwhile, Liu is trying to relieve freeway congestion another way — by enticing more people to use public transit.

Currently, she is poring over data related to Utah's mass transit systems, including buses and its light rail system known as TRAX, to figure out why riders like certain routes and not others. She is also researching how easy or difficult it is for riders to

drive or bike to and from a particular train station, all factors known as the "first mile, last mile."

"If you make the first and last portion of the trip [to and from a train station] easier for people it becomes more attractive for them to use," she says.

She's also collaborating with Salt Lake City on its successful GREENbike sharing program in which people can rent a bicycle at one of many downtown stations. She is examining rider data to determine why people like certain bike routes over others.

A graduate of Beijing Jiaotong University in electrical engineering, Liu eventually turned to civil engineering after working with an advisor on aviation data. She received her master's in transportation planning and management at Texas Southern University and a Ph.D. in civil engineering at the University of Washington.

"Once I got into the program, I was exposed to all fields of transportation — from planning, to operations, and using simulation technology to evaluate how congested roadways can be," she says. "It's something that people experience every day but not everyone can explain why it happens."

ROBOTIC RESEARCH

From the hulking Terminator to the lovable R2-D2, people's notion of what robots are has been shaped mostly by science fiction. But science fact is much different. Robotics can range from sophisticated tools on manufacturing lines to precise machines that perform delicate surgeries.

At the tip of robotics research are faculty members from the University of Utah's Department of Mechanical Engineering and the School of Computing who have been developing the next generation of autonomous machines. Now, their work will be receiving even more recognition in the future — the Utah State Board of Regents has approved the new University of Utah Robotics Center (UURC), the latest addition to the list of research centers for the U's College of Engineering.

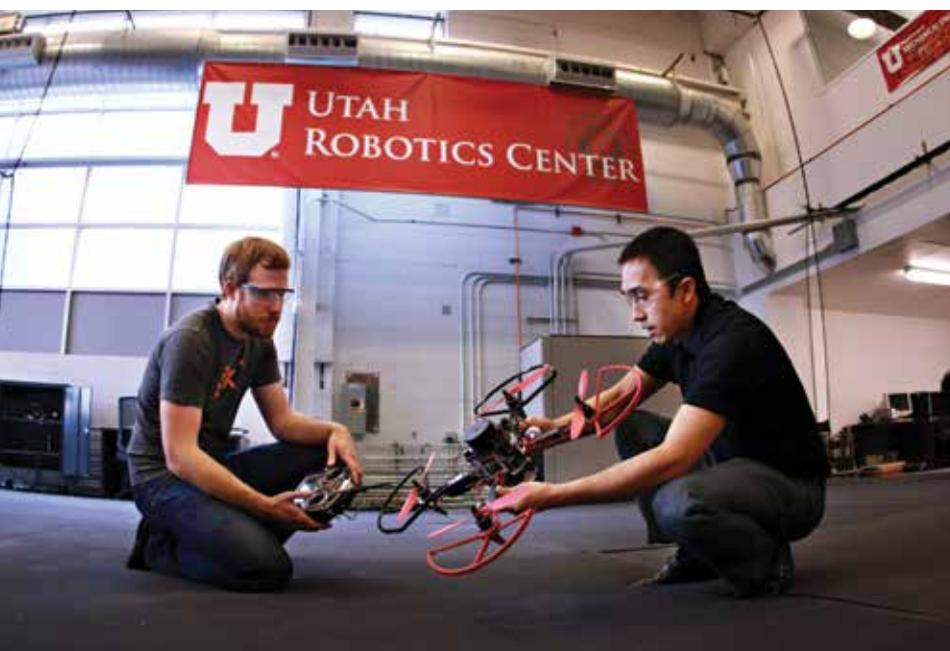
"The advantages of this are really about visibility — you might say a sense of identity. It identifies us as a center of excellence as a robotics center in the state of Utah and elsewhere," said School of Computing professor John Hollerbach, co-director of the center and director of the school's robotics track. "It's our hope that our increased visibility with the center translates into higher goals in terms of funding and grants. We also hope it will attract more people, more students, more faculty and visitors."

The center is the consolidation of eight faculty-run labs researching a wide array of fields in robotics including medical robotics, machine learning, autonomous robots, self-driving cars, human motor control, drones, climbing robots, and robot vision. In addition to the individual labs, the center also received two larger lab spaces in the newly-refurbished Rio Tinto Kennecott Mechanical Engineering Building.

Another focus for the lab will be its continued outreach effort, promoting science and math for younger students throughout the state. That includes sponsoring summer computing camps for K-through-12 students as well as helping organize the regional FIRST Robotics and FIRST LEGO League competitions.

The UURC offers a master's degree and Ph.D. in the Robotics Track, a joint program of study. It was the second robotics program ever offered in the U.S. and has five faculty members from the mechanical engineering department and four from the School of Computing.

"The center will not only provide the foundation for the Robotics Track but also allows our research and curriculum to flourish even more," said U mechanical engineering associate professor Mark Minor, co-director of the center. "The center also provides a focal point for youth considering STEM careers."



ALUMNUS SPOTLIGHT

SCOTT GOCHNOUR

Scott Gochnour wanted to make sure that life-saving medications would always be affordable for all people, and he did two things to make that happen: In 1988, he joined a local start up then known as TheraTech that produces innovative drug delivery systems as well as generic drugs, and then he stayed with that company his entire 28-year career to ensure its massive growth.

It's a rarity, Gochnour says, for anyone in the pharmaceutical industry to stay with the same firm their entire career, but how could he leave Utah, he asks?

"I had my family here, and it's a great place to live," said Gochnour, who received his bachelor's at the U in materials science and engineering in 1988 and is now vice president of global generic research and development at Actavis, a division of Allergan, the company that now owns TheraTech. "It just seemed to always work out that I was growing with the company."

When Gochnour joined TheraTech in 1988, a small pharmaceutical business started by two University of Utah professors and Utah investor Dinesh Patel, he was one of just nine employees. Today, the company is about to merge with the largest generics pharmaceutical company in the world and has more than 500 employees on a 14-acre site in the University of Utah's Research Park.

"I just love what I'm doing," he says. "I feel like I'm contributing to people's health and coming up with newer, safer drugs over the years that allow them to live a healthier life. And I'm helping them out by providing them at a cheaper price."

As head of research, Gochnour's job is to manage three international teams in the development of new "transdermal" products, drugs that are delivered to the body through the skin, either through patches similar to a nicotine patch or films that dissolve in the mouth. They include a patch that delivers pain medications for sufferers of orthopedic and cancer pain and another that delivers



testosterone or estrogen for hormone-replacement therapy. All are generic forms of earlier drugs that are now much more affordable than the name brands.

Gochnour was just a teen-ager when he was captivated by the story of the first artificial heart — Jarvik 7 at the University of Utah — and its first patient, Barney Clark. That incident sparked Gochnour's interest in bio-materials and engineering. He considers himself lucky, he said, because he knew early on what he wanted to do in life and stuck with it. Despite unsuspecting fears, he jumped into his career and never wavered, he said, advice he would give any engineering student.

"A lot of people in STEM careers just aren't sure what to expect, and even I didn't," he said. "But my personality fit into engineering because I love dealing with problems and I love to troubleshoot. I like to prove to people who say you can't do something that they can be wrong and that I can overcome those obstacles."

IN BRIEF

WALKWAY NAMED “JOB’S CROSSING”

The new pedestrian walkway that connects the recently-refurbished Rio Tinto Kennecott Mechanical Engineering Building to the rest of the University of Utah campus is now officially called “Job’s Crossing.”

The naming of the walkway is due to the generous donation of a leadership gift to the College of Engineering by alumnus Jason Job, founder of industrial engineering and construction firm, Job Industrial Services.

Job (pronounced Jōb, as in the biblical figure) earned his bachelor’s in chemical engineering at the U in 1997 and credits his experiences here for a booming career, which ultimately led to him starting his own successful business.

“The reason I contributed to it is because of the education I received at the U and the help they [professors] gave me in getting my first job. I am very grateful,” he said. “It’s time to give back to the sources that helped me.”

The 114-foot-long Job’s Crossing is a walkway that spans across North Campus Drive, providing a safer more ADA-accessible crossing route for students and faculty. In addition to the bridge, the area also includes a bus stop with shelter and a new snow-melt system. The walkway, which was completed last fall, improves pedestrian safety while also easing traffic flow along 100 South and North Campus Drive.

“I can’t imagine the building without the bridge. Not only is it aesthetically pleasing to look at, but it also provides an essential connection to the campus,” Tim Ameel, chairman of the U’s Department of Mechanical Engineering, said about the necessity for Job’s Crossing. “We have estimated the number of crossings each weekday to be in the thousands. The bridge provides a safe way to cross the highway and also minimizes traffic backups.”



DEANS RECEIVES NSF CAREER AWARD

University of Utah bioengineering assistant professor Tara Deans is the recipient of the National Science Foundation’s Career Award for her research in manipulating adult stem cells to control the production of blood platelets and red blood cells, key elements in helping blood clot after a serious wound. The five-year grant is for more than \$500,000.

Deans’ research is in “synthetic biology,” the science of designing and building new biological components and systems for the human body. She is studying how adult stem cells can naturally make the choices to become either red blood cells or platelets in order to help heal traumatic wounds. This research could ultimately aid doctors in controlling the production of red blood cells and platelets in the lab so victims in accidents or battlefields don’t have to rely on the availability of live donors for transfusions.

“There are a lot of diseases where people don’t make enough red blood cells or platelets,” Deans explained. “So this is about understanding the mechanisms of these cell choices. Once we understand that, then we can use approaches in synthetic biology to control the various signals responsible for cells becoming red blood cells and platelets. This is an important first step in understanding how we can produce these cells for healing injuries and diseases in the human body.”



IN MEMORIAM: STEPHEN C. JACOBSEN

Some called him Utah's real Iron Man. Stephen C. Jacobsen was a brilliant scientist who created wondrous technology in the field of robotics, including the Sarcos exoskeletal robotic suit and the "Utah Artificial Arm" mechanical prosthetic.

"Dr. Jacobsen was the embodiment of an integrator. He lived to design," said friend John E. Wood, a former University of Utah bioengineering professor who worked with Jacobsen.

Jacobsen, University of Utah Distinguished Professor Emeritus of Mechanical Engineering and one of the College of Engineering's most illustrious alumni, passed away April 3 at University Hospital in Salt Lake City of a stroke. He was 75.

"Many of his inventions were successfully marketed through companies he founded, and they are still improving our quality of life," said Richard B. Brown, dean of the U's College of Engineering.

Jacobsen's research into robotics would lead to many innovations via the company he founded in 1983, Sarcos, a Salt Lake City-based research and development firm that designs and manufactures robotics systems. While head of Sarcos, Jacobsen developed the exoskeletal robotic suit for soldiers. In 1973, Jacobsen — with the help of other engineers — created the "Utah Artificial Arm," a prosthetic for amputees.

He was born in Salt Lake City and received his bachelor's and master's degrees in mechanical engineering from the University of Utah and a Ph.D. in mechanical engineering from the Massachusetts Institute of Technology in 1973. After MIT, Jacobsen became a professor in the U's Department of Mechanical Engineering, and he also had appointments as a research professor in the U's bioengineering and computer science departments as well as in the Department of Surgery. He was named a Distinguished Professor of Mechanical Engineering in 1996 and Distinguished Professor Emeritus of Mechanical Engineering in 2013.

In his career, Jacobsen and his companies have acquired more than 200 patents, and he led nearly 360 research projects in chemical sensing, virtual reality interfaces and drug delivery systems. He also developed linear scale sensors and other microscale devices, coining the term "MEMS," for microelectromechanical systems. He received countless honors and was named a member of the National Academy of Engineers, the American Institute for Medical and Biological Engineering and the National Academy of Inventors.

Jacobsen is survived by his wife Lynn, daughter Genevieve Boyles and son Peter Jacobsen. The family held a private memorial service April 22.

To read a family tribute, go to: www.coe.utah.edu/jacobsen





COLLEGE OF ENGINEERING

OFFICE OF THE DEAN

72 S. Central Campus Drive
Salt Lake City, UT 84112-9200
www.coe.utah.edu

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STUDENT LIFE

SCIENCE OF SKIING

University of Utah senior Kelan Albertson found his way to materials science and engineering via the ski slopes.

An avid downhill skier since he was 3 years old, Albertson was so enamored with the winter sport he decided to go into engineering mostly because he wanted to work in the ski industry developing new materials and designs for skis.

“It [skiing] is a hobby, and it’s a big reason why I’m in materials science,” says Albertson, who went to high school in Boise before attending the U. “It’s become very powerful because it was a factor for me to come down to Utah to begin with and to choose this path for the rest of my life.”

While skiing was the impetus for his engineering education, Albertson’s focus in materials science while attending the U has been on something entirely different — fuel cells and drug delivery. He has been helping material science and engineering professor Shelley Minter develop tiny fuel cells for medical implants that are powered through a process in which the body metabolizes things including carbohydrates, sugars or protein. This could power future devices such as health monitors.

Meanwhile, Albertson also has been working with another advisor, materials science and engineering assistant professor (lecturer) Jeffrey Bates, on a project involving



special contact lenses that act as a drug delivery system for glaucoma patients. He is researching the synthesis of a pH-sensitive hydrogel that would work in a lens that delivers medication to the eye over a period of time.

Once out of college, Albertson would like to take his knowledge in engineering to develop the ultimate pair of skis or perhaps even develop new composites that could improve other types of outdoor recreational equipment. He said his journey through the U’s College of Engineering has been an exhilarating experience that has expanded his horizons and prepared him for a career in engineering.

“It’s tough to leave. I’m not ready to stop being a student,” he says. “I’ve met a lot of great professors who really care about us, and I can’t say enough about my time here at the U.”