CSL: COORDINATED SCIENCE LAB

ANNUAL REPORT

2015

TABLE OF CONTENTS

DIRECTOR'S MESSAGE - KLARA NAHRSTEDT

For CSL, 2015 was both a year of challenges and opportunities.

While the State of Illinois continues to have an ongoing budget crisis, CSL has worked to ensure that it has had minimal impact on our research. In fact, CSL's research expenditures rose from $28.2 million in FY14 to just over $31 million in FY15. In addition, the Lab opened up the CSL Studio, which provides an additional 15,418 square feet of research and office space.

Much of CSL's growth has been driven by interdisciplinary research, particularly in the areas of cybersecurity; food, water, and energy; health IT; intelligent robotics; and smart cities. In the past year, the Lab has:

- Launched the **Intelligent Robotics Lab** to develop a new generation of robots that can seamlessly interact with humans.

- Opened new space for the **Health Care Engineering Systems Center**, which aims to provide more advanced, technology-based training for physicians and research in the health IT realm.

- Secured $42.5 million in **cybersecurity and cyber resiliency** funding through the Information Trust Institute.

- Helped Illinois win the **Midwest Big Data Hub**, one of four national data hubs funded by NSF, which aims to develop new data sharing capabilities, build new data-centric communities around themes such as smart cities, food-water-energy, digital agriculture, health-care and other societal domains, and more.

In addition to devoting resources to attracting new grants, we are working to establish an interactive and interdisciplinary community. For example, CSL's robotics experts must work alongside agriculture researchers to develop UAVs that truly impact food production. We're actively reaching out to faculty in the liberal arts and sciences, applied health, and agricultural, consumer and environmental sciences in our quest to develop new transformative technologies.

CSL is also working to create more collaborative environments within our walls. In 2015, we opened new collaborative space in the lower level and remodeled two conference rooms on the fourth floor, which now boast state-of-the-art video conferencing capabilities. A small conference room on the second floor went online in February 2016, also featuring the latest in video conferencing technologies.

Our goal is to position CSL to lead new interdisciplinary centers, which federal agencies are increasingly looking to as they seek to solve big problems. By providing a community where researchers can collaborate, CSL aims to innovate the next generation of breakthrough technology.

SONIC

SONIC TAKES FIRST STEPS IN TRANSFORMING THE FUTURE OF COMPUTING
It's no secret that Moore's Law is up against a society that increasingly demands devices that are smaller, less costly, and provide longer-lasting battery life.

In the past, such advances have been made possible by the frequent reduction in size of a basic building block – the transistor switch. Today, these switches are so small that their behavior is increasingly unpredictable, because of nanoscale non-idealities. But SONIC, a $30 million multi-university center, launched in 2013 under the DOD- and SRC-funded STARnet program, is overcoming the physical limitations of the nanoscale regime.

SONIC brings together 24 faculty and more than 85 graduate student/postdoctoral researchers from nine renowned U.S. universities (see a full list at sonic-center.org). They focus on SONIC's mission of developing the foundations for statistical information processing on nanoscale device and circuit fabrics. SONIC's success relies on its ability to foster collaborations among diverse researchers, said Naresh Shanbhag, SONIC's director and the Jack S. Kilby Professor of Electrical and Computer Engineering at Illinois.

In the last three years, SONIC's innovative research agenda has made it enormously successful by all accounts, filing six patent applications in the last year alone. Here are some highlights:

Designing Shannon-inspired systems

SONIC's promise to overcome the physical limitations of transistors is based on applying the work of Claude Shannon, the father of information theory, to integrated circuits. However, using information processing, instead of data processing, to extend scaling of nanoscale devices requires a complete paradigm shift in computing--no easy task.

One of SONIC's greatest accomplishments to-date, Shanbhag said, is proving that it is possible to build such Shannon-inspired and brain-inspired chips. The center has successfully developed new algorithms that have since been mapped to architectures and to functioning chips.

Ten-times improvement in energy efficiency and density

As a result of the new models, SONIC researchers have reached new world records in power efficiency and power density of information processing systems. It did so with the work of Associate Professor Pavan Hanumolu, who achieved a 10-times improvement in quiescent power efficiency and the smallest controller area via time-based signal representation, and Assistant Professor Robert Pilawa, whose switched capacitor DC-DC converter 10-times volume reduction in the power conversion stage.

"SONIC is pioneering the concept of *in situ* information processing," Shanbhag said. "This is the idea of embedding information processing in the same substrate that senses data. We want devices, such as the FitBit or Google Glasses, that not only collect data, but also process the data."

Embedding Information Processing on Epidermal Patch

Led by Illinois Professor John Rogers, an expert in wearable devices, SONIC researchers have demonstrated health monitoring functions. These include real-time *in situ* measurement of heart and respiration rates, blood pressure, and oxygen levels on epidermal patches.

Enabling Beyond CMOS Technology

Complementary metal-oxide semiconductors (CMOS), which typically refers to a battery-powered integrated circuit, is today's industry standard. But the ability to scale CMOS is slowing.

While beyond-CMOS technologies have not been viewed as mature enough to replace the standard, SONIC has succeeded in implementing them into working systems.

"As is the case in all of SONIC's other accomplishments, the key to this achievement is to leverage system-level Shannon and brain-inspired statistical information techniques to compensate for nanoscale non-idealities," said Andrew Singer, SONIC's associate director and Fox Family Professor of Electrical and Computer Engineering at Illinois. "The statistical information processing approach taken in the SONIC Center is enabling these device and circuit fabrics that would otherwise be considered too early-stage to be useful, to build meaningful, functionally complex computational tasks."

Future Directions

In its remaining two years, SONIC researchers plan to make the research results broadly applicable across a host of application domains, including determining the fundamental limits of computing on nanoscale fabrics and demonstrating the realization of statistical information processing systems by developing an in-sensor and in-memory computing platform.

"The goal of the STARnet program is to conduct research with impact in 10-plus years," Shanbhag said. "However, quite a few of the concepts that we have come up with have potential to be implemented in the near-term. They can be built into today's emerging applications."

STRATEGIC INITIATIVES

Over the past year, the Lab has made a concerted effort to apply fundamental strengths in communications, control, and computing to interdisciplinary applications that will transform the way we live, work, and play.

These themes include healthcare technology; intelligent robotics that assist us in our day-to-day lives; protection of our confidential information and precious resources; intelligent and secure technology for food, water, and energy; and smart cities. Take a closer look:

Health IT

More advanced health care technology will result in better patient outcomes and preventive care. The Health Care Systems Engineering Center (HCSEC), a collaboration between the University of Illinois and OSF Healthcare, established a new space in the CSL Studio this year, providing a place to develop new technologies and cyber-physical systems to advance medical simulation and training, and to drive a transformation in the practice and quality of health care.

T. (Kesh) Kesavadas, director of HCSEC, is working on new technology that will help doctors and physical therapists treat remote therapy patients. In addition, the center installed the Raven II, an open-source surgical robot that will allow future doctors to acquire hands-on training in robotic surgery without the use of a patient.

Intelligent Robotics

In the future, robots will play an important role in everything from military applications to commercial applications, including areas such as precision agriculture, public safety, construction sites, elderly care, and remote package delivery.

In order to advance the intelligence and decision-making processes in robotics, CSL launched a new Intelligent Robotics Lab, under the leadership of Director Naira Hovakimyan and Associate Director Tim Bretl, to create a new generation of smart unmanned aerial vehicles (UAV) and robots that can seamlessly interact with humans. Additionally, Hovakimyan has received multiple grants for her work designing "friendly" robots that could assist an aging population. Bretl is collaborating with colleagues in civil and environmental engineering on technology that will improve the safety of mobile cranes, and is working with Soon-Jo Chung and Seth Hutchinson to build robotic bats for monitoring construction sites.

Protection of the Homeland

Increased strength in cybersecurity of our critical infrastructures helps keep data safe from attack, damage, or unauthorized access. The Information Trust Institute (ITI), housed in CSL, has been at the forefront of such research. In the past year alone, ITI has received $42.5 million in cybersecurity and cyber resiliency-related funding from the federal government. The funds created two initiatives in the last year—the Critical Infrastructure Resilience Institute, a Department of Homeland Security-funded effort to provide a better understanding of the complex issue of managing catastrophic risk to critical infrastructure; and the Cyber Resilient Energy Delivery Consortium, funded by the Department of Energy to create more secure and resilient energy delivery systems for the electric, oil, and gas industries.

Food, Water and Energy

In the future, big data could help unlock the mysteries of the natural sciences, including efficient and intelligent use of our food, water, and energy. This past year, the University of Illinois was given $5 million from the Nation Science Foundation to lead the Midwest Big Data Hub. The Hub is one of four national consortiums to accelerate advancements in the rapidly emerging field of big data analysis, and CSL researchers will contribute to big data research of the natural and built world, which includes water, food, and energy; digital agriculture; transportation; and advanced manufacturing.

Society

Advancement in society will rely on the effective implementation of smart cities and communities, network science, business analytics, and the Internet of Things. The newly established Midwest Big Data Hub, comprised of researchers from CSL and the National Center for Supercomputing Applications (NCSA), will focus on these efforts and allow researchers to better collect, mine, and analyze data, leading to greater efficiency and, ultimately, a higher quality of life and more robust society.

ENTREPRENEURSHIP

Within the University's vibrant culture of innovation, several CSL faculty have translated research in the lab into entrepreneurial opportunities in the past year. These four start-ups are using advanced technology developed at CSL to make significant and visible impacts on society.

IntelinAir
CSL and MechSE Professor Naira Hovakimyan leads research in the next generation of unmanned aerial system platforms, and in the past year, her start-up company, IntelinAir, licensed the technology. With advanced aerial drones, IntelinAir aims to assist farmers with data that can help improve crop yield and reduce costs with support for weed identification, nutrient prescription, and weather damage. To gain data insight, IntelinAir employs advanced precision flight technology, high resolution image capture with a variety of sensors, and comprehensive data analytics, including image stitching and pattern matching. They also provide support for other commercial applications, such as forestry management, cell tower and wind farm inspections, and crop and farm insurance assessments.

Reconstruct Inc.
Conceived by CSL Professor Tim Bretl (aerospace engineering) and his co-founders Mani Golparvar-Fard (civil and environmental engineering) and Derek Hoiem (computer science), Reconstruct Inc. focuses on visual analytics for the construction industry. After incorporating in December 2015, Reconstruct Inc. plans to employ small, computer controlled aerial robots that autonomously navigate both indoor and outdoor construction job sides, conduct visual inspection with onboard cameras, and more. The team is working to use these robots to measure construction progress and provide detailed and continuous performance data on workers and equipment.

OceanComm
This Illinois start-up is commercializing the first video-capable wireless underwater acoustic modem, which enables wireless video streaming underwater and wireless remote control of underwater machines and vehicles. Current methods to install, maintain, or repair infrastructure for offshore resources, like oil and gas, requires vehicles that are tethered all the way to the surface—an expensive undertaking. Developing a wireless solution will help cut costs and provide more freedom for operators to explore and operate well beneath the ocean's surface. Named one of the oil and gas industry's most promising technology startups, OceanComm is located at Research Park in Champaign and was co-founded by CSL and ECE Professor Andy Singer and CSL alumnus Dr. Thomas Riedl.

Network Perception's new tool
Illinois cybersecurity start-up Network Perception, led by CSL researchers Robin Berthier, David Nicol, and William Sanders, is preparing to launch a new software solution, called NP-Live, in the marketplace next year. NP-Live provides continuous monitoring of a company's network and can be used in many sectors, including energy. The tool makes it easier to detect vulnerabilities that can lead to security breaches. It helps analyze how traffic moves from a trusted zone (e.g., networks that support critical infrastructure) to an untrusted zone (e.g., a corporate network that connects to the Internet), and it can alert IT professionals if the traffic flow patterns deviate from the baseline.

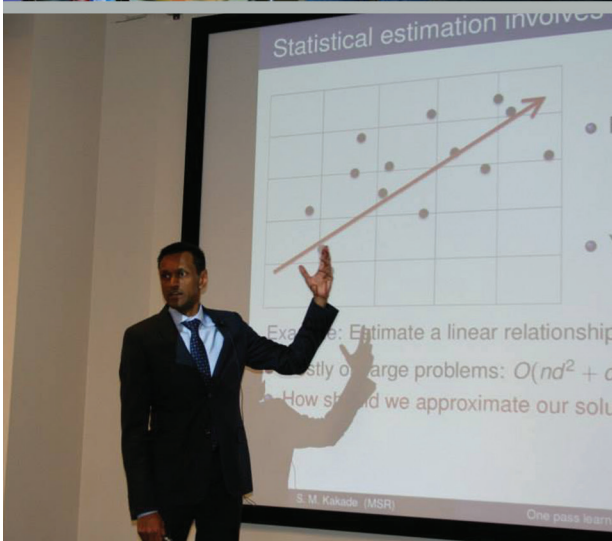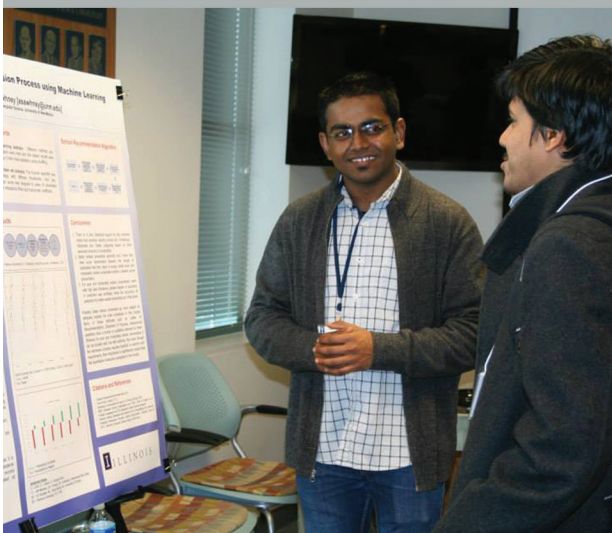# ROUND UP OF STUDENT ACTIVITIES

2015 CSL Student Conference
The tenth annual CSL Student Conference was held Feb. 26-27, 2015 and focused on the areas of robotics and control; privacy and security; machine learning; big data; and smart cities. With a mix of student presentations and posters, talks by invited speakers, and panel discussions, the student conference showcased the breadth of student work at CSL and provided opportunities for interactions amongst many areas of research. Additionally, two Best Student Talk Awards and one Best Poster Award were given.

Social Hour & Video of the Month
CSL Social Hour occurs each Friday during the academic year and features a short talk from a CSL researcher or special guest. It is an opportunity for researchers to network and learn more about the wide variety of research at CSL. Additionally, each month, students are invited to submit a video of their research, and a Video of the Month is selected and announced at the last Social Hour of the month.

Engineering Open House
Every year, the student-led Engineering Open House (EOH) features two days of more than 250 exhibits and competitions throughout campus that showcase the work of engineering students at the University of Illinois. In 2015, CSL opened many labs for families, students, and community members to explore, including exhibits in CSL and the CSL studio space featuring mobile augmented reality, aircraft safety and automation, swarm robot navigation, and video super-resolution. An estimated 20,000 visitors attend EOH every year.

CONGRATULATIONS ON WINNING

VIDEO OF THE MONTH

This certificate recognizes

KEVIN MEIER

as a certified Coordinated Science Lab VOM maker and awards all of the benefits associated with this title.

NOV/DEC 2015

WINNER WINNER

CSL COORDINATED SCIENCE LAB

2015 EVENT HIGHLIGHTS

Allerton
CSL co-hosted the 53rd Allerton Conference on Communication, Control, and Computing on Sept. 30-Oct. 2. The international conference drew 477 people from industry, academia, and government to discuss innovation in the fields of communication, control, and computing to the Allerton Park and Retreat Center. Professor Martin Vetterli, of Ecole Polytechnique Fédérale de Lausanne, delivered the keynote address. This year, 173 papers were presented across 55 sessions, as well as two tutorial talks.

SONIC Annual Meeting
In its third year, the SONIC Center—which designs robust, energy efficient, and intelligent computing platforms for nanoscale devices—has posted some impressive achievements, including setting a world-record in the energy-efficiency of a chip-to-chip interconnect. The Center, directed by Naresh Shanbhag, celebrated its achievements at its annual review meeting Sept. 30-Oct. 1 in Champaign. More than 120 faculty, students, and sponsors attended, and six students received Student Research Awards based on work presented at the poster session.
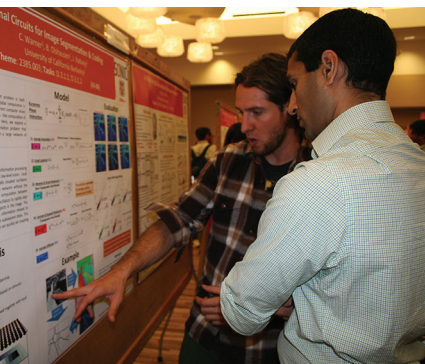
Chien Lecture
The Robert T. Chien Distinguished Lecturer Series has been bringing eminent researchers from all over the world to speak at CSL since 1979. It is just one of the lasting legacies of the former CSL director who started the lecture series. This past year, CSL welcomed Paolo Pirjanian on September 9. Pirjanian is the chief technology officer at iRobot, and he spoke of his experiences in starting a robotics company, developing technologies, building products, and selling the products.

CCBGM Planning Meeting
On March 2-3, the Center for Computational Biotechnology and Genomic Medicine (CCBGM) Planning Meeting welcomed 100 participants to the University of Chicago Gleacher Center. Prospective industry members from 28 companies attended, along with research teams from Illinois, Mayo, and the University of Chicago, to ensure that the new Center's research portfolio aligns with the needs of industry. The research teams presented proposed computational biotechnology, agritech, and genomic medicine research projects, soliciting feedback for level of interest and industrial relevancy.

CAEML Planning Meeting
More than two dozen companies sent representatives to the Center for Advanced Electronics through Machine Learning (CAEML) Planning Meeting on Nov. 2-3 at Illinois. Led by Elyse Rosenbaum, CAEML is a proposed NSF I/UCRC that aims to apply emerging machine-learning techniques to microelectronics and micro-systems modeling. Ten project opportunities were presented, providing a summary of CAEML's projected research in areas such as modular machine learning, power delivery networks, and high-speed circuits.

NEW FACULTY AND STAFF

Georgios Fellouris

An assistant professor of statistics, Georgios Fellouris holds a PhD in statistics from Columbia University. He joined Illinois from the University of Southern California, where he was a postdoctoral research assistant. Fellouris' research interests include sequential hypothesis testing; quickest change detection; sequential parameter estimation; sequential design; decision making under communication constraints; educational measurement and cognitive assessment; and epidemic detection.

Fellouris

Nam Sung Kim

Nam Sung Kim is an associate professor of electrical and computer engineering whose research incorporates devices, circuits, and architecture for power-efficient computing. He holds a PhD in computer science and engineering from the University of Michigan Ann-Arbor. Before joining Illinois, he was tenured at the University of Wisconsin-Madison, a position he held after working as a senior research scientist at Intel from 2004 to 2008. He was recently named an IEEE Fellow.

Kim
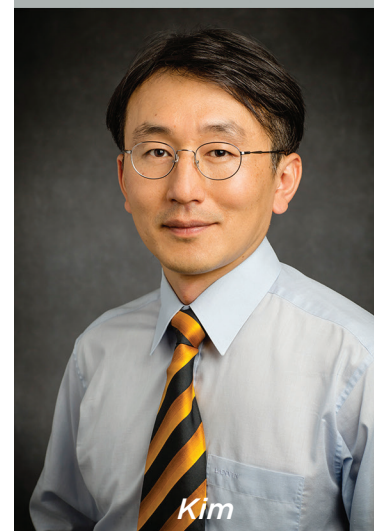
Victoria Stodden

Victoria Stodden joined the Illinois Graduate School of Library and Information Science in 2015. Her research interests center on the multifaceted problem of enabling reproducibility in computational science. She is the developer of the "Reproducible Research Standard," a suite of open licensing recommendations for the dissemination of computational results, and winner of the Kaltura Prize for Access to Knowledge Writing. She received a PhD in statistics and a law degree, both from Stanford University.

Tandy Warnow

Tandy Warnow is the Founder Professor of Engineering, joining the Illinois faculty in 2014 and CSL in 2015. She is a professor of computer science and bio-engineering and an ACM Fellow. Her research combines mathematics, computer science, probability, and statistics, in order to develop algorithms with improved accuracy for large-scale and complex estimation problems in phylogenomics (genome-scale phylogeny estimation), multiple sequence align-ment, and metagenomics. She holds a PhD in mathematics from the University of California, Berkeley.

Stodden

New Staff

Suma Pallathadka Bhat – Research Assistant Professor of ECE, CSL
Pramod Chembrammel – Research Scientist, HCESC
Steve Granda – Research Programmer, ITI
Armgard Haken – Research Program Manager, CSL
Valerie Head – Account Technician I, CSL
Steven Konstanty – Senior Research Programmer, CSL
Linda Meccoli – Office Manager, CSL
Todd Nicholson – Research Programmer, CSL
Michelle Osborne – Office Support Specialist, HCESC
Zacharia Reed – Coordinator of Research Programs, ITI
Brenda Roy – Office Support Specialist, CSL
August Schiess – Coordinator of Communications, CSL
Matthew Smith – Research Programmer, CSL

Warnow

RESEARCH AWARDS

Vikram Adve
ACM Fellow, 2015; University Scholar, 2015

Mohamed Ali Belabbas
Faculty Early Career Development Award, National Science Foundation

Roy Campbell
Selected to represent University of Illinois as a member of the Governor's Technology Advisory Board, Subcommittee on Security

Scott Carney
Fellow, Optical Society of America

Ben Chidester
CompGen Fellowship, 2015

Soon-Jo Chung
Associate Editor, AIAA Journal of Guidance, Control, and Dynamics; AIAA Guidance, Navigation, and Control Conference Best Paper Award

Venanzio Cichiella
2015 Ross J. Martin Award

Ryan Corey
SONIC Claude Shannon Award for his work entitled "Speech Enhancement for Resource-Constrained Listening Devices" at the SONIC Annual Review Meeting in October 2015

John Criswell
Honorable Mention, 2015 ACM Doctoral Dissertation Award; UIUC David Kuck Doctoral Dissertation Award

Minh Do
Fellow, Institute of Electrical and Electronics Engineers

Henry Duwe
Best in Session in Reliable Systems Design I at the 2015 TECHCON in September 2015

Gary Eden
Appointed to the Naval Studies Board, National Academy of Sciences; Appointed to the Panel on Ballistics Science and Technology of the Army Research Laboratory, National Academy of Sciences; Named associate editor of *Applied Physics Reviews*; Member of the editorial board of *Scientific Reports*

Motahhare Eslami
Facebook PhD Fellowship Finalist; Best Paper Award at ACM CHI 2015; Google PhD Fellowship Nominee; Invited to participate in MIT Rising Stars in EECS

Jonathan Freund
Secretary Treasurer of the Division of Fluid Dynamics of the American Physical Society; Associated Editor for APS Journal: Physical Review Fluids

Grace Xingxin Gao
College of Engineering Everitt Award for Teaching Excellence, University of Illinois at Urbana-Champaign; List of Teachers Ranked as Excellent by Their Students, University of Illinois at Urbana-Champaign; Best Paper Award, ION GNSS+ 2015 conference; Elected satellite division officer (treasurer), Institute of Navigation; IEEE Senior Member

William Gropp (with Tarun Prabhu)
Best Paper award at EuroMPI'15

Naira Hovakimyan
W. Grafton and Lillian B. Wilkins Professor of Mechanical Science and Engineering, UIUC; Society of Women Engineers Achievement Award; 2015 Engineering Council Outstanding Advising Award, UIUC; 2015 Plenary Speaker, 55th Israel Annual Conference on Aerospace Sciences

Wen-mei Hwu
Ramakrishna Rau Award, Institute of Electrical and Electronics Engineers, Computer Society; Faculty Award, IBM Corporation

Peter Kairouz
SIGMETRICS 2015 Best Paper Award and 2016 Harold L. Olesen Award for Excellence in Undergraduate Teaching

Namsung Kim
IEEE Fellow

Negar Kiyavash
Center for Advance Study Associate for year 2016-2017; Humboldt Research Fellowship for Experienced Researchers, 2015

Philip Krein
Chair of the IEEE Transportation Electrification Community; Chair of the IEEE/PSMA Workshop on Power Electronics and Electrical Challenges for Engineering Energy-Efficient Buildings

John L. Larson
Life Membership, IEEE, 2015

Jean-Pierre Leburton
Recognized as an IEEE Nano Technology Council Distinguished Lecturer

Yanjun Li
Best Student Paper Award at SPARS 2015, with former CSL student/postdoc Kiryung Lee, and Yoram Bresler

Joseph Lyding
2014 Feynman Prize in Nanotechnology; Fellow, American Association for the Advancement of Science; Award for Outstanding Research, American Vacuum Society Prairie Chapter

Jonathan Makela
Delivered Prize Lecture, 2015 Coupling, Energetics, and Dynamics of Atmospheric Regions

RESEARCH AWARDS CONTINUED

Thiago Marinho
Focal Point Grant, Graduate College, UIUC

Sayan Mitra
C. Holmes MacDonald Outstanding Teaching Award, Institute of Electrical and Electronics Engineers, Eta Kappa Nu

Elham Mohimi
Outstanding Graduate Student Award

Pierre Moulin
Elected member Board of Governors of the IEEE Information Theory Society 3-year term

Klara Nahrstedt
Named to the "10 women in networking/communications that you should know" selected by the Networking Networking Women (N2Women); selected to represent University of Illinois as a member of the Governor's Technology Advisory Board, Subcommittee on Data

Angelia Nedich
Best Paper Award at WiOpt 2015 (with Kobi Cohen and Rayadurgam Srikant; Member of the Board of Governors of the IEEE Control Systems Society (CSS); IEEE Control Systems Society (CSS) Liaison for INFORMS

Seewong Oh, Pramod Viswanath and Peter Kairouz
Best Paper Award at SIGMETRICS 2015

Robert Pilawa-Podgurski, Yutian Lei and Wen Chuen Liu
Best Paper Award at the IEEE Workshop on Control and Modeling for Power Electronics

Robert Pilawa-Podgurksi
Air Force Office of Scientific Research Young Investigator Award; Google/IEEE Power Electronics Society Little Box Challenge Academic Award; Associate editor of IEEE Transactions on Power Electronics; Richard M. Bass Outstanding Young Power Electronics Engineer Award, Institute of Electrical and Electronics Engineers, Power Electronics Society

Elyse Rosenbaum
Best Paper Award, 2014 EOS/ESD Symposium

Romit Roy Choudhury
2015 ACM Sigmobile Rockstar Award; 2015 IBM Faculty Research Award; OverLay Best Demo at ACM HotMobile 2015; Chaired ACM HotMobile 2015

Rob Rutenbar
Member, Advisory Committee for the National Science Foundation (NSF) Computing and Information Sciences (CISE) Directorate; Keynote Speaker, 2015 ACM International Symposium on Physical Design (ISPD'15)

Srinivasa Salapaka
Fellow of American Society of Mechanical Engineers

William H. Sanders
Fellow, American Association for the Advancement of Science; appointed a member of the National Research Council's Forum on Cyber Resilience

Pete Sauer
PES Prabha S. Kundur Power System Dynamics and Control Award, Institute of Electrical and Electronics Engineers

Lui Sha
Member of NASA Advisory Council's Aeronautic Committee; Co-recipient of IEEE Simon Ramo Medal with John Lehoczky and Ragunathan Rajkumar

Naresh Shanbhag and Mingu Kang
2015 ISCAS Best Paper Award

Naresh Shanbhag
Associate editor for the *IEEE Journal of Solid-State Explaoratory Computational Devices and Circuits*; Associate Editor, *IEEE Journal of Solid-State Exploratory Computational Devices and Circuits*

R. Srikant
Indian Institute of Technology, Madras Distinguished Alumnus Award, 2015; IEEE INFOCOM Achievement Award, 2015; IEEE INFOCOM Best Paper Award, 2015 (coauthors: Lei Ying and Xiaohan Kang); Best Paper Award, WiOpt, 2015 (coauthors: Kobi Cohen and Angelia Nedich)

Lav Varshney
NYC Media Lab - Bloomberg Data for Good Exchange Paper Award, 2015

Shobha Vasudevan
Early Career Award, IEEE Council of Electronic Design Automation; Outstanding New Faculty Award, Association for Computing Machinery, Special Interest Group on Design Automation

Pramod Viswanath
ACM Sigmetrics, 2015 Best Paper Award; Microsoft Women Graduate Research Fellowship, Jiaqi Mu, 2015-16

Zhangyang (Atlas) Wang
Baidu Research Scholarship

Tandy Warnow
ACM Fellow

Martin Wong
2nd Place, ACM TAU 2015 CAD Software Contest on Timing Analysis; 2015 Synopsys EDA Research Award; 3rd Place, ACM CADathlon Programming Contest at IEEE/ACM ICCAD-2015
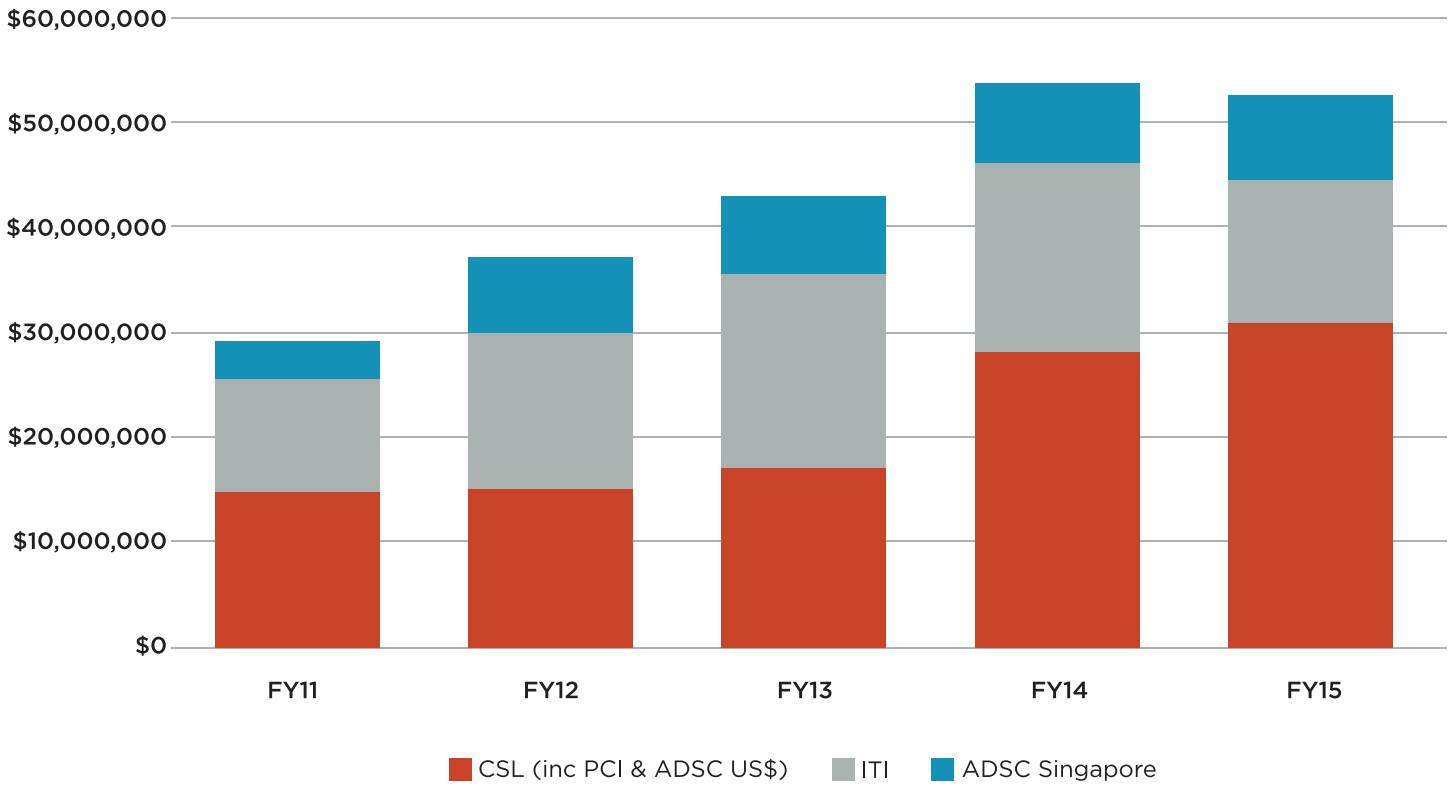
Shashank Yaduvanshi
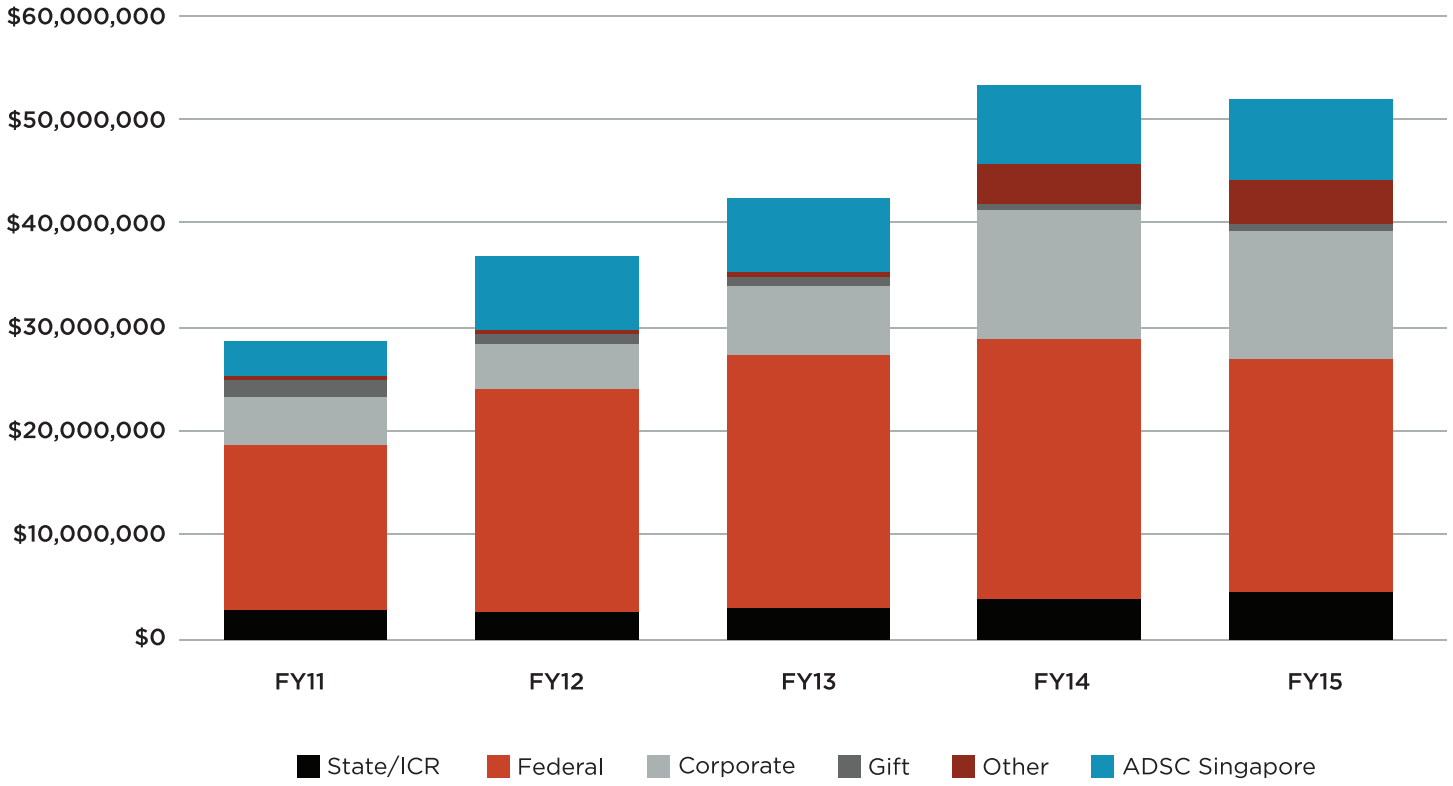Siebel Scholar Class of 2016

Pengkun Yang
Jack Keil Wolf Student Paper Award, IEEE International Symposium on Information Theory (ISIT)
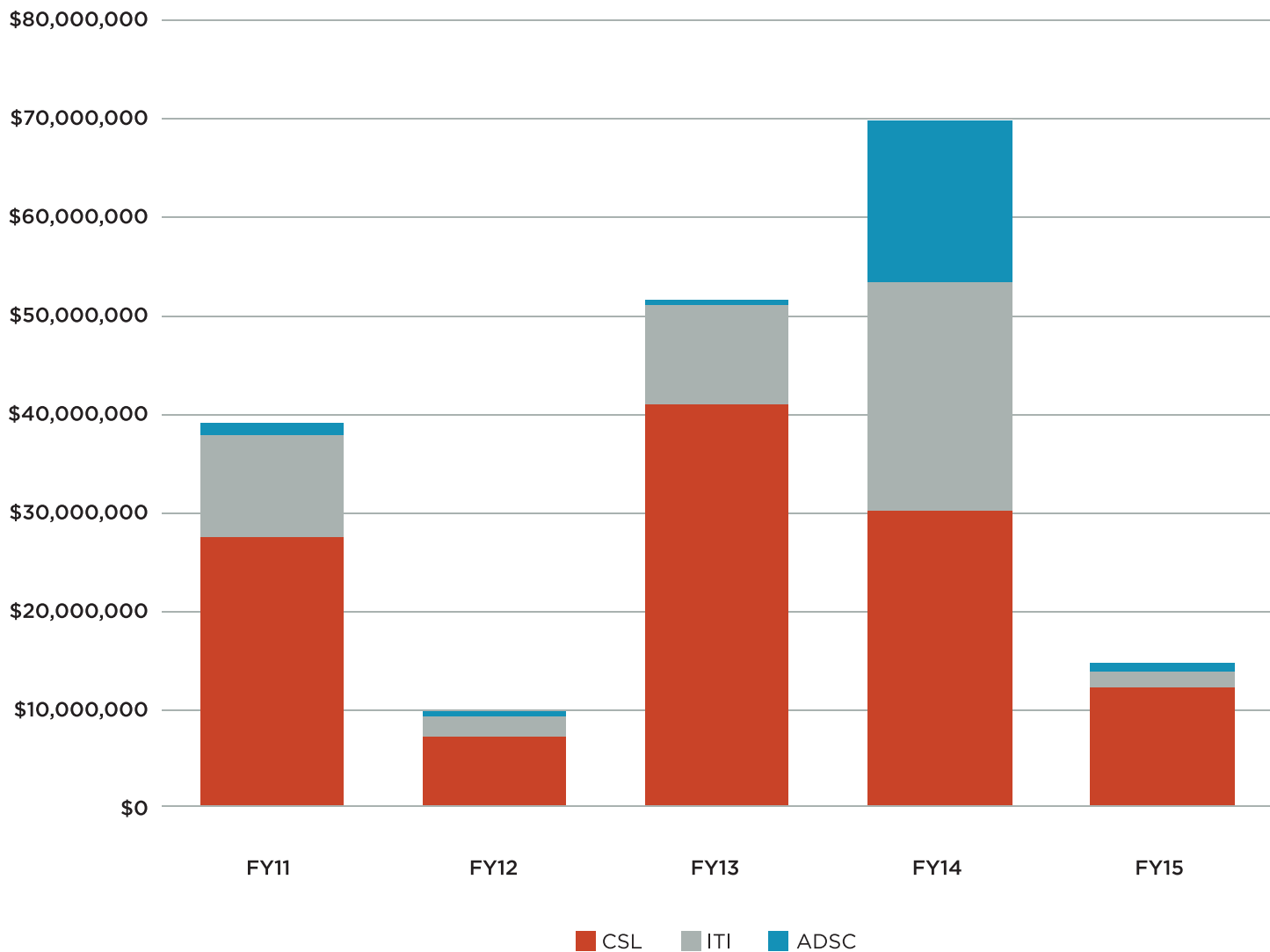
BY THE NUMBERS

TOTAL EXPENDITURES BY FISCAL YEAR

Legend: CSL (inc PCI & ADSC US$)   ITI   ADSC Singapore

CSL & INSTITUTE EXPENDITURES BY TYPE

Legend: State/ICR, Federal, Corporate, Gift, Other, ADSC Singapore

Y-axis: $0, $10,000,000, $20,000,000, $30,000,000, $40,000,000, $50,000,000, $60,000,000

X-axis: FY11, FY12, FY13, FY14, FY15

BY THE NUMBERS CONTINUED

NEW CONTRACTS/GRANTS AWARDED BY FY

Legend: CSL | ITI | ADSC

CSL: COORDINATED SCIENCE LAB

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