



CITRIS AND THE BANATAO INSTITUTE IMPACT REPORT 2016-2018





What is CITRIS?

The Center for Information Technology Research in the Interest of Society (CITRIS) and the Banatao Institute is a fully functioning organized research unit within the University of California Merced and is recognized as one of the four University of California CITRIS campuses: Merced, Berkeley, Davis, and Santa Cruz. CITRIS develops synergistic partnerships with academic institutions and corporate collaborators worldwide to collectively produce innovative solutions to challenges in four primary sectors: Connected Communities, Health, People and Robots, and Sustainable Infrastructure.

CITRIS at UC Merced addresses California's most pressing societal and environmental problems by leveraging cutting-edge technologies and incorporating a convergence of student-driven initiatives, seed grants and faculty research, and corporate partnerships.

Mission Statement

The Center for Information Technology Research in the Interest of Society (CITRIS) and the Banatao Institute create information technology solutions for society's most pressing challenges.



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LEADERSHIP AND STAFF

Working together towards a greater goal



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Forest Management Approaches in the Southern Sierra Nevada Ecoregion.

Principal Investigators: Professor Jeffrey Jenkins (UC Merced), Professor Brett Milligan (UC Davis), Professor Teenie Matlock (UC Merced), Dr. Anne Kelly (UC Merced)

National parks, forests and public lands provide opportunities for people to interact with nature that can improve human well-being through mental health, identity, and connectedness. However, forest systems are vulnerable to disturbances such as wildfire, drought, and disease, and as these landscapes change so do the values, activities and the management approaches that sustain them. In the southern Sierra Nevada ecoregion, warming and variability in the amount and timing of precipitation has led to decreased snow pack, and mega-fires with historically unprecedented severity resulting in unexpected succession outcomes. With these climate change impacts, the legal landscape is evolving to reflect the importance of our reliance on the resilience of the ecosystem services provided by the forests and watersheds of the state. For example, watersheds are now legally defined as part of the water infrastructure in California. Different agencies use different management approaches with regard to climate change, visitor use, fire suppression, prescribed fire, surface water storage projects and pro-active resources management practices. These approaches are valued differently by those who manage public lands or those who recreate on these lands, while at the same time, we all rely on the natural infrastructure and ecosystem services of these areas. We propose to develop the Comparative Adaptive Management and Ecosystem Response Assessment (CAMERA) to photographically survey the preferences of the forest community associated with resilient or vulnerable landscapes, the management projects used to sustain them, and to communicate impacts of climate change on regional public lands and watersheds.

Consequences-Aware Co-Piloting System for Human-in-the-Loop Drone Operations

Principal Investigators: Professor Mark Mueller (UC Berkeley) and Professor YangQuan Chen (UC Merced)

Small unmanned aerial systems (UAS) are becoming more and more prevalent, driven by consumer interest and their potential for revolutionizing aspects of commercial applications, such as delivery of urgent goods. The expected ubiquity of such systems raises concerns about their safety and the ability of such autonomous systems to operate safely in densely populated areas (where their value will be greatest). We propose to develop a system which adds an additional layer of safety to aerial systems operated by a human pilot, by monitoring the UASs environment for visual cues, and monitoring the human pilot for signs of distraction. The system will endow a UAS with the ability to reason about its safety, and the consequences of safety failures during its operation. The UAS will furthermore continuously reason about possible safety maneuvers in response to likely failures — in the event of an emergency, the vehicle can then execute its last safe maneuver, thus reducing the system's danger. We will exploit the capabilities offered by combining expertise from UC Berkeley and UC Merced. Prior experience with rotor-craft, and safety thereof from Berkeley will be combined with experience on human factors, general UAS safety, and the drone safety center at UC Merced.

A Multispectral and Thermal Imaging sUAS System for Monitoring Crop Water Use and Detecting Water Stress Operations

Principal Investigators: Professor Yufang Jin (UC Davis), Professor Kenneth Schackel (UC Davis), Professor YangQuan Chen (UC Merced)

California's growers face great water use challenges due to the expansion of perennial crops and a warmer and drier climate. Accurate and timely estimate of crop consumptive water use and water stress at a field scale is the missing link in the current on-farm irrigation management. Field-based methods are limited by the high cost, while remote sensing approaches are constrained by accuracy, spatial and temporal resolution. We here propose to develop and test a robust and cost-effective measurement and analytical approach to fill this gap, using the emerging drone and imaging technology. Calibrated multi-spectral and thermal imaging cameras will be integrated on a leading drone platform. We will use this fully integrated sUAS system to collect the aerial imageries over several walnut and almond sites in California, where we have both on-farm and plot irrigation experiments and ground measurements of evapotranspiration (ET) and water stress ongoing. Analytical approaches will be developed and validated to estimate ET and quantify water stress based on the multi-spectral and thermal imagery. This project put together the best combination of talents to figure out the best cost-effective way of advancing the plant water monitoring technique, with scientific rigor, not only in data acquisition stage but also in the post flight data processing and analytical phase. The resulting capability will provide growers observation-based guidance for site-specific and time-sensitive irrigation management, and thus ensure agriculture sustainability. The ET mapping tool will also improve consistent estimate of water budget and thus support state and local water agencies for both water planning and regulatory/compliance purposes.

2018 Awards

A Sensor System for Robotic Monitoring and Mapping of Plant Root and Shoot Health

Principal Investigators: Professor Reza Ehsani (UC Merced), Dr. Alireza Pourreza (UC Davis)

Many diseases, pests, stresses, and production practices may affect the growth, density, and distribution of a plant's root system. The ability to non-destructively monitor and quantify plant root size and density is very important and can provide very useful information to researchers and growers. In this project, we propose to use X-ray technology for observing roots. The exposed X-ray can be passed from soft soil and detected by an X-ray detector. The use of X-ray technology in agriculture has been very limited, while it has been used in food processing plants to evaluate fruit internal quality. Radiation has been a concern with using X-ray systems for practical in-field applications, plus X-ray systems are usually very expensive and are not designed for field applications where rugged systems are needed. However, recent advances in the field of autonomous ground robots has created an opportunity to use the X-ray-based sensors safely for applications in agriculture, in particular, for root mapping. In order to prevent farm workers and operators from exposure to X-ray radiation, an unmanned ground robot will be used to navigate through the field, identify the potentially stressed plants, and conduct X-ray root scan from a safe distance to a remote operator. The robot will be equipped with an optical sensing system and a real-time processor that conducts a preliminary plant health evaluation and in case a plant does not look healthy it triggers the X-ray root scan.

Persistent Autonomous Monitoring for Early Detection and Prediction of Wildfires

Principal Investigators: Professor Katia Obraczka (UC Santa Cruz), Professor Stefano Carpin (UC Merced), Professor Scott Stephens (UC Berkeley)

Experts in IoT, robotics, artificial intelligence, and fire science will partner to design, deploy, test, and evaluate under real-world scenarios a novel IoT system to enable accurate, timely, and scalable wildfire detection and prediction. Due to the sheer size of sensitive areas to be monitored, automation is the only scalable answer to persistent and accurate prediction, and timely detection and alerting. The proposed system will consist of both mobile and stationary nodes and will complement existing remote sensing solutions by gathering not only images, but also in-situ data from a variety of built-in including temperature, humidity, wind activity, fuel stick sensors, etc. Using sensor fusion algorithms that are able to learn and adapt to changing conditions, the proposed system will be able to dynamically allocate its resources in order to perform accurate and timely wildfire detection and prediction, while operating in potentially vast and remote regions. Additionally, historic data from these various types of sensors collected over multiple seasons will provide novel information to fire scientists and help advance fire science to answer questions such as the possible interrelations between climate records and wildfire occurrence or potential.

Using Smart City and Building-Specific Air Quality Data for Improved Indoor Air Quality and Energy Efficiency

Principal Investigators: Dr. Jovan Pantelic (UC Berkeley), Professor Mark Modera (UC Davis), Professor Wolfgang Rogge (UC Merced)

Dense networks of air quality sensors distributed throughout the urban environment can provide highly granular and localized environmental data. Collected data contain information about local pollution levels that are often different than those measured with environmental stations placed at very large distances from one another. This dense sensing network provides information for improved ventilation and mechanical and cooling decision making. A combination of outdoor and indoor sensors can provide building-specific air quality data that can be used to use natural ventilation in a more efficient way or better optimize building control systems to ensure safe indoor air quality and potentially improve building energy efficiency. Using this data, building control systems can better prevent natural ventilation modes of building operation when outdoor air is polluted and mitigate against elevated exposure due to the indoor pollutant buildup, avoid under-ventilating building spaces when outdoor air is not polluted, optimize between air temperature and pollution to provide the most energy efficient ventilation rates, optimized between quantity of filtered outdoor air, pressurization of indoor environments and infiltration of outdoor air.



GRANTS & RESEARCH

JAPAN

BRIDGE

Dr. Daniel Nover, School of Engineering

The Japanese Society for the Promotion of Science (JSPS) recently awarded the 2017 BRIDGE Fellowship to Dr. Daniel Nover from UC Merced's School of Engineering. The BRIDGE Fellowship is designed to build collaborations between American scientists and engineers who have been funded by JSPS in the past with Japanese researchers at qualifying universities. Dr. Nover will spend October as a visiting fellow in the Yamashiki Lab at Kyoto University where he will work to build research partnerships in water resources and disaster risk management. Additionally, he will work to build international exchanges between UC Merced and Kyoto University.

CHINA

CERC-WET

Professor Joshua Viers, School of Engineering

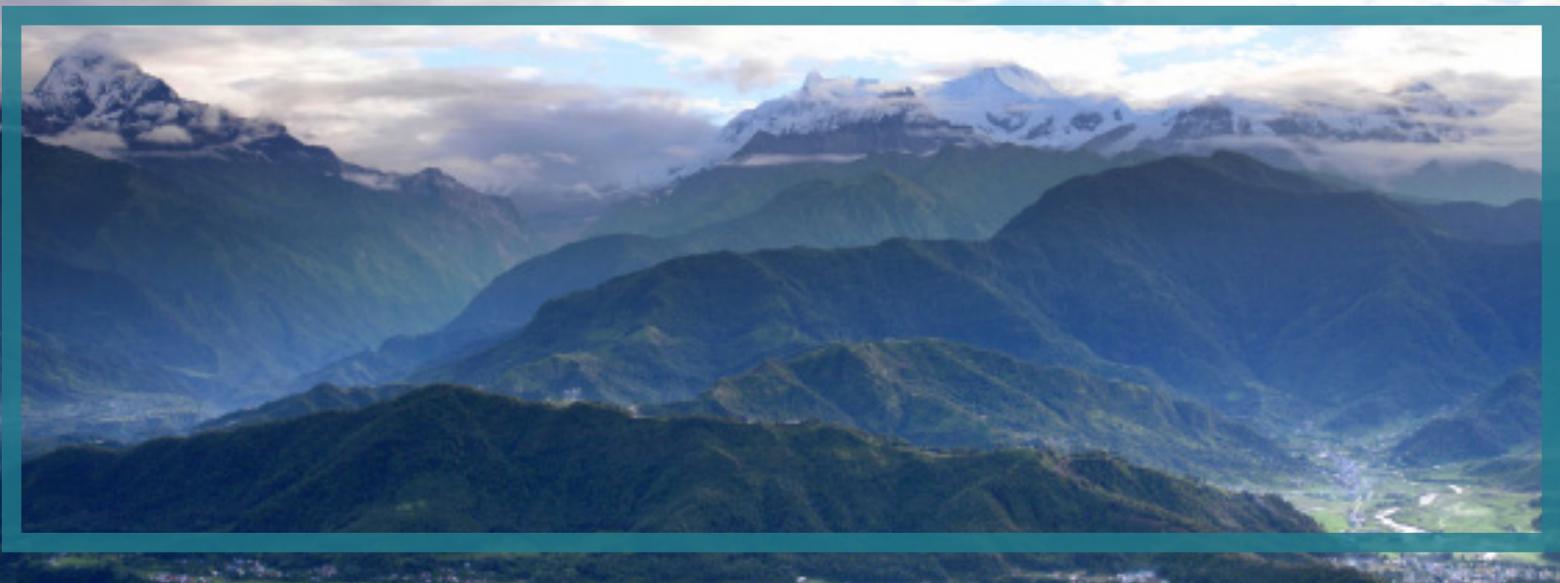
The Clean Energy Research Center for Water Energy Technologies (CERC-WET) consortium tackles water-related aspects of energy production and use in cooperation with Chinese counterparts. CERC WET is a University of California multi-campus research consortium funded by a joint initiative between China and the United States with the intent to develop and aggregate the best available knowledge and information about the energy-water nexus. Funding from the US Department of Energy, the California Energy Commission, and China's Ministry of Science & Technology contribute to this project. As part of the consortium, UC Merced and CITRIS researchers have begun a series of research activities related to hydropower research and efforts to improve hydropower performance to achieve power and environmental goals, as well working to design environmentally-friendly cooling systems. Key engagements to date include partnerships with Institute of Water & Hydropower Research, the International Association of Hydro-Environment Engineering Research, the Chinese Academy of Sciences Key Laboratory for Geography and Limnology in Nanjing, and Chang'an University in Xi'an.

PHILIPPINES

PhilDev IDEA

Dr. Daniel Nover, Professor Abel Chuang and, Professor Joshua Viers, School of Engineering

With funding from the Philippine Development Foundation's (PhilDev) IDEA project, CITRIS researchers Dr. Nover, Professor Chuang, and Professor Viers traveled to the Philippines to conduct workshops on "Technopreneurship" to support development of training in technological entrepreneurship and innovation among engineering faculty and students in Filipino universities. Dr. Nover traveled to St. Louis University in Baguio City in July where he conducted the one-week workshop in cooperation with the School of Architecture and Engineering. He also conducted background research necessary for subsequent grant proposals, notably the Philippines California Advanced Research Institutes (PCARI), funded by PhilDev with support from the Philippines Department of Science and Technology (DOST). Professor Viers traveled to Palawan State University, where he conducted a one-week Technopreneurship workshop with the School of Engineering. Central Luzon State University hosted Professor Chuang for a similar engagement. Ongoing engagements with St. Luis University and Partido State University are focused on improving social impacts through technological innovation.



NEPAL

StreamDev

Professor Joshua Viers and Dr. Daniel Nover, School of Engineering

The StreamDev project was funded by a seed grant from the UC Berkeley Development Innovation Lab under the USAID funded Higher Education Solution Network (HESN) to support a one-year research project in collaboration with Kathmandu University in Nepal. The project is focused on implementation of novel stream monitoring technology to inform Integrated Water Resources Management in the Roshi River Basin in Nepal. Since the project's start, UC Merced Professor Josh Viers, International Development Specialist Dr. Daniel Nover, and graduate student Lorenzo Booth have focused on implementing the StreamDev project. Professor Viers and Dr. Nover traveled to Kathmandu for a two-week trip to liaise with partners in Kathmandu University and conduct initial piloting of the stream monitoring technology.

CALIFORNIA, USA

USDA/NIFA

Professor Joshua Viers and Professor Stefano Carpin, School of Engineering

This USDA/NIFA funded project investigates a co-robotic approach to precision irrigation where a team of humans and robots move through the fields to adjust low-cost adjustable drip irrigation emitters at the plant level. RAPID—Robot-Assisted Precision Irrigation Delivery—will be designed for cost-conscious farm managers to be retrofitted to existing irrigation systems and incrementally expanded to increase irrigation precision and plant yield, reduce water usage, and with robots, permit thousands of emitters to be incrementally adjusted during nights and weekends. The project will involve the design, development, and evaluation of a series of prototypes of low-cost, robust co-robotic systems compatible with existing drip irrigation infrastructure in vineyards and orchards.

The project will build on prior work in irrigation modeling and develop feedback algorithms compatible with available sensing technologies using diffusion models to optimize desired emitter settings. The project will also extend results in robotic Orienteering Planning to advise humans and guide robots about when, where, and how to act to achieve desired field conditions at the plant level. Field evaluations are performed with farm managers and growers in the wine producing regions of California, including project partner E&J Gallo vineyards in nearby Snelling, California.



PHILIPPINES

PCARI

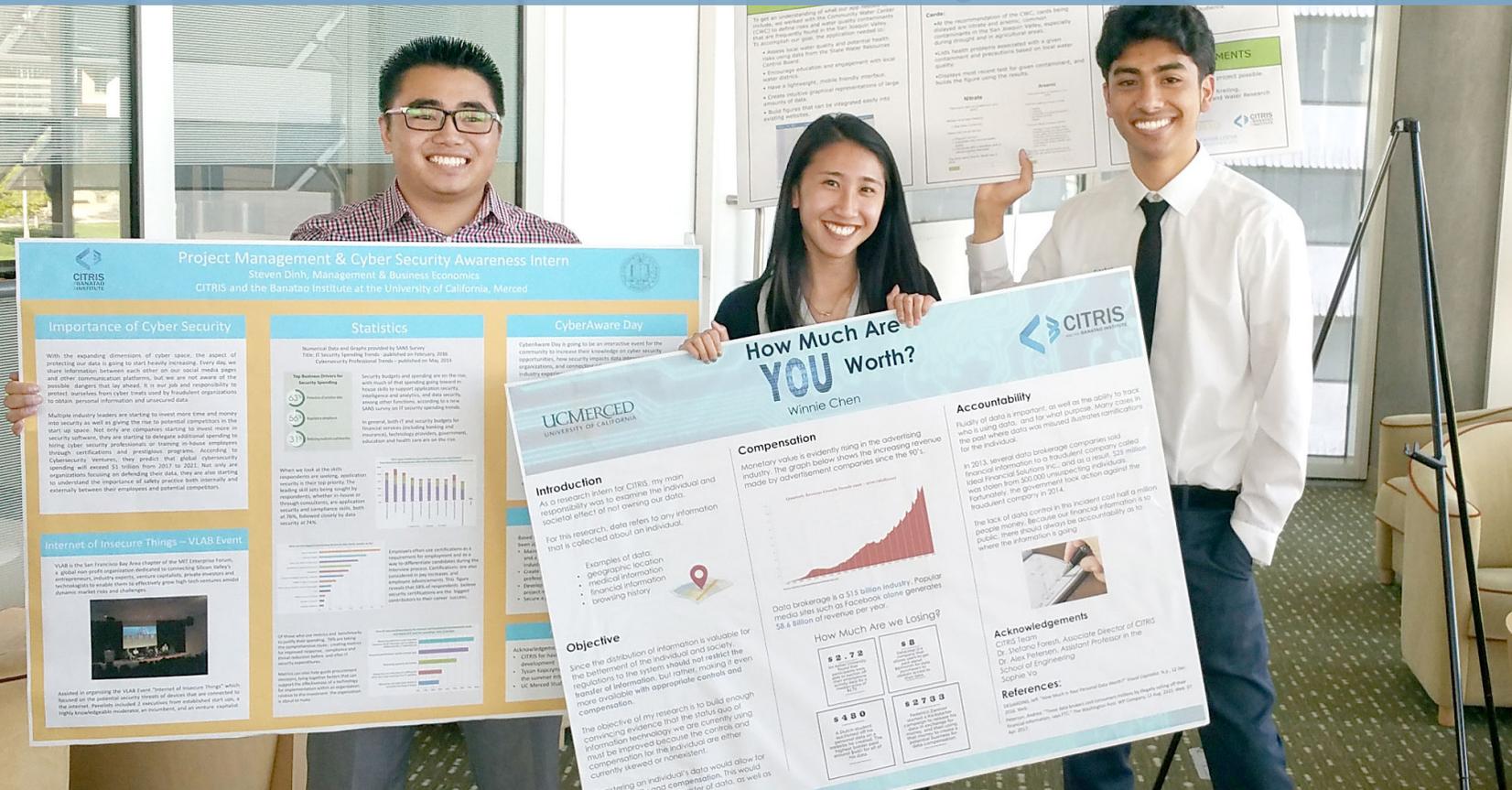
Professor Abel Chuang, School of Engineering

In the Philippines, improving reliability and increasing energy from renewable sources is the basis for environmental and economic sustainability. Philippine-California Advanced Research Institutes (PCARI) is investing in these environmentally-friendly energy technologies to promote innovation and sustainable outcomes. Funded by the GREEN POWER program, this effort consists of two major projects that could generate and produce the green power for sustainable energy. Professor Abel Chuang of the School of Engineering is currently working on both aspects of this research with a focus on hydrogen generation using solid oxide electrolysis cells and energy conversion using polymer exchange membrane fuel cells. He is developing solutions related to novel catalyst materials and cell designs by experimental and simulation approaches. This research is in cooperation with the University of the Philippines, Diliman.

Professor Rinlee Butch M. Cerveras and students from his lab at the University of the Philippines, Diliman visited UC Merced and the TEEL to discuss share their current research related to solid electrolyte electrolysis and learn TEEL's work on the polymer electrolyte fuel cell and catalyst development. For one week these students from the Philippines learned, within the lab setting, our research methods.

Students from Professor Joey D. Ocon's Laboratory of Electrochemical Engineering visited our lab to share their research and to learn more about the research and equipment that TEEL uses. This was also the beginning Joy Marie Morra's and Maricor Divinagracia's extended stay as foreign exchange researchers. For about three months Morra and Divinagracia learned from TEEL lab members and aided our research efforts.

STUDENT PROJECTS



The Future Leaders in Innovation

The Student Success Internship Program's mission is to provide undergraduate students with an opportunity for self-directed learning, professional development and career exploration within a higher education institutional context. It serves to develop awareness about professional development options in order for students to develop career pathways and set goals.

Those goals include:

- Create connections between internship experience and course work across the curriculum.
- Demonstrate understanding between undergraduate education experience and departmental outcomes in the internship environment.
- Apply internship work experience to further cultivate discipline knowledge.
- Develop increased understanding of the complexity in the department.
- Demonstrate and identify professional accountability.

Adriana Gomez

Adriana Gomez, expected to graduate spring of 2018, advocated early STEM education by engaging elementary students to activities which emphasized the importance of sustainability.

Johnathan Deas

Some of Johnathan's previous projects within CITRIS include research in tire sensing, materials, and connected car technologies. He is the electric vehicle intern for CITRIS at UC Merced.

Steven Dinh

Prior to his graduation in spring 2017 Steven had secured a full-time job offer at Lockheed Martin Space Systems, located in the Silicon Valley, as their Multi-Functional Finance Analyst.

Winnie Chen

Winnie, who is expected to graduate spring of 2018, showed great interest in data ownership with respect to cyber security in the ever-changing world of technology.

Student Success Internships

UC Sprouts

Adriana Gomez, UC Sprouts Program

The vision of the UC Sprouts program is to provide quality supplemental STEM education to elementary students in the Merced community by developing and executing a curriculum that will allow them to plant and tend to an edible garden. During the early developmental phases, CITRIS has supported this initiative by providing the initial funding needed to purchase the necessary resources. Elementary students will get the chance to learn about plant development, nutritious eating, the importance of recycling and composting, and learn about the college experience from UC Merced students.

Constant Current Electric Vehicle

Johnathan Deas, Electric Vehicle Intern

The intention of this project is to allow more constant usage of current in order to extend the life of current battery technologies. By developing a dynamic stator control system, a potentially more efficient electric motor can be made, with much of the groundwork going into creating a state-space model. The intended goal of this project is to create a detailed mathematical model of this motor and control system.

Internet of Insecure Things

Steven Dinh, Project Management and Information Security Awareness Intern

The purpose and goal of hosting a VLAB event and Cyber Awareness Day is to ultimately inform the community on security related issues within a technology-impacted environment. Cyber Awareness Day provides opportunities for the community to increase its knowledge of information security within data intensive organizations as well as connect educational leaders with industry professionals. Similar to Cyber Awareness Day, the “Internet of Insecure Things” VLAB event focuses on a panel discussion that addresses Wi-Fi enabled devices and how startups are competing against large corporations in the cyber security realm.

Future of Ownership

Winnie Chen, Data Ownership Research Intern

The current construct of society consists heavily of a rising trend known as the “sharing economy.” Such sharing ranges from personal information to vehicles to property, along with other continuous daily contribution simply by existing. When data is acquired without our knowledge, our identities become less personal and more accessible. This poses a threat to the public because of the negative consequences associated with it. In order to understand the future concerns of this trend, CITRIS has created a project that will hopefully bring forth knowledge regarding this potential harm. The main purpose of this project is to examine the current state of ownership, which would allow us to make predictions about the future, and possibly create the incentive to change. As more research is conducted, there seems to be a connection between loss of ownership to decrease of wealth, an important correlation that should not be ignored. For these reasons, CITRIS believes it is an unavoidable issue that we must delve further into. The project hopes to create a strong argument for a need of technological ownership management.



FEATURED PROJECTS

“Future of Transportation” VLAB Event and Pirelli Project

Sophie Vo and Michiro Robinson, Technology & Innovation Interns

In light of the rapidly-evolving trends in automotive vehicle technology, CITRIS at UC Merced has engaged itself to produce a report on what the future of transport technology will look like. The Pirelli Project concerns the outlook for fleets, ride sharing, autonomous vehicles, connected cars, and sensing capabilities. Interns on this project are pooling research from patents, publications, and our own interviews with stakeholders in the industry. In the fall, interns also volunteered on VLAB’s Future of Transportation team to help coordinate and execute a panel event on flying cars and pilot-less drones. Here, we were able to hear from and interface with individuals on the forefront of transportation innovation. This semester, our team looks forward to building on our December Midpoint Report and completing our deep dives into the aforementioned topic areas.

These students are deep diving into the innovations that are driving technologies such as data sensing, deep learning, IOT, new materials, as well as autonomous, connected, electric cars and trucks, to get a better understanding of what the relative impacts of these technologies will be on tire manufacturers. The team has released a report outlining the deep dive topics at a high level, a report on the future state of the trucking industry, and documents with details on topics of particular interest.

The team has built its research by compiling information from journal reports, news articles, patent searches, press releases, and interviews conducted with stakeholders in the industry. Having developed a strong interest in the topic from working on this project, some team members even became involved in the organization of the VLAB event on flying cars, “The Future of Transportation: Freeway or Flyways?”, which took place in Palo Alto in November 2016.

For CITRIS students, it has been a highly engaging learning experience thanks to the enthusiasm of experts regarding what the future of the automotive industry will look like. Pirelli has been highly receptive to the analysis that the CITRIS team has conducted thus far, and the team looks forward to elaborating on the potential opportunities that it has identified for Pirelli and building on its recommendations.



CITRIS sponsored event

HackMerced

Shubham Naik and Deo Halili



HackMerced is a 36 hour-long programming competition organized by the students at UC Merced where you and hundreds of other contestants will team up, learn, code, design and pitch cool and creative projects that you always wanted to try out. HackMerced is open to all individuals that are either enrolled at a high school or university and between the ages of 14 to 22. This is an opportunity for beginners, pros, and those in between to have fun building what they desire for cool prizes!

From the start to the end, the event recruited around 20 students to help build, program, and organize the event. The event itself was from February 10-12, 2017 and hosted around 350 students from all over the world including students from Canada, Egypt and Germany. HackMerced in 2017 had expanded from a local event to a global show that brings together minds

from all over the world.

The event hosted eight workshops to help students learn more about various technological and entrepreneurship related topics including web development, server development, brand design and startup pitching. After 36 hours there were more than 100 project submissions, with three winners that created applications such as a neural network that found adult content online, an augmented reality tool that taught students how to use a ukulele and a food delivery app for UC Merced.

The impact CITRIS hopes to leave on campus and the community is visible through its constant involvement and efforts to provide support to students. The CITRIS team hopes to continue being involved with campus activities and upcoming events for HackMerced and other similar-student-development-centered events.



SHUBHAM NAIK

“As the director of HackMerced I was tasked at outlining and carrying forward the event and ideals of this student group. I was able to utilize my leadership and management skills to direct the 30 hour long program and student volunteers.”



CYBER AWARE DAY

Cyber Security: A World of Opportunities

The aim of Cyber Aware Day is to educate students from all backgrounds on the rapidly-developing world of cyber security. Industry experts will convene to discuss what cyber security is, what its challenges are, and the landscape of job opportunities that this space presents for students.

Introductory Remarks



Tyson Kopczynski

VP of Security at Oportun

With more than 20 years of experience in information security/technology, Tyson Kopczynski has become known as an industry leader with both strategic vision and a reputation for helping organizations cope with an ever-changing technology landscape. While his background is firmly within the information security realm his abilities span a variety of technologies and specialties. He has also written numerous detailed white papers or guides, authored/contributed to technology books, posted to an industry-known blog, given many technical presentations and currently has a pending “Payments” related patent. In his spare time, he often provides security, technology, and strategy guidance (typically anonymously) to organizations both public and private across the globe and across many different industries.

Keynote Address



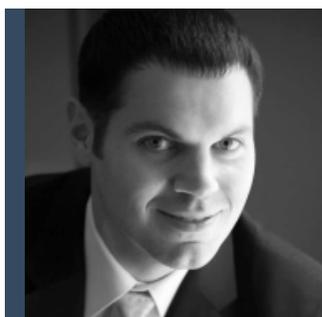
Caroline Wong

Vice President of Security Strategy at Cobalt

Caroline’s close and practical information security knowledge stems from broad experience as a Digital consultant, a Symantec product manager, and day-to-day leadership roles at eBay and Zynga. She is a well-known thought leader on the topic of security metrics and has been featured at industry conferences including RSA (USA and Europe), OWASP, AppSec, and BSides.

Caroline was featured as an influencer in the 2017 Women in IT Security issue of SC Magazine. She received a 2010 Women of Influence Award in the One to Watch category and authored the popular textbook *Security Metrics: A Beginner’s Guide*, published by McGraw-Hill in 2011. Caroline graduated from UC Berkeley with a B.S. in Electrical Engineering and Computer Sciences and holds a certificate in Finance and Accounting from Stanford University Graduate School of Business.

Panelists



Shaun Gilmore

Senior Program Manager at Microsoft's TCG

Shaun Gilmore is a Senior Program Manager in Microsoft's Trustworthy Computing Group. Shaun is co-author of the SAFECode Principles of Software Assurance Assessment, co-editor of ISO/IEC 27034 Application Security, and a recognized expert on secure development practices and software assurance. He holds a Master's Degree in Information Systems Security from Carnegie Mellon University and is a graduate from the University of Scranton.



Michael Arrowsmith

Senior Director at Splunk

With over two decades of experience, Michael Arrowsmith has been instrumental in developing, shaping and molding the information security world for each company he has been involved with. Michael is currently serving as Senior Director of Cloud Security at Splunk and is the founder of Splunk's Cyber Security team. Prior to joining Splunk, he has served in a number of roles within Cyber Security and Information Technology working with companies such as; Lawrence Livermore National Laboratories, ReServe Interactive and FedEx Office. Michael holds a B.S. from San Jose State University.

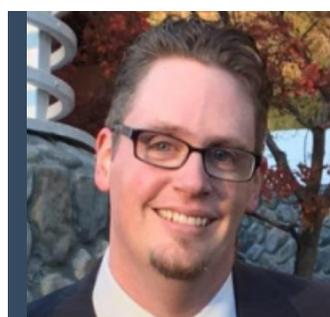


Amul Kalia

Analyst at EFF

Amul is an analyst with the Electronic Frontier Foundation (EFF), a nonprofit digital civil liberties organization based in San Francisco. EFF has a team of lawyers, activists, and technologists who ensure that our constitutional rights are protected online. At EFF, Amul helps the staff spot opportunities where it would be helpful for the organization to add its voice. Amul writes on a variety of issues from copyright abuse to cybersecurity. In addition

to communicating one-on-one with the general public about EFF, Amul conducts online security trainings in the community. Most recently, Amul is part of the team within EFF working on issues surrounding the Equifax data breach, including how the victims should be compensated. Amul's academic background is in political science and public policy.



Nicholas Dugan

Deputy CIO and Chief Information Security Officer at UC Merced

Nick is the Deputy CIO and Chief Information Security Officer at UC Merced. Over nearly two decades, Nick has held a variety of IT and information security positions across three University of California campuses. In his current role overseeing the IT Operations and Security divisions of the UC Merced Office of Information Technology, Nick is focused on promoting cybersecurity awareness while building a secure and robust technology environment

to support the needs of a rapidly growing research university. Nick holds a B.A. in Computer Science from UC Santa Cruz.





THE MOBILE APP CHALLENGE

Creating applications that create an impact.

Originating at UC Merced in 2011, the CITRIS [Mobile App Challenge](#) is a semester-long competition that empowers undergraduate students to develop mobile applications for social impact while fostering innovation, community service, and career development. Guest speakers, industry mentors, and peer networking helps students move rapidly from idea to prototype over the course of the spring semester.

At the start of the Spring 2017 semester, 25 teams and 69 students joined the challenge to design, build, and pitch their ideas in the categories of: Connected Communities, Health, People and Robots, and Sustainable Infrastructures.

Judges: Spring 2017

Ryan Durant	PG&E
Jason Hallett	Topcon Positioning Systems
David Needham	Oportun
George Pugh	E&J Gallo Winery
Brian Bamsch	Google
Victor Gonzalez	Paypal

Judges: Spring 2018

Ryan Durant	PG&E
Esteban Perez	Intel
David Needham	Oportun
David Ahl	TOPCON
Tracy Younkin	E&J Gallo

Thank you Sponsors



Mobile App Challenge Winners



2017, 1st Place Winners: Brian Hungerman, David Hungerman (Respectively) of Team Iterate

2017 Winners

1st place award of \$5,000: Iterate

2nd place award of \$2,500: Good Juju | 3rd place award of \$500: Seed

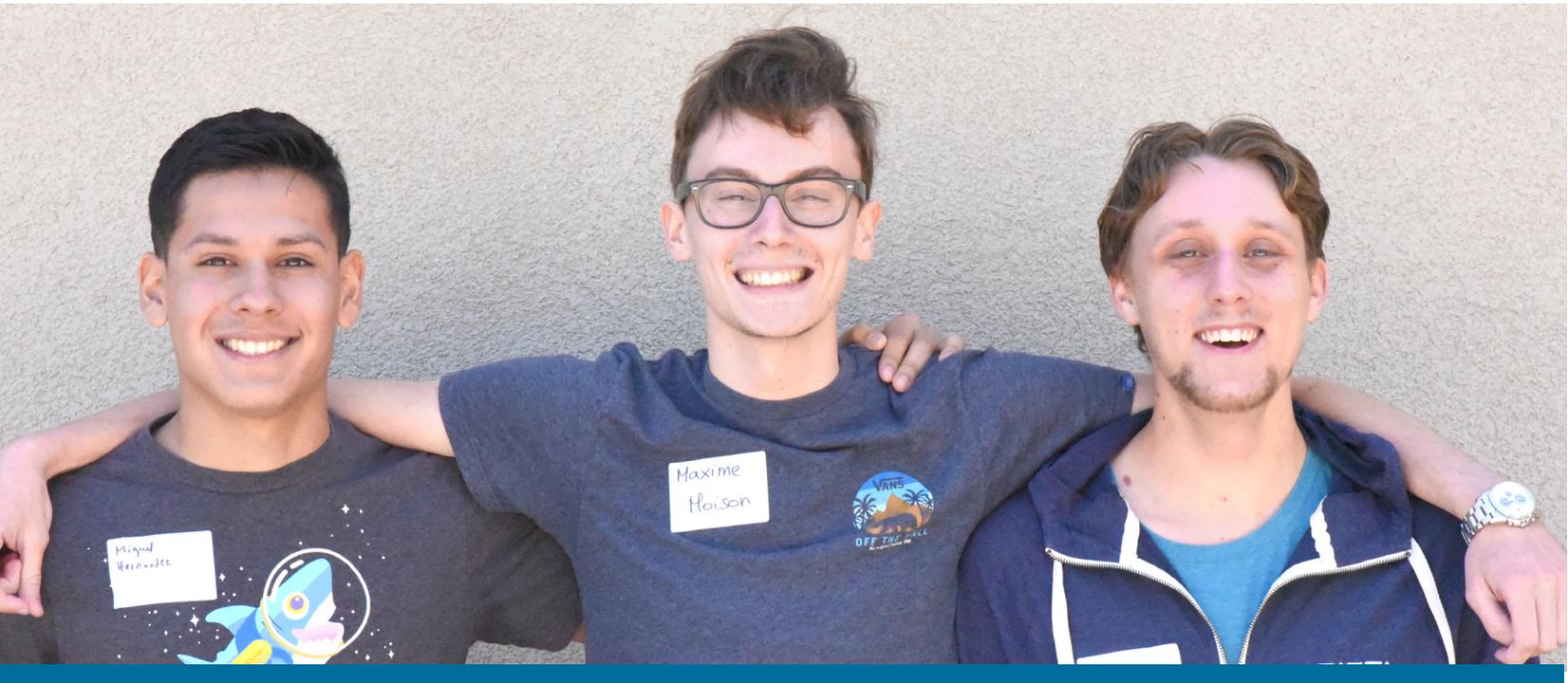
On Friday, May 12, 2017, seven student teams pitched their mobile applications before a panel of esteemed judges at the Innovate to Grow showcase event. The sixth annual CITRIS Mobile App Challenge Demo Day at UC Merced then culminated with a celebration of the students' progress throughout the semester and presentation of awards to the following teams: CADD, Good Juju, Groovy, Growth, Iterate, Reach, and Seed. The following year, on May 11, 2018, 16 other student teams similarly pitched their mobile applications, and in the seventh annual CITRIS Mobile App Challenge teams, CSS; FAARM; Bobcat Courses; Ozone; and, Lunch Line were awarded.

Words from Brian Hungerman of team Iterate

"The Mobile App Challenge was the biggest thing to happen to me during my freshman year of UC Merced. It connected me to so many great, bright-eyed people, and they took me into their circles and made Merced feel more like a home for me. This is the power the Mobile App Challenge has: It brings together like-minded individuals as they pursue projects they are passionate about. Through this, we all seemed to bond and mesh together."

"Teaching programming has long been a passion of mine, and I took the Mobile App Challenge as an opportunity to innovate and solve the most pressing issue computer science educators face: The sense of obscurity and exclusivity of coding. Iterate, our application, was born due to problems I see so many new programmers facing. Iterate aims to make programming easy to digest while not spoon-feeding information to the next generation's Mark Zuckerberg and James Goslings."

"At first, I didn't think Iterate had too much actual value, but when so many judges and colleagues expressed their interest, it instilled in me a sense of worth that I initially didn't see myself. The community behind the Mobile App Challenge made me confident in my ideas, and that is what I am most thankful for CITRIS and our sponsors. I am thankful they provided me, a young first-year programmer, with an amazing environment from which I've grown so much."



2018, 1st Place Winners: Miguel Hernandez, Maxime Moison, Christian Verkinoff (Respectively) of Team Bobcat Courses

2018 Winners

1st place award of \$4,000: Bobcat Courses

2nd place award of \$2,000: Ozone | 3rd place award of \$1000: Lunch Line

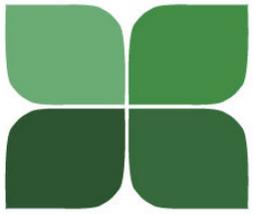
Tech for Social Good Program

The CITRIS Mobile App Challenge is working under the CITRIS and the Banatao Institute's Tech for Social Good program. This program supports student-led learning and technology development for healthy, sustainable, connected, and equitable livelihoods in the United States and abroad.

To achieve its mission, the Tech for Social Good program provides funding support to undergraduate, graduate, and postdoctoral students, groups, teams or organizations developing hardware, software, events or programs that support healthy, sustainable, connected, and equitable livelihoods in the United States and abroad.

Incubator Investment Program

In 2017, CITRIS provided an investment of \$250 to up to five Mobile App Challenge (MAC) teams if accepted into an incubator or accelerator of their choice by June 30, 2017. Teams accepted in an incubator will also be eligible for an additional investment of \$750 after participating and successfully meeting the requirements of the program for three months from their starting date. Investments will be made to teams that provide evidence of acceptance and present the business plan to CITRIS. Review will be made on a rolling basis. Some examples of incubators include: UC Merced Venture Lab, CITRIS Foundry and, Innovation Lab.



Ag Tech Day

Notable Speakers 2017

Brandon Stark	Director, University of California Center of Excellence on UAS Safety
David Doll	Farm Advisory, UC Center for Agriculture & Natural Resources
Joshua Viers	Associate Professor & Director of CITRIS, UC Merced
Ken Goldberg	Professor, UC Davis
Lance Donny	CEO, OnFarm Systems
Nigel Quinn	Lawrence Berkeley National Lab & Fresno State University
Peter Schuerman	AVC for Research & Economic Development, UC Merced
Roger Royse	Attorney, Royse Law Firm
Ronald Zink	Founder & Managing Partner, EdgeCo
Stavros G. Vougioukas	Professor, UC Davis
Tapan Pathak	Assistant Research Professor, UC Merced
YangQuan Chen	Professor, UC Merced MESA Lab

Keynote Address 2017

Ronald Zink, J.D.

Founder & Managing Partner, EdgeCo

EdgeCo is an innovation management group focused on helping companies bring their industrial products and services into the digital age. Prior to starting EdgeCo, Ron held executive roles at Deere & Co., the leading global agriculture group, and Microsoft Corporation. Ron led the digital transformation group at the heart of Deere's revolutionary precision agriculture strategy, which successfully developed and commercialized a series of new digital farming products and applications that are now fully embedded in Deere's strategy and incorporated into every new machine sold.

At Microsoft, Ron served in a variety of senior legal and business roles, including at the center of the company's pivotal engagement with the European Union (EU). Earlier in his career, Ron was in private law practice at a prominent intellectual property law firm where he advised companies of all sizes, from start-ups to Fortune 500 corporations, on the protection, licensing and litigation of intellectual property rights relative to their businesses. Ron grew up on farm and cattle ranch in North Dakota and has degrees in electrical engineering and law.

Notable Speakers 2018

Joshua Viers	Professor & Director of CITRIS, UC Merced
Gabriel Youtsey	Chief of Innovation Officer, UCANR
Sumer Johal	CEO of Agralogics
Abbas Ghassemi	Senior Lecturer, UC Merced
Reza Ehsani	Professor, UC Merced
Curtis Garner	Senior Farm Analyst, Bowles Farming Company
Bill Jennings	VP Engineering of FarmX
Emily Lawrence	Executive Director, National Ag Science Center
Terry Brase	Director, West Hills Community College Farm of the Future
Emery Silberman	Technology Engineer, Bowles Farming Company
Saswata Basu	Founder of Ochain
Chad Hokama	Co-founder and VP Engineering of HarvestPort
Glenda Humiston	VP of UCANR

Keynote Address 2018

Bill Jennings

VP Engineering of FarmX

Bill has thirty years of development experience ranging from high volume consumer products, atomic clocks, and worldwide networking systems for major Enterprises and Service Providers. Bill was an advisor for many privately held, and two public companies leading to acquisitions and/or public offerings. He has led teams developing four multi-billion-dollar product lines from concept to volume installation. Bill was recently inducted into the Engineering Hall of Fame by the Silicon Valley Engineering Council.

Today, at FarmX, Bill is bringing the same innovations to precision agriculture by developing patent-pending solutions to collect soil and plant data in a very accurate and cost-effective manner. This data is being used by machine learning algorithms that make commercial agriculture significantly more productive while conserving our natural resources.

California is internationally known for its innovation in the field of agriculture by consistently leading the world in high-quality results for many generations of growers. Bill will review some advances that have established California as a leading center of excellence over the years and how current technology will further create value for those adopting approaches being established and validated today. These advances include new cultural practices, integration of big data into field operations, imaging from many sources and in-field sensors to optimize profits and increase yields for growers without negatively impacting quality.

FRONTIERS IN TECHNOLOGY



The Innovative Speaker Series

Innovation is at the heart of the University of California. In university labs and in companies, UC researchers and alumni work in research and development to improve our collective future. From healthcare to the environment, from clean energy to big data, we live in an era of unprecedented technological challenges and opportunities. Now more than ever, creativity and analytic thinking are in great demand. Sponsored by CITRIS and supported by EECS, the “Frontiers in Technology” seminar series brings to UC Merced visionary innovators from leading industries that are working to create the next big technological breakthrough. It offers a unique chance to learn from key players the qualities, the stimuli, and the resources needed to make a difference in today’s rapidly evolving technological and societal horizon.

Dr. James Gosling

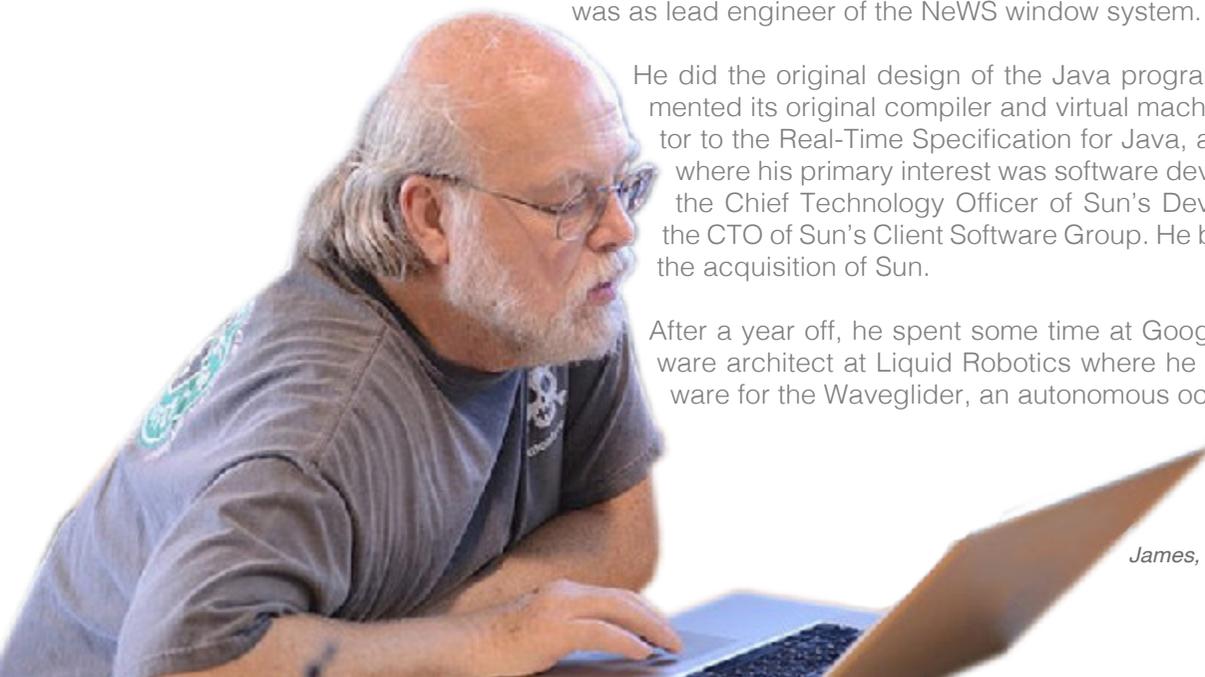
Computer Scientist

Dr. James Gosling received a B.S. in Computer Science from the University of Calgary, Canada in 1977. He received a Ph.D. in Computer Science from Carnegie-Mellon University in 1983. The title of his thesis was “The Algebraic Manipulation of Constraints”.

He spent many years as a VP & Fellow at Sun Microsystems. He has built satellite data acquisition systems, a multi-processor version of Unix, several compilers, mail systems and window managers. He has also built a WYSIWYG text editor, a constraint-based drawing editor and a text editor called ‘Emacs’ for Unix systems. At Sun, his early activity was as lead engineer of the NeWS window system.

He did the original design of the Java programming language and implemented its original compiler and virtual machine. He has been a contributor to the Real-Time Specification for Java, and a researcher at Sun labs where his primary interest was software development tools. He then was the Chief Technology Officer of Sun’s Developer Products Group and the CTO of Sun’s Client Software Group. He briefly worked for Oracle after the acquisition of Sun.

After a year off, he spent some time at Google and is now the chief software architect at Liquid Robotics where he spends his time writing software for the Waveglider, an autonomous ocean-going robot.



James, image obtained from eubilla.com



Dr. David Merrill

Entrepreneur in Residence at Lemnos Labs

“In this talk I compared and contrasted research versus startup innovation, based on my experiences at Stanford, the MIT Media Lab and Bay Area startups. I discussed how the desired outcomes of each context encourages different kinds of risk and exploration, takeaways from my research experiences and how we structure the early ideation process at Lemnos Labs where I am an Entrepreneur in Residence.”

Dr. David Merrill is a technology executive and hardware startup founder with a computer science and human computer interaction background. His tactile learning system startup Sifteo—based on his Ph.D. from MIT—was acquired by drone-maker 3D Robotics in 2014 to become the kernel of a new consumer product group. At 3D Robotics he took various roles on the team that launched Solo, the Smart Drone in 2015. Then he led R&D and IP.

Alumnus of MIT, Stanford Computer Science and Symbolic Systems. TED speaker. Human-computer interaction expert. Drone builder. His work has been featured by the Discovery Channel, Popular Science, Wired, and the New York Times. Dr. Merrill is currently Entrepreneur in Residence at Lemnos Labs, an early-stage VC firm in San Francisco, working on the next project.

Dr. Brandie Nonnecke

*Research and Development Manager for CITRIS, UC Berkeley
and Program Director for CITRIS, UC Davis*



Dr. Brandie Nonnecke is the Research & Development Manager for CITRIS, UC Berkeley and Program Director for CITRIS, UC Davis. She is a Fellow at the World Economic Forum where she serves on the Council on the Future of the Digital Economy and Society. Brandie researches human rights at the intersection of law, policy, and emerging technologies. Her current research is focused on the benefits and risks of AI-enabled decision-making, including issues of fairness, accountability, and appropriate governance structures. She has published research on algorithmic-based decision-making for public service provision in the urban context and outlined recommendations for how to better ensure application of AI to support equity and fairness. She is also researching ethics of biometric-based digital identity systems and recently published a piece highlighting the risks of digital ID systems for refugees.

“We have a complicated relationship with tech. Throughout history, technological advancements have helped us address some of our most pressing challenges, but its application has also created new ones. Dr. Nonnecke will share examples of how tech—from AI and digital identity systems to social media platforms—can be applied to change our world for good, but also provides caution on how tech must be designed and applied in ways that are inclusive, fair and just.”





FRONTIERS IN TECHNOLOGY

Dr. Mark Palatucci

Co-founder and Head of Cloud AI and Machine Learning at Anki

Dr. Mark Palatucci is the Co-founder and Head of Cloud AI and Machine Learning at Anki. While at Anki, he led the software teams that developed award winning products including Anki Overdrive and Cozmo. He is an inventor on multiple U.S. Patents, and was awarded Ph.D. fellowships from the National Science Foundation and Intel Corporation for his research on machine learning. Dr. Palatucci earned a bachelor's degree in computer science from the University of Pennsylvania and his M.S. and Ph.D. in Robotics from Carnegie Mellon University.



“For the past several decades, consumer applications of robotics have been more science fiction than reality. However, recent developments in deep-learning, cloud AI, and plummeting prices of both computation and sensing have created the necessary components for a rapidly growing consumer robotics industry to finally emerge. In this talk, I’ll discuss the evolution of Anki from three Ph.D.s and a kitchen table prototype to a global company that has quickly become the second largest producer of consumer robots in the world. I’ll share many of the successes and challenges of producing robots at the million-plus unit scale, and the important trends that will impact both academia and industry. I’ll talk about the importance of emotion and character for building a great user experience, and some surprising findings about human-robot interaction. I’ll also discuss Anki’s unique “bottoms-up approach” to robotics and show how with an increasingly complicated series of low-cost mass-market robots, we’ve created a virtuous cycle that’s driving growth in the industry and moving to a future with intelligent, emotive, robot characters for every home.”



Chandrakant Patel

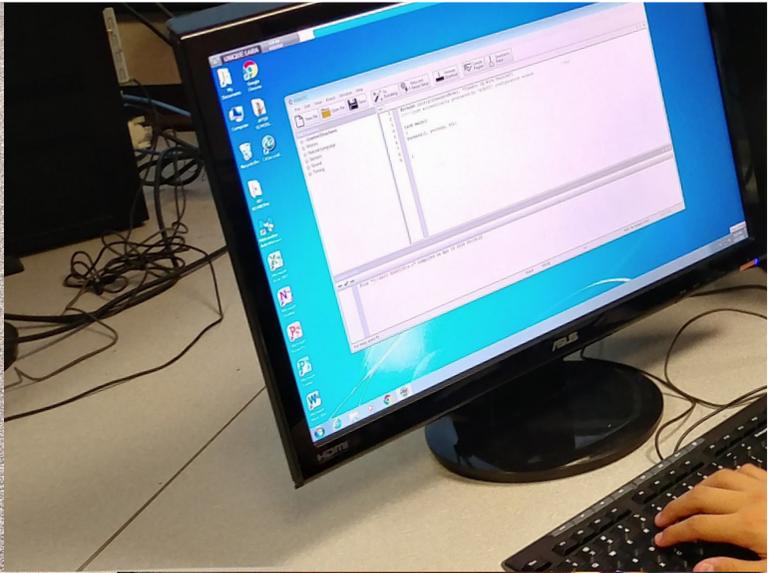
Chief Engineer and Senior Fellow at HP Inc.

Chandrakant is currently the Chief Engineer and Senior Fellow of HP Inc. Chandrakant has led HP Labs in delivering innovations in chips, systems, data centers, storage, networking, print engines and software platforms. He is a pioneer in thermal and energy management in data centers, and in the application of the information technology for available energy management at city scales. Chandrakant is an ASME and an IEEE Fellow, and has been granted 151 patents and published more than 150 papers. An advocate of return to fundamentals, he has served as an adjunct faculty in engineering at Chabot College, UC Berkeley Extension, San Jose State University and Santa Clara University. In 2014, Chandrakant was elected to the Silicon Valley Engineering Hall of Fame.

“Humanity will face more change over the next 15 years than in all of human history to date. The world will be deeply affected by population increase, shifting resource constraints, rapid urbanization, changing demographics, hyper globalization and sustainability challenges. Moreover, externalities such as environmental pollution, natural disasters and military conflicts will increasingly become a burden to society.”

“In this talk, I will outline the megatrends and examine the role of future cyber physical systems in addressing these 21st century megatrends. I will seek to drive a vigorous conversation on the role of physical fundamentals and information technologies in instantiating systemic innovations that make life better for everyone. I will close with a perspective on an idea-to-value framework that builds on lessons I have learned in my career in Silicon Valley.”

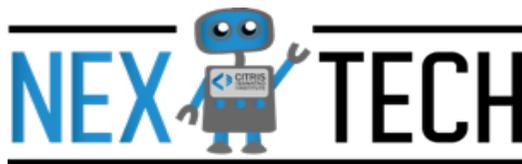
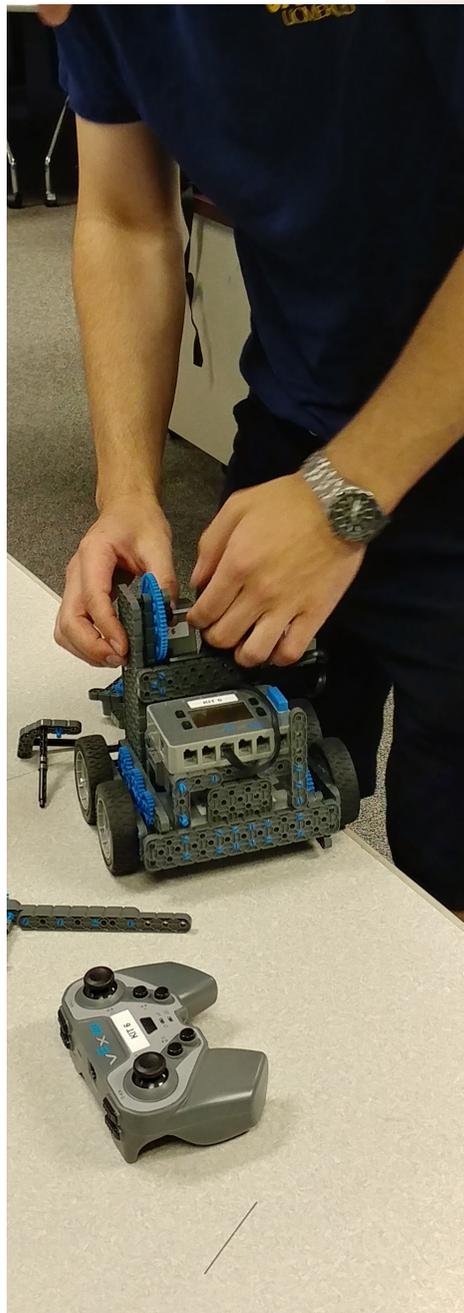
NEX TECH



The NexTech Program

CITRIS is pleased to offer a six-week program, two days a week for a few of hours, that engages local middle school students to participate in robotics. No previous experience is required to join, and enrollment is free. During this program, students will have the opportunity to learn:

- Team Work
- Building Experience
- Visual Programming
- Motor Movement
- Sensor Control





The Center for Information Technology Research in the Interest of Society

The Center for Information Technology Research in the Interest of Society (CITRIS) and the Banatao Institute is a fully functioning organized research unit within the University of California, Merced and is recognized as one of the four University of California CITRIS campuses: Merced, Berkeley, Davis, and Santa Cruz. CITRIS develops synergistic partnerships with academic institutions and corporate collaborators worldwide to collectively produce innovative solutions to challenges in four primary sectors: Connected Communities, Health, People and Robots, and Sustainable Infrastructure.

With our cutting-edge laboratories and renowned faculty experts, CITRIS serves as an incubator for translating new ideas into working prototypes. This intersection of information technology research, advanced fabrication and testing facilities, and a mission to create products for the benefit of society distinguishes CITRIS from other interdisciplinary research centers.

For over 15 years, CITRIS has brought world-class research to bear on real-world problems. With continued support from the University of California, industrial partners, state agencies and philanthropic organizations, we will make strides to improve the lives of Californians for the next generation and beyond.

CITRIS at UC Merced addresses California's most pressing societal and environmental problems by leveraging cutting-edge technologies and incorporating a convergence of student-driven initiatives, seed grants and faculty research, and corporate partnerships. This impact report concludes efforts contributing to creating information technology solutions for society's most pressing challenges.

Check out the exciting work happening at our CITRIS sister campuses!

Visit our webpage

citris.ucmerced.edu

citris-uc.org

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The Center for Information Technology Research in the Interest of Society (CITRIS) and the Banatao Institute at UC Merced creates information technology solutions for society's most pressing challenges.

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