UC San Diego
Jacobs School of Engineering

Pulse

SPRING 2016

CONTEXTUAL ROBOTICS INSTITUTE

engineering + social sciences

Robotics Institute Launched

In October 2015, we launched the Contextual Robotics Institute at UC San Diego. Many people have asked about the term "contextual robotics." The answer is both straightforward and forward-looking: context is necessary for autonomy. Robots that rely on context in real time will pave the way for many safe and useful robotics systems that work up-close and personal with people, and with other robots. Elder care robots and assisted living robots are just two examples. This next generation of context-sensitive robots will transform medicine, transportation, environmental sensing, advanced manufacturing and many other areas, thanks to their ability to perceive, process and act upon context in real time.

We founded the Contextual Robotics Institute as a collaboration between the Jacobs School of Engineering and the UC San Diego Division of Social Sciences. More than 42 professors and research scientists from engineering and the social sciences joined the Institute at its launch. Their teams of professors, researchers and students will perform approximately $50 million in robotics-related research over the next 4 to 5 years. The students on these teams are cutting their teeth on tough problems at the intersection of sensing and perception; cognition and coordination; and mobility and manipulation. The image on the cover of this issue of Pulse illustrates a related controls project, which you can read about on pg. 10.

As part of our investment in the future of robotics, we are growing our robotics faculty. The Jacobs School recently hired four new robotics professors and we are in the middle of three more robotics faculty searches. This is in addition to our recruitment for a faculty director for the Institute, which is also in progress.

Our robotics institute builds on key strengths in San Diego and the greater CaliBaja region including wireless, defense, software engineering and analytics, artificial intelligence and advanced manufacturing industry sectors. We are leveraging these strengths on both sides of the U.S.-Mexico border to build a world-class center for the design, development and production of useful robotics systems that act based on a real-time understanding of the world. In October 2015, we held our second Contextual Robotics Forum at UC San Diego. This annual event is one of the ways we strengthen our regional robotics ecosystem. Please join us in our work to propel CaliBaja forward as a world leader in robotics. Feel free to reach out to faculty directly via our website: ContextualRobotics.ucsd.edu or contact me at:

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Albert P. Pisano, Dean

Jacobs School of Engineering

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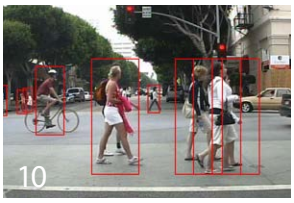

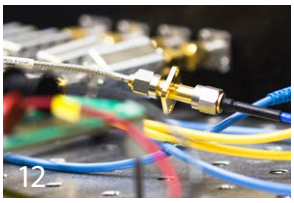

FRONT COVER

Turtlebots and quadcopters serve as a testbed for developing effective human-swarm interaction techniques that allow one person to control and interact safely with a robotic swarm (pg. 10).

BACK COVER

Engineering leaders start here. Nearly 1,800 engineers and computer scientists graduated from the Jacobs School of Engineering in 2015.

Engineering Student Success

On a Tuesday afternoon in December, half a dozen engineering students huddled around a table in a Jacobs Hall study room. The group, made up of two tutors and a handful of students, mostly freshmen, was working on intervals.

Joanna Ly went over the concept, while her tutoring partner Ashley Qu wrote out questions on a white board for the students. "I always come in here nervous and worried that I won't have all the answers," said Ly, a sophomore chemical engineering major. "But they get it and it feels great. It's extremely rewarding."

The study group is part of Learning Communities, a program that is itself part of the larger Student Success Initiative launching this year at the Jacobs School of Engineering. The Student Success Initiative is a master plan for student success at the Jacobs School, which aims to increase retention and diversity.

"We want to provide an atmosphere of excellence and support for all our students," said mechanical engineering professor Olivia Graeve, who is the program's faculty leader. "We want to support all our students and prepare future engineers who have the skills to engage effectively with an increasingly diverse society."

Within that framework, Learning Communities creates formal study groups. The goal is to provide students with a supportive environment where they can develop confidence while building study skills and learning the value of studying in a group setting. Groups meet two or three times a week for two-hour stretches. The study groups provide support for calculus and physics classes. The program is at a pilot stage this year, and will expand next year.

"This is a huge university, so it's nice to have a study group already set up for us," said Pamella Abergas, a first-year environmental engineering major. "It's easy to feel isolated." The study group has helped her stay focused and accomplish her goals, she said. "If I have trouble in a class, I come here before I go to office hours."

The study groups reinforce concepts ahead of tests, said Aliya Kassam Pirbhai, a freshman mechanical engineering major. "We go over everything we need to know, the theory and the formulas," she said. She moved from the Ivory Coast to San Diego in fall 2015. The Learning Communities program has helped her ease in to her new life, she said. "It's very helpful."

Math Matters

What equations do you need to build a robot's arm? Or MIT's cheetah robot? What math do you need to run Tesla's manufacturing plant? Students tackle these questions — and more — in the new "Engineering Applications of Mathematics" module, part of the existing ENG 1-2-3 course series offered by the IDEA Student Center at the Jacobs school. Lectures are reinforced with hands-on labs, where students also learn to use MATLAB and Python. "It is well known that student success in engineering is highly dependent on student success in math, and perhaps more importantly, on the ability to connect and apply the math to the engineering," said Michelle Ferrez, IDEA Student Center Director. "Our goal is to better prepare our engineering students for the type of learning and applications that are required of them as undergraduate engineering students and to ensure that we provide the resources and opportunities for them to succeed."

LEARN MORE: IDEA.ucsd.edu

Student Success Initiative group study session

RELEVANCE AND EXCELLENCE

New research centers help industry connect with teams of professors and graduate students

In 2014, the Jacobs School of Engineering reinvented the way it launches and runs new research centers. Two years later, eight "agile research centers" are the result of this move; and more centers are on the way. Each center is focused on issues critical to society and serves as a platform for interactions between research teams at UC San Diego and industry partners with mutual research interests.

"We are a big school, a powerful school, a diverse school," said Albert P. Pisano, Dean of the Jacobs School of Engineering. "We launched the agile research centers program to harness the creativity of the faculty for maximum impact. Each agile center is built around a research vision that addresses big challenges facing society that no individual professor, lab or industry partner could take on alone."

The latest two centers are the CaliBaja Center for Resilient Materials and Systems (pg. 6) and the Center for Microbiome Innovation (pg. 7).

"We maintain all the science, engineering fundamentals and rigor as we focus on relevance to society," said Pisano.

The Center for Wearable Sensors was the first agile center to launch. Professors Joseph Wang and Patrick Mercier pulled together a broad palette of expertise and built a research center focused on developing and integrating the hardware, software, sensors, and data-analysis tools required to realize the promise of wearables for human health, medicine, environmental monitoring and much more.

"Our faculty self-organize around research areas and challenges, where they can have an outsized impact in both academia and in real-world applications," said Pisano.

Rob Knight, a pediatrics and computer science professor, recently launched the Center for Microbiome Innovation (pg. 7). The center pulls together many existing strengths across campus to harness complex microbial communities for the benefit of humanity. Improved human health and agriculture as well as nearly limitless renewable energy are just a few of many possibilities.

LEARN MORE: bit.ly/ARcenters

JACOBS SCHOOL AGILE RESEARCH CENTERS

- CaliBaja Center for Resilient Materials & Systems
- Center for Extreme Events Research
- Center for Microbiome Innovation
- Center for Visual Computing
- Center for Wearable Sensors
- CHO Systems Biology Center
- Sustainable Power and Energy Center

Want to connect with the Jacobs School about an agile center or another university-industry collaboration?

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CaliBaja Center for Resilient Materials & Systems

RESILIENTMATERIALS.UCSD.EDU

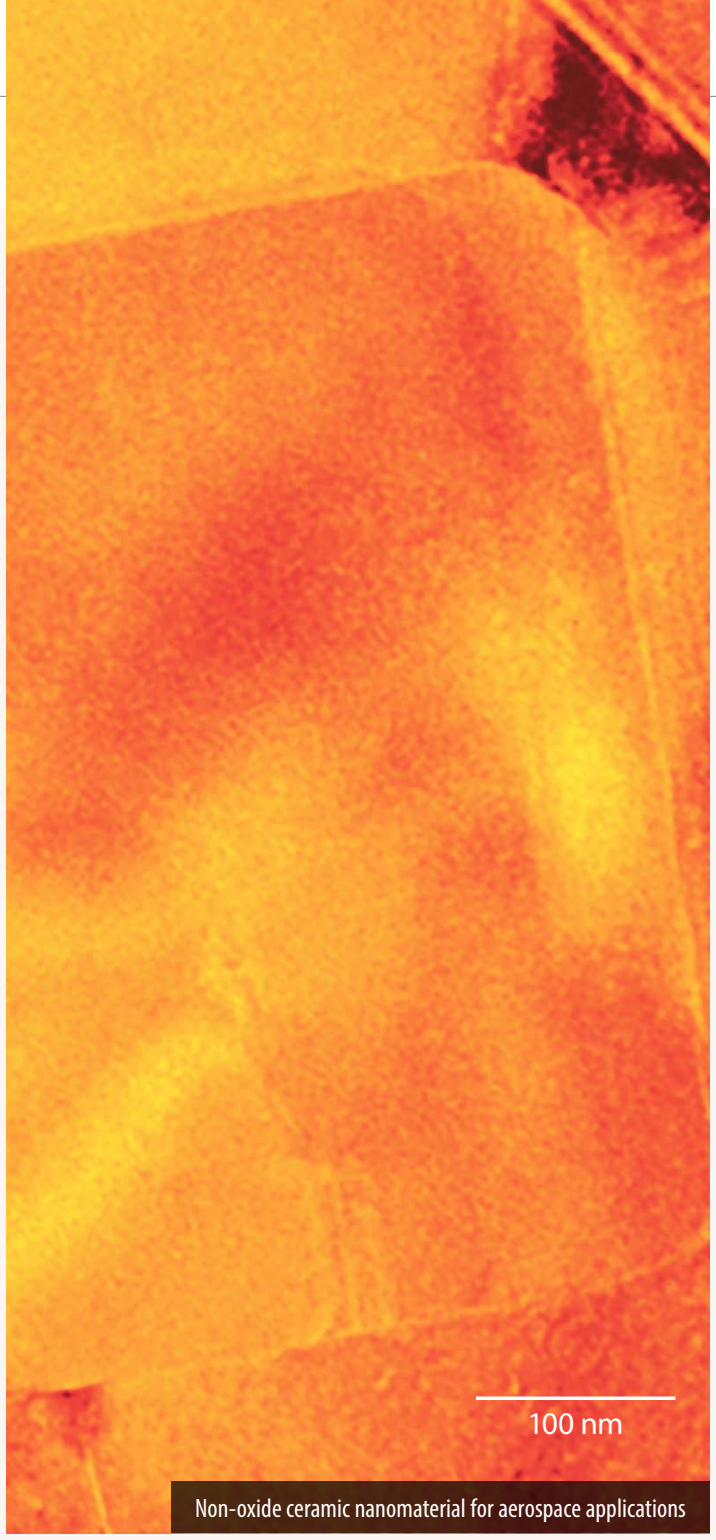
We revolutionize the design, testing and manufacturing of materials and systems for extreme environments.

ULTRA-HIGH TEMPERATURES | ACIDIC CONDITIONS | RADIATION | ULTRA-LOW TEMPERATURES | EXTREME DEFORMATIONS | EXTREME PRESSURES

A wide range of industries, including aerospace, nuclear, defense, biomedical, pharmaceuticals, energy and advanced manufacturing work in entreme environments. Innovation in these areas often requires new classes of materials and new devices with extraordinary tolerances, such as materials that can withstand temperatures of up to 4,000 degrees Fahrenheit before melting. And sometimes "extreme" means "extremely small." Center researchers, for example, are developing new ways to handle liquids at the micro- and nano-scale. This work has applications for biomedical devices such as skin-based sensors, as well as water desalinization and other environmental applications.

Creating 21st Century Technologists

"Developing tomorrow's high-tech, cross-border workforce is critical to the growth of the San Diego-Tijuana region," said mechanical and aerospace engineering professor Olivia Graeve, the director of this new Center. Graeve and her colleagues at UC San Diego are collaborating with the UNAM Center for Nanoscience and Nanotechnology (CNyN-UNAM) in Baja California to develop 21st Century technologists with the talent and cultural fluency needed to forge global collaborations that leverage the CaliBaja border region's industrial strengths.



Non-oxide ceramic nanomaterial for aerospace applications

MATERIALS DESIGN AND COMPUTATION

CHARACTERIZATION AND DIAGNOSIS

ECONOMIC EVALUATION

MANUFACTURING AND INTEGRATION

SYNTHESIS AND FABRICATION

TALENT DEVELOPMENT

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Center for Microbiome Innovation

MICROBIOME.UCSD.EDU

UC San Diego is at the forefront of the microbiome revolution.

Microbiome research is disrupting drug development, clinical medicine, agriculture, environmental science and much more. UC San Diego is a hotspot for this work, thanks to a network of collaborating, world-leading labs in microbial ecology, genomics and other "omics" sciences, big-data science, as well as fundamental, environmental and clinical research.

Collaborate with us.

Research Partnerships

Our work has profound potential for improving human health and well-being, personal care products, agriculture and veterinary science, food science, renewable energy production, and ecosystem protection and function in the face of climate change.

Technology Development

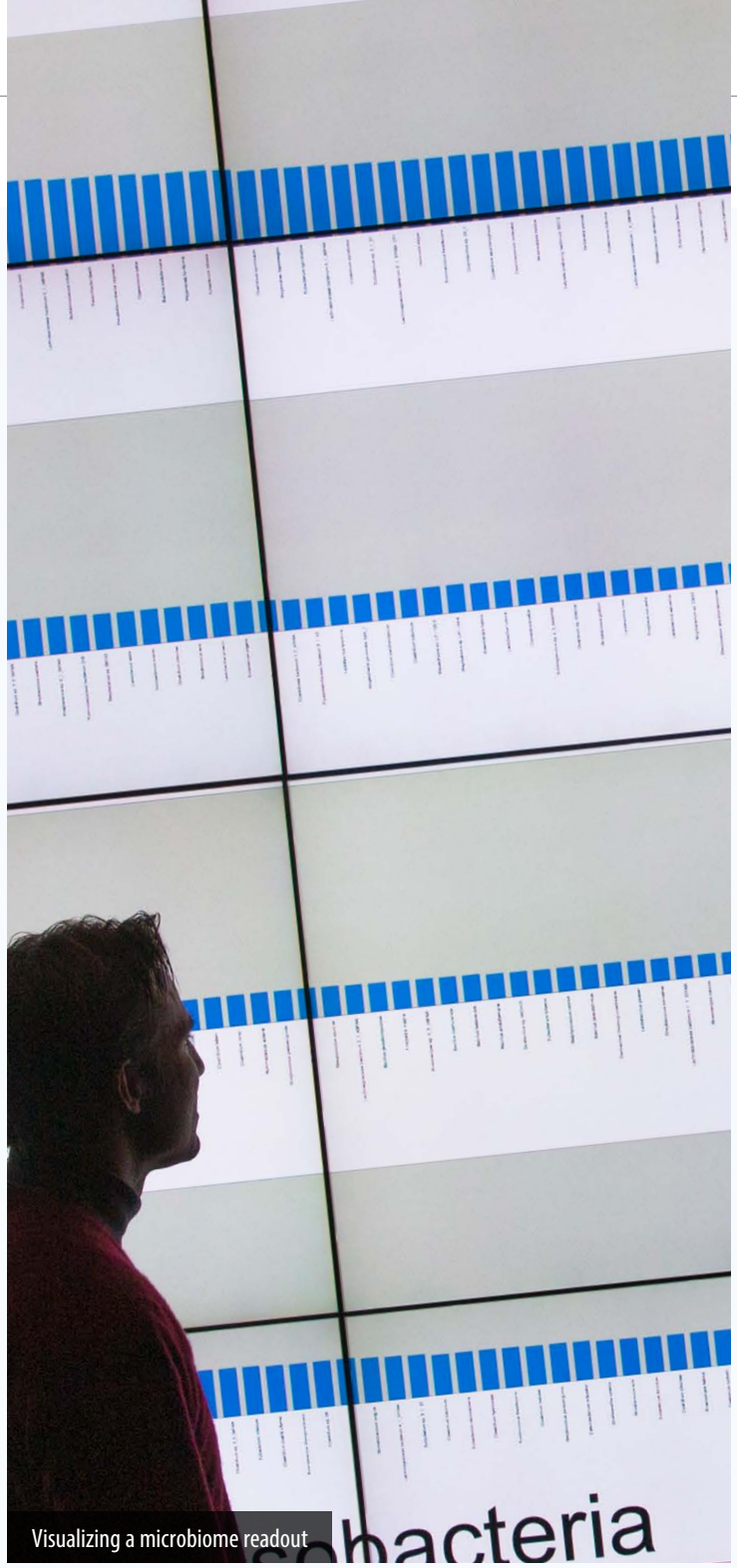
We have the context crucial for the development and testing of tomorrow's game-changing microbiome sample-reading, processing, metabolomics analysis, and data-analysis tools and systems.

Rapid Response

Rapid turnaround for sample readout and analysis. Research teams around the world with interesting microbiological samples rely on our best-in-class microbiome and metabolome data generation and analysis expertise.

Microbiome Workforce

We prepare students from the life sciences, engineering, computer science and medicine to innovate and lead in the rapidly evolving disciplines crucial for leveraging microbiome science for real-world applications.



Visualizing a microbiome readout

Research Strengths Converging at the Microbiome

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- #1 RANKED BIOMEDICAL ENGINEERING PROGRAM
- WORLD LEADERS IN "OMICS" SCIENCES
- DRUG DISCOVERY AND PERSONALIZED MEDICINE
- CELLULAR AND CHEMICAL IMAGING
- BIOLOGISTS WITH BIG-DATA EXPERTISE
- DISEASE DIAGNOSTICS AND CLINICAL TRIALS
- QUANTITATIVE MEASUREMENTS AND MODELING
- BIG-SCIENCE COLLABORATIVE RESEARCH INFRASTRUCTURE
- UNDERSTANDING AND FIGHTING ANTIBIOTIC RESISTANCE

CONTEXTUAL ROBOTICS INSTITUTE

Integrating Disciplines for Contextual Robotics

Helpful robots will act based on the physical context, the emotional context and the sociological context that they perceive in real time. Engineers and social scientists from UC San Diego are working together to ensure that the robots of the future will not just do things better, but will be helpful to humanity.

Below are some of the research areas that the Jacobs School of Engineering and the Division of Social Sciences are advancing and integrating in order to develop safe and helpful robotics systems that see, think and do in real time, in the real world, often in close proximity to humans.

ContextualRobotics.ucsd.edu

SENSING + PERCEPTION

- Deep learning and statistical analysis of images and video for object detection, scene understanding and context sensing
- Computational models for recognizing actions and inferring intent and relationships
- Processing of inputs from real-life applications
- Sensing, control and optimization algorithms

COGNITION + COORDINATION

- Distributed decision making and evolution of group behavior despite uncertainty and limited communication
- Embodied Artificial Intelligence
- Synthetic brain architectures
- Methods of coupling high-performance computing and the Internet of Things with local planning and decision making
- Conveying ethical and moral imperatives to robot behavior

MOBILITY + MANIPULATION

- Biologically inspired actuators (limbs) and new materials
- Robust feedback control mechanisms for distributed, noisy, unknown environments
- Models using context to direct safe and appropriate action
- Coordinated fault-tolerant motion of multiple actuators or vehicles despite limited communications and time delays
- Nano- and micro-robotics

Smarter Smart Vehicles

A new generation of "smart" cars that enable safer, stress-free, efficient and enjoyable driving will soon hit the road thanks to research in the Laboratory for Intelligent and Safe Automobiles (LISA) at UC San Diego, led by electrical engineering professor Mohan Trivedi.

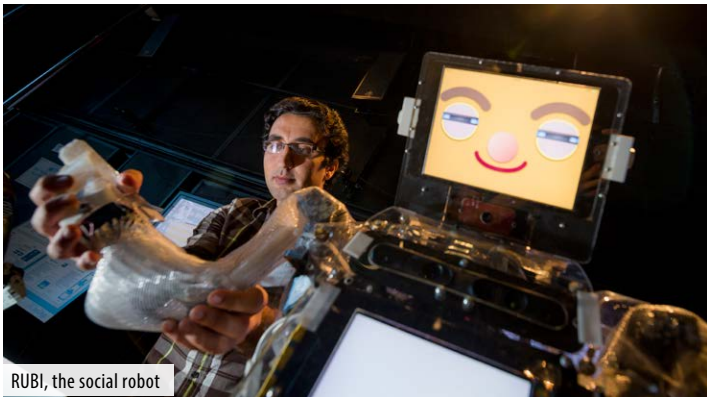
LISA's vision for intelligent vehicles is what Trivedi calls a human-centered distributed cognitive system, in which humans and robots cooperate with each other, rather than compete with each other. "This distributed cognitive system should be able to learn and execute perceptual, cognitive and motor functions in a synergistic manner, where humans and machines both understand the strengths and limits of one another," said Trivedi. A main goal of LISA, he added, is not for the car to completely take over the driving, but to better understand the driver to help avoid accidents and navigate through chaotic situations.

Over the last 15 years, LISA researchers have developed technologies to monitor and understand what's happening both inside and outside cars on the road. The team equips its vehicles with cameras and other sensors to observe the movement of the driver's head, eyes, hands and feet and to monitor the surrounding traffic. They then use these data to develop machine vision and machine learning algorithms that can learn the driver's patterns and predict the driver's intended maneuvers a few seconds before they happen.

Members of LISA in front of an intelligent testbed vehicle
Left to right: Frankie Lu, Mohan Trivedi, Sean Lee, Ravi Satzoda

Moving forward, LISA researchers are developing intelligent driver assistance systems that assess when it's safe to merge, brake, change lanes, accelerate and decelerate. So if drivers take their eyes off the road and begin swerving, cars could momentarily take control of steering and braking to avoid obstacles and collisions. During his talk at the Contextual Robotics Forum last October, Trivedi announced that these intelligent assistance features will be installed in the Audi A8 in 2017. Other versions of these systems are also being adopted for consumers in Asia and Europe.

Learn more: cvrr.ucsd.edu/LISA


RUBI, the social robot

Expression Detection

RUBI the robot is a preschool classroom veteran. With a screen for a head and a tablet for a body, she has helped researchers study the development of young children whose ability to speak is limited. RUBI teaches preschoolers colors, shapes and songs. She is equipped with a computer expression recognition toolbox, and some of the technology that researchers developed on RUBI led to an algorithm that can detect smiles and is currently in use in Sony digital cameras.

RUBI is the brainchild of Javier Movellan, the founder and long-time director of the Machine Perception Lab, which also developed Diego-san, a robot that helped elucidate why infants smile at their mothers, and the Einstein robot, which helped researchers learn more about how both humans and robots perceive emotions.

Movellan is also a co-founder of Emotient, a pioneer in analyzing facial expression that was recently acquired by Apple, according to news reports. Movellan, Emotient co-founders Marni Bartlett and Gwen Littlewort, who are also from the Machine Perception Lab, and their team, developed a facial-recognition technology with applications in many fields. The startup's technology has helped advertisers assess how viewers are reacting to ads in real time. Physicians have used Emotient software to interpret pain levels in patients who otherwise have difficulty expressing what they're feeling, while a retailer has employed the company's AI technology to monitor consumers' reactions to products on store shelves.

Movellan, Bartlett and Littlewort are now at Apple's Cupertino headquarters, but the Machine Perception Lab will go on, said electrical engineering professor Ramesh Rao, director of the Qualcomm Institute, where the lab is housed. "We will expand the use of research around Diego-san as a testbed for developing new software and hardware for more specialized robotic systems," he said. "We are […] also leveraging the lab for faculty and staff researchers to develop other types of robotic systems to serve a variety of purposes and environments."

RUBI is joining the lab of cognitive science professor Andrea Chiba, where she will help researchers learn more about robot-human interactions in the classroom.

Robot Swarms + Humans

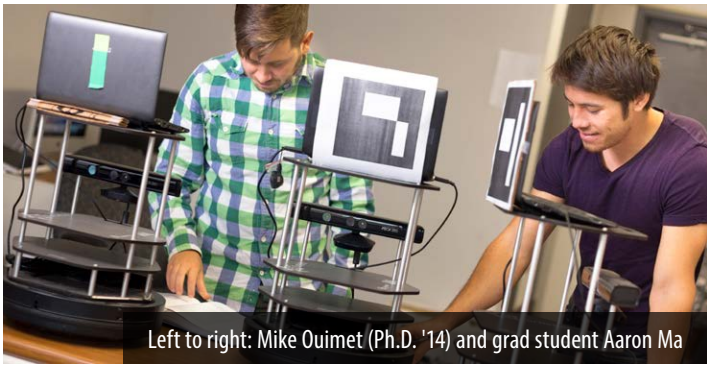
Q: What does it take to send a swarm of robotic scouts into a disaster area and get them to report back?
A: Complex distributed computing and controls algorithms.

Developing these kinds of algorithms is the challenge that Jorge Cortes and Sonia Martinez, both professors of mechanical engineering at the Jacobs School, have decided to tackle.

While it can take up to 30 people to safely operate a single unmanned vehicle, Cortes and Martinez and their research team are trying to "invert the pyramid" and get one person to control more than 20 robots.

To develop safe and effective human-swarm interaction techniques to control a swarm of robotic scouts, the researchers take into account the dynamics of each robot, the robot's decision-making process and robot-to-robot communications. A researcher giving input to the swarm of robots can generate a complex cascade of effects that must be understood across the swarm.

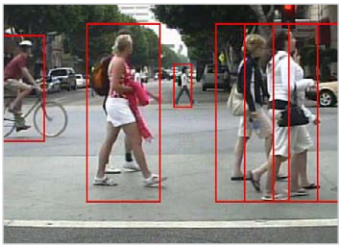
The team's first task focused on optimal swarm deployment in known environments. Researchers developed algorithms to get the robots to optimally cover a specific area. The network of robots can adapt when one robot fails or another is added. The algorithm can also take into account a wide range of factors, such as the robots' battery levels, to give the bigger territory to the robots with the most battery life.


Left to right: Mike Ouimet (Ph.D. '14) and grad student Aaron Ma

Cortes and Martinez's team used Turtlebots and quadcopters as a testbed for the algorithms. (See cover image.) The team includes graduate students Aaron Ma and Evan Gravelle and undergraduate students from several majors, including mechanical and electrical engineering and computer science.

Ma has developed an Android app that allows a user to easily specify a density function for an area, which then gets conveyed to the robotic swarm. The density function concept is the mechanism that enables seemingly effortless human-swarm coordination towards a common goal.

Next steps include applying these ideas in complex unknown scenarios, equipping the robots with better scene understanding tools and maybe even developing a brain-machine interface to control them.




Pedestrian Detector

Electrical engineers have created a new pedestrian detection system that's faster and more accurate than existing systems. The technology, which could be used in cars, robotics, security cameras and image and video search systems, is unique in that it analyzes video images closer to real time (2 to 4 image frames per second) with close to half the errors of existing systems.

The new system combines a traditional computer vision classification architecture, known as cascade detection, with deep learning models. Cascade detection works by cropping out areas in an image that are clearly not pedestrians, like the sky or empty road. While this method is fast, it isn't powerful enough to distinguish between a pedestrian and very similar objects like trees, which the algorithm could recognize as having person-like features such as shape, color and contours.

On the other hand, deep learning models are capable of complex pattern recognition, which they can perform after being trained with hundreds or thousands of examples, but they work too slowly for real-time implementation.

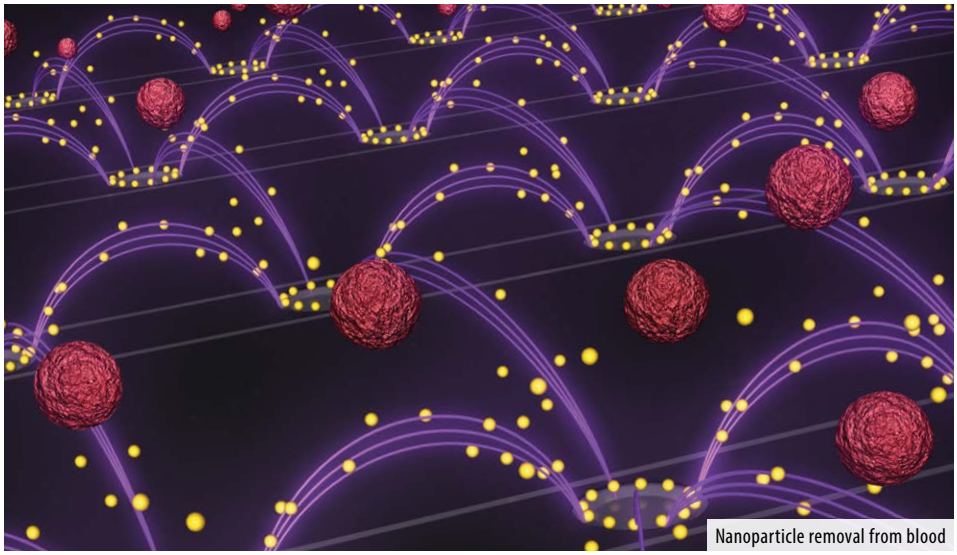
Electrical engineering professor Nuno Vasconcelos and his team developed an algorithm that takes the best of both worlds: it uses the quicker and simpler cascade detection technology to filter out most of the non-pedestrian parts of an image, then uses deep learning models to process the more complex remainders of the image.

According to Vasconcelos, this is the first algorithm to include stages of deep learning and cascade detection. "The results we're obtaining with this new algorithm are substantially better for real-time, accurate pedestrian detection."

The algorithm currently only works for binary detection tasks, such as pedestrian detection, but the researchers are working to make it detect different types of objects simultaneously.

Read more: bit.ly/pedestriandetection

Removing Nanoparticles from your Blood


Nanoparticle removal from blood

Nanoparticles — tiny objects 1,000 times smaller than the width of a human hair — are gaining popularity as vehicles for delivering drugs to targeted sites in the body. However, removing these nanoparticles from the bloodstream for further study is a time-consuming and challenging task. Nanoengineers at the Jacobs School have developed an electric chip that separates drug-delivery nanoparticles from blood within minutes.

The new technology will enable researchers to study what happens to drug-delivery nanoparticles circulating in a patient's bloodstream and determine whether these particles are compatible with a patient's blood.

"We were interested in a fast and easy way to take these nanoparticles out of blood plasma so we could find out what's going on at their surfaces and redesign them to work more effectively in blood," said Michael Heller, a nanoengineering professor at UC San Diego and senior researcher on the project.

The electric chip used to isolate drug-delivery nanoparticles was manufactured by Biological Dynamics, a Jacobs School spin-out which licensed the original technology from Heller's lab. The chip is the size of a dime and contains hundreds of tiny electrodes that generate a rapidly oscillating electric field that selectively pulls nanoparticles out of a plasma sample. After inserting a drop of blood plasma spiked with nanoparticles into the electric chip, researchers demonstrated nanoparticle recovery within seven minutes.

The technology works on different types of drug-delivery nanoparticles. Moreover, the technique doesn't require any modifications to the nanoparticles or plasma samples — an advantage over other nanoparticle separation methods.

The chip's ability to pull nanoparticles out of plasma is based on differences in material properties between the nanoparticles and plasma components. When the chip's electrodes apply an oscillating electric field, the nanoparticles' positive and negative charges re-orient at a speed different from the charges in the surrounding plasma. This momentary charge imbalance creates an attractive force between the nanoparticles and the electrodes. As the electric field oscillates, the nanoparticles gravitate toward the electrodes while plasma stays behind. The electric field is designed to oscillate at just the right frequency to do this: 15,000 times per second.

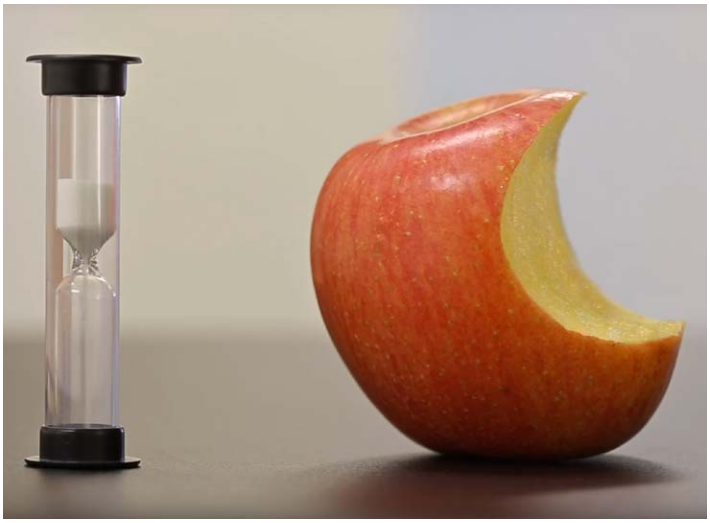
Slow Eating

In a pilot study, researchers investigate whether pausing between bites can help kids to avoid overeating.

Getting children to wait 30 seconds between bites of food just might allow them to realize early on that they're no longer hungry. And this could help keep them from overeating.

"To lose weight, you need to stop eating. But it's not that simple for most people," said bioengineering professor Marcos Intaglietta, a co-author on the new study. "So we decided to investigate how effective eating slowly would be."

The study's goal was to minimize the amount of food children ate before their stomach told their brain that they're no longer hungry — the so-called "satiety reflex," which takes about 10 minutes to kick in. "You can adopt this slow eating approach for yourself and keep it up for the rest of your life," said Jacobs School bioengineer and co-author Geert Schmid-Schönbein. "You can teach this approach to your children."



The study, a collaboration with physicians and researchers at higher education institutions in Mexico, showed that children didn't gain excessive weight when chewing slowly. The team would like to conduct further studies with a larger sample size both in Mexico and in Southern California.

(L-R) Eduardo Temprana, ECE Ph.D. student and first author on the Science paper and co-author Nikola Alic.

Faster Fiber Optics

On June 26, 2015 the New York Times ran an article with the headline "An Advance May Double the Capabilities of Fiber Optics." The story described Jacobs School research published in the journal Science. The next month, the same team of UC San Diego electrical engineers doubled those capabilities yet again. This work has the potential to significantly increase the data transmission rates and energy efficiency of the fiber optic cables and systems that we all rely on for the internet as well as our cable, wireless and landline networks.

"Today's fiber optic systems are a little like quicksand," said Nikola Alic, the project lead from electrical engineering professor Stojan Radic's lab. "With quicksand, the more you struggle, the faster you sink. With fiber optics, after a certain point, the more power you add to the signal, the more distortion you get, in effect preventing a longer reach."

The electrical engineers making these advances have figured out how to bypass "the quicksand effect" which has effectively capped how much power you can give to a fiber optic signal and still decipher it on the other end. This power limit caps the distance information can travel in fiber optic cables.

"Our approach removes this power limit, which in turn extends how far signals can travel in optical fiber without needing a repeater," said Alic, who earned his electrical engineering Ph.D. at UC San Diego in 2006.

Repeaters, also known as electronic regenerators, are expensive and power-hungry systems that extend the reach of fiber optic signals.

In lab experiments at UC San Diego's Qualcomm Institute, the electrical engineers successfully deciphered information after it travelled a record-breaking 12,000 kilometers through fiber optic cables with standard amplifiers and no repeaters.

The breakthrough relies on wideband "frequency combs" developed in Radic's Photonics Systems Group. The frequency combs described in their 2015 Science paper ensure that the signal distortions — called crosstalk — that arise between bundled streams of information travelling long distances through the optical fiber are predictable, and therefore, reversible at the receiving end of the fiber.

"Crosstalk between communication channels within a fiber optic cable obeys fixed physical laws. It's not random. We now have a better understanding of the physics of the crosstalk," explained Radic. This approach pre-compensates for the crosstalk that occurs between the multiple communication channels within the same optical fiber.

"After increasing the power of the optical signals we sent by 20 fold, we could still restore the original information when we used frequency combs at the outset," said electrical engineering Ph.D. student Eduardo Temprana, the first author on the Science paper.

According to Alic, this work could be implemented in real-world fiber optics systems in just a few years. The last big challenge is to get the pre-compensation step running in real time. Right now, it's being done offline.

Google supported this work through a research grant and Sumitomo Electric Industries provided fibers used in the experiments. Stojan Radic was recently named the Charles Lee Powell Professor in Wireless Communications at UC San Diego.

Earthquake Shake Table Wins $5.2M Grant


A soil box stands upon the shake table at the Englekirk Structural Engineering Center, awaiting testing.

A full-scale six-story steel-frame building; a low-damage column for bridges; and innovative designs to isolate buildings from earthquake forces. These are some of the projects that structural engineers at the Jacobs School and beyond will have the opportunity to test on an exceptional scale thanks to a $5.2 million grant from the National Science Foundation.

In the past 11 years, research at UC San Diego's shake table, the largest outdoor shake table in the world, has led to important changes in design codes for commercial and residential structures and new insights into the seismic performance of geotechnical systems, such as foundations, tunnels and retaining walls. It also has helped validate the use of new technologies to make buildings more likely to withstand earthquakes.

The five-year grant, awarded after a highly competitive process by NSF's Natural Hazards Engineering Research Infrastructure (NHERI) Program, will provide funding for the facility's operation and maintenance. "The data and fundamental knowledge provided by the landmark tests performed at this facility support the development, calibration and validation of the next generation of computer simulation models for civil infrastructure systems. They also allow us to continually improve design methodologies," said Joel Conte, the grant's principal investigator and a professor of structural engineering at the Jacobs School. "We are helping engineers come up with new concepts, new technologies and new seismic safety systems."

For example, the six-story building will be the first of its kind to be tested for seismic loading and post-earthquake fire. Its frame will be made of cold-formed steel (CFS), a light-weight material made from recycled steel that is easy to manufacture, durable and non-combustible. The project is sponsored by the steel and insurance industries, as well as the U.S. Department of Housing and Urban Development and the California Seismic Safety Commission.

nheri.ucsd.edu

Affordable Access to Nanotech for Companies


Inspecting silicon wafers used to manufacture Professor Todd Coleman's bio-sensors

UC San Diego recently won a $5.5 million grant from the National Science Foundation to advance nanoscale science, engineering and technology research. Part of the NSF award will enable UC San Diego to provide industry partners large and small with affordable, streamlined access to its state-of-the-art nanotechnology facilities and expertise.

"With this support and vote of confidence, we aim to double the annual number of user hours for our combined nanotechnology facilities and maximize the impact of nanotechnologies to as many fields of research and industry sectors as we can reach," said electrical engineering professor Yuhwa Lo, a principal investigator for UC San Diego's Nanotechnology Infrastructure.

UC San Diego's facilities include the 15,000 ft^2 Nano3 Nanofabrication Cleanroom and Characterization Facility and the Chip-Scale Photonics Test Facility — both based at the university's Qualcomm Institute — and several nanomagnetics research labs. To date, more than 110 companies and users from 180 university groups and national labs have used the Nano3 facility.

This program offers users from industry open, affordable access to a broad spectrum of nanofabrication and characterization technologies and expertise that enable and accelerate cutting edge scientific research, proof-of-concept demonstration, device and system prototyping, product development and technology translation. The initiative leverages specialized resources and expertise at UC San Diego for NanoBioMedicine, NanoPhotonics, and NanoMagnetics, enabling transformative research and education, and accelerating the translation of discoveries and new nanotechnologies to the marketplace.

For more information about how your company can benefit from these state-of-the-art resources: **sdni.ucsd.edu**.

Mary Bui-Pham

When Mary Bui-Pham completed her Ph.D. in chemical engineering at the Jacobs School ('92), she never dreamed she'd be known as "the fixer" at a major online media company. Now, she is the Chief-of-Staff for Publisher Products, a division of Yahoo!, Inc. that includes Yahoo.com, Yahoo Finance, Yahoo Sports, Tumblr, Flurry, and Polyvore. "I manage all the day-to-day operations for Publisher Products. If there's a football game on and something glitches on the Sports app, I immediately get a text from my siblings in Chicago about it. Chicagoans are always on top of that!"

What has your career path been like?

I received my Ph.D. in chemical engineering from UC San Diego in 1992, and then went on to do two postdocs. During that time, I was doing computational modeling of flames, and we had a big multi-lab/university project that was going to be part of Supercomputing '96…the notion of distributed computing was very new at that time. I realized that in the labs, we have more Ph.D.s per square foot than anywhere else, and we're great at doing research — but not at technical project management. Nonetheless, that was the role in which I found myself, since there was a need for someone to organize and manage projects. Because of that, I took a job at NetGravity, which later merged with DoubleClick and then Google.

Do you feel like the skill set you possess was nurtured at the Jacobs School?

Absolutely. I was trained to use data to make decisions. My time at the Jacobs School also taught me perseverance; months of grueling work taught me that there's no problem that's not solvable. That's how my brain works now — I'm not afraid of big problems.

The Jacobs School is all about innovation and investment, and that story is more compelling now than it's ever been. I can't wait to see how the Dean's Experience Engineering initiative will prepare students for the real world. The more prepared they are, the more valuable they will be, and nothing beats experience in that respect.

Read more: bit.ly/bui-pham

Shraddha Chaplot

On Twitter recently, Shraddha Chaplot (BS, electrical engineering '08) celebrated her 10π birthday, a milestone that highlights her love for numbers and math. It also highlights something else: Chaplot's passion for highlighting the opportunities that engineering and information technology careers can provide.

As a Jacobs School undergraduate, Chaplot spent a summer working on a team of engineering students at Cisco where they focused on the energy efficiency and power management of Cisco products. Chaplot and her teammates were hired through the Jacobs School's Team Internship Program. When Chaplot graduated from UC San Diego, Cisco hired her full time; and she joined a team that tested products to ensure they were usable by people with disabilities. Chaplot is now part of Cisco's Corporate Social Responsibility team. She also serves as a motivational speaker. While her interests in mathematics and mechanics were nurtured when she was very young, Chaplot encourages others to consider engineering or information technology even if they are coming to the field later in life. "It's never too late to get involved with IT and networking," she writes in a Cisco essay posted on the Huffington Post website. In her speeches, Chaplot talks about the power of individuals — something she says everyone should exercise. "I have been an individual contributor during my time at Cisco, and I wouldn't have it any other way. We have the power to show how a combination of the brain and heart — good ideas and a desire to make the world a better place - can transcend any title you have."

Read more: bit.ly/Chaplot

Electrical Engineer Named Wolf Scholar

Phoebe Contreras-Jones receives scholarship honoring Jack Keil Wolf

Phoebe Contreras-Jones, the first Wolf Scholar on campus

When electrical engineering undergraduate Phoebe Contreras-Jones called to share the news, her mother started crying; she was overwhelmed with pride. Contreras-Jones had just found out she was named the inaugural recipient of the Jack Keil Wolf Endowed Scholarship, which is awarded to outstanding undergraduates in electrical and computer engineering at the Jacobs School of Engineering.

"The scholarship will drastically reduce the amount in loans I will have to take out. It means I can focus on school," said Contreras-Jones. "And the donors want to mentor me. I can't describe how much that means to me."

The scholarship honors Jack Keil Wolf, who was a pioneer in information theory and a professor of electrical and computer engineering at the Jacobs School.

"Jack was an inspiring teacher and mentor," said Roberto Padovani, executive vice president at Qualcomm Technologies. Padovani studied under Wolf as a graduate student at the University of Massachusetts, Amherst. After Wolf's passing in 2011, Padovani and his wife, Colleen, helped to establish the scholarship in Wolf's name.

"He was a great researcher in communication systems, information and coding theory and was honored with many awards, but at his heart it was the joy of teaching that made him happy," said Padovani.

Now, Wolf's legacy will continue to impact generations of students — starting with Contreras-Jones.

Endowed Chair

Gift from Shao-Chi and Lily Lin will establish endowed chair in Aerospace Engineering and Applied Physics

There were just a few buildings on the main campus when Shao-Chi (S.C.) Lin was recruited to UC San Diego from Boston in 1964. His leading-edge work on the physics of strong shock waves and hypersonic flight caught the attention of the founders of UC San Diego's engineering program, and his research and teaching contributed to its early success. Now, a legacy gift from S.C. Lin and his wife, Lily, will help to attract and retain exceptional faculty members at the Jacobs School of Engineering.

"It's important to give back," said S.C. and Lily Lin. "The university gave us many opportunities. Now it's our turn to give younger researchers and scholars a helping hand."

The Lins made a $2 million bequest to endow a Shao-Chi and Lily Lin Professor in Aerospace Engineering and Applied Physics, as well as to set up a scholarly exchange fund. Once established, the endowed chair will provide a dedicated source of funds, in perpetuity, for the chair holder's academic and teaching activities.

"Endowed chairs are vital to the Jacobs School, enabling us to attract and retain world-renowned faculty," said Albert P. Pisano, dean of the Jacobs School of Engineering. "We are grateful to the Lins for their generous support and confidence in UC San Diego's engineering program."

A professor emeritus of mechanical and aerospace engineering, S.C. Lin is regarded as a pioneer in the study of short wavelength, high-power gas lasers. Many of his students have gone on to do important work in the field as well, including helping to spawn a number of private and public high-tech companies.

"The best reward has been seeing my students become successful professors, entrepreneurs and leaders," said Lin.

The Lins' passion for giving back stems in part from their own experiences as students. Lily Lin received a four-year scholarship for her undergraduate study at St. Joseph College in West Hartford, Conn., where she earned her bachelor's degree in chemistry. S.C. Lin obtained his Ph.D. from the Graduate School of Aeronautical Engineering at Cornell University with the support of a fellowship.

York Society

With their gift, the Lins have become members of the York Society at UC San Diego. Named in honor of Herbert York, UC San Diego's founding chancellor, the York Society recognizes and thanks an exceptional group of alumni, faculty, parents, staff, community leaders and other friends, whose generosity through planned gifts helps secure the future of one of the world's greatest universities.

For more information on the York Society, visit the UC San Diego Office of Gift Planning at giftplanning.ucsd.edu.

To learn more about supporting the Jacobs School of Engineering, please contact William Burfitt, Executive Director of Development at wburfitt@ucsd.edu or (858) 246-0593.

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ENGINEERING LEADERS START HERE

Nearly 1,800 engineers and computer scientists graduated from the Jacobs School of Engineering in 2015.

That's a major boost to the technical and entrepreneurial workforce for the San Diego region, California and the nation. We are sharing student profiles online.

Find them at: bit.ly/hashtagilooklikeanengineer

Heryang Lee
Structural Engineering ('17)

"We are beyond just strictly 'studious' individuals — we have our own struggles, aspirations and experiences that make us who we are and drive us to pursue engineering."

Ryan Collins
Electrical Engineering ('16, MS '17)

"Maybe one day I will be helping to put rovers, or even people, on Mars," says Ryan who is obsessed with outer space and robotics.

Elsie Varela
Environmental Engineering ('17)

Elsie plans to connect environmental engineering to public health and calls herself a "social-justice oriented, tree-hugging, feminist engineer."