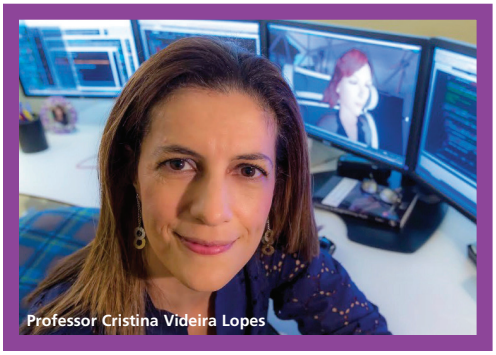
ISR Connector

INSTITUTE FOR SOFTWARE RESEARCH / UNIVERSITY OF CALIFORNIA, IRVINE

HOT RESEARCH

Simulating Cities: A Software Engineering Perspective

Despite all the reasons why complex simulations are desirable for decision and policy making, and despite advances in computing power, large distributed simulations are still rarely used. The reality is that developing distributed simulations is much harder than developing non-distributed, specialized ones, and requires a much higher level of software engineering expertise. Prof. **Cristina Lopes** and her students have been working on a software architecture, and a corresponding software framework, which have the goal of lowering the barriers for the simulation of large, complex systems, such as entire cities.



Professor Cristina Videira Lopes

One of the main challenges in doing complex systems simulations, including cities, is the fact that they embody many different subsystems, each of them relatively, but not completely, independent from the others. For this reason, there are many similarities between the concept of aspect (as given by Aspect-Oriented Programming) and the general concept of aspect of a city that urban planning researchers routinely use. All these aspects are conceptually distinct, but interact with each other over essentially the same objects (data) of the simulation. Moreover, each of these subsystems tends to fall under different expertise, different groups of people who understand them. Aggregating that knowledge under one large simulation is a daunting task.

One way to divide a complex simulation system into smaller parts is to distribute the data. Simulators partition the workload by simulating different objects at each time frame. While scalable in terms of number of objects, this approach is not scalable in terms of simulation complexity: many different subsystems need to access the same data, so each simulation node needs to simulate all subsystems. Another approach is to divide the load by subsystem: functions such as physics simulation, scripts processing, and client management, are run in distributed simulators, and object attributes are synchronized when updated. This a good solution for

RESEARCH BRIEFS

Prof. **Alfred Kobsa**, his former student **Bart Knijnenburg** who is now an Assistant Professor at Clemson University, and Martijn Willemsen from the Technical University of Eindhoven, Netherlands, received an award totaling $882K in a joint competition of the U.S. National Science Foundation and the Netherlands Organisation for Scientific Research (NWO). The topic of their planned research is "Using Process Tracing to Improve Household loT Users' Privacy Decisions."

Prof. **Sam Malek** has received a $119K award from the FBI for a project entitled "Analysis of Android Application Packages for Security-Relevant Properties."

Prof. **Paul Dourish** was a featured speaker at AI NOW - The Social and Economic Implications of Artificial Intelligence Technologies in the Near-Term, a public workshop on the future of AI co-hosted by the White House Office of Science and Technology Policy and the NYU Information Law Institute in July. A video of his talk "Sites of Deliberation" is available on the conference website, https://artificialintelligencenow.com.

Prof. **Sameer Patil** (Indiana University Bloomington) has earned three federal patents for his work in app search and discovery. The common thread connecting these patents is their focus on protecting individual privacy while also opening up the convenience of social app search to a wider audience.

Prof. **Sam Malek**, Associate Project Scientist **Joshua Garcia**, Prof. **Nenad Medvidović** at USC, and Prof. Mehdi Mirakhorli at RIT have been awarded $130K by the National Science Foundation (NSF) for their research on "Planning and Prototyping a Community-Wide Software Architecture Instrument."

Director **Richard N. Taylor** has been ranked #1 in software engineering on the 2016 AMiner Most Influential Scholar Annual List which names the world's top-cited scholars in science and engineering. The list is conferred in recognition of outstanding technical achievements with lasting contribution and impact to the research community. Recipients are automatically determined by a computer algorithm deployed in the AMiner system that tracks and ranks scholars based on citation counts collected by top-venue publications. Prof. **Nenad Medvidović** (USC) ranked at #6, and Profs. **André van der Hoek**, **Jim Jones**, and **Jim Whitehead** (UCSC) ranked in the top 100. A total of eight ISR/IRUS alumni ranked in the top 100.

More Research Briefs on page 7.

IN THIS ISSUE

MESSAGE FROM THE DIRECTOR

Cybersecurity has moved from an occasional-but-unnerving news item to a persistent, pervasive concern. As the White House has made clear, "cybersecurity is one of the most important challenges we face as a Nation. Advances in cybersecurity science and engineering are urgently needed to preserve the Internet's social and economic benefits." Neither Southern California, nor our Nation, is where it needs to be to protect against trade secret and other theft, compromise of private information, threats to our critical infrastructure, and, most recently, attempts to influence democratic processes. We believe that this is one of the grand technical and policy challenges of our time.


Taylor

ISR is certainly not alone in recognizing these concerns. Indeed, UCI has wisely recognized both the importance and urgency of these issues with its recent establishment of the Cybersecurity Policy and Research Institute (CPRI) and its continuing support of the Institute for Software Research (ISR)'s broad mandate in addressing socio-technical issues associated with software engineering.

Going forward, ISR and CPRI will cooperate, jointly pursuing core research challenges as they pertain to software and other technological infrastructures used to enable vital public functions and to the protection of security, privacy, and civil liberty interests. Public infrastructure takes many forms, from supporting the electricity distribution grid, to ensuring the integrity of dams and reservoirs, to supporting the financial transactions that undergird the economy, to the health and welfare of people. With regard to mobile devices, in a unanimous 2014 decision, the United States Supreme Court recognized their indispensable and central role, stating that smartphones are "such a pervasive and insistent part of daily life that the proverbial visitor from Mars might conclude they were an important feature of human anatomy." Such devices are routinely used in myriad personal and sensitive ways, including conducting day-to-day financial transactions, constantly tracking users' locations and managing travel arrangements of all kinds, and handling vital healthcare information.

Additionally, the ability to lawfully secure and process digital evidence from mobile devices is increasingly vital to law enforcement's criminal justice and public safety functions. Many criminal arrests now involve the seizure of smartphones or other mobile devices, with resulting digital evidence often making the difference between meting out justice and failing to do so. At the same time, however, it is increasingly clear that simultaneous advances both in security mechanisms (e.g., strong end-to-end encryption), intended to protect the consumers, and of "hacking" and other surveillance tools, raise meaningful and time-sensitive questions about privacy and civil rights and responsibilities. We have observed that, as vital debates around these issues rage, there is too little non-ideological, non-outcome-determinative, scientifically based research data. We aim to change that. "Follow the data."

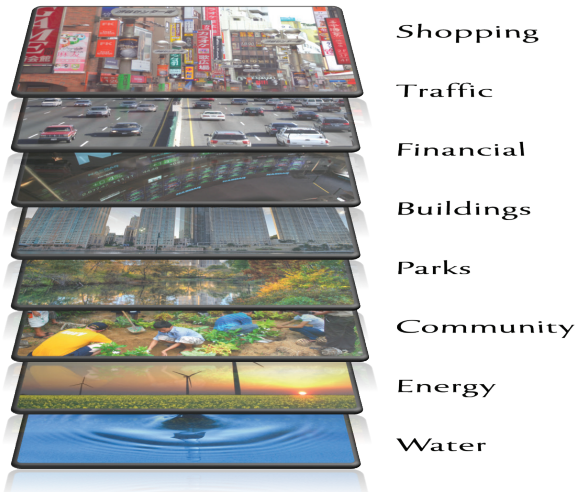
Professor **Sam Malek** (malek@uci.edu) leads ISR's work in this area. Bryan Cunningham (hbcunnin@uci.edu) leads CPRI as its Executive Director. Several other ISR faculty are working on various aspects of these concerns, and we hope to add additional faculty in the future. Together ISR and CPRI will be actively addressing this vital area. Contact us to join the effort!

ISR collaboration with other faculty and groups on campus is not limited to cybersecurity. An additional recent focus, led by Associate Director **Crista Lopes**, is directed at open-source scientific data processing in support of astronomy. ISR's contributions to the world of open-source systems are long-standing and well known (such as Dr. **Walt Scacchi's** diverse contributions in this area, and our prior contributions to Web technologies). But the move towards working with astronomy is new and timely.

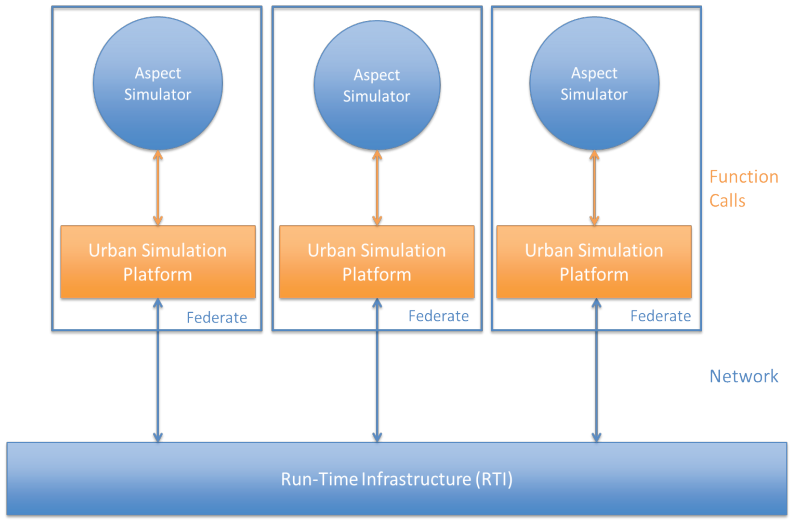
UC Irvine is particularly well positioned in the world of astronomy, thanks largely to its access to the Keck Observatories — twin 10m telescopes that have expanded our understanding of the universe like no other telescopes on Earth. UC contributes significant resources each year to maintain these (and other) world-class Astronomy facilities, and any astronomer at UC Irvine has privileged access to these powerful tools of exploration. However, UC Irvine astronomers share access with every other astronomer in the UC system, as well as astronomers at Caltech and Yale. One way to make the most of our access is to build upon UCI's strength in software research. Keck instruments today are becoming so large and complicated that the software used to analyze the data can make all the difference between a sudden groundbreaking discovery and years of struggle. Professor Lopes is leading the effort to marshal resources and set technical directions for the development of software architectures and components for telescopic data pipelines, working with faculty in the School of Physical Sciences.

Whether cybersecurity, astronomy, or any interdisciplinary topic, it's all a matter of cooperation. And recognizing that software is at the core of virtually every major scientific and business enterprise. ISR has a great and exciting future ahead!

ISR Director **Richard N. Taylor** can be reached at taylor@uci.edu.



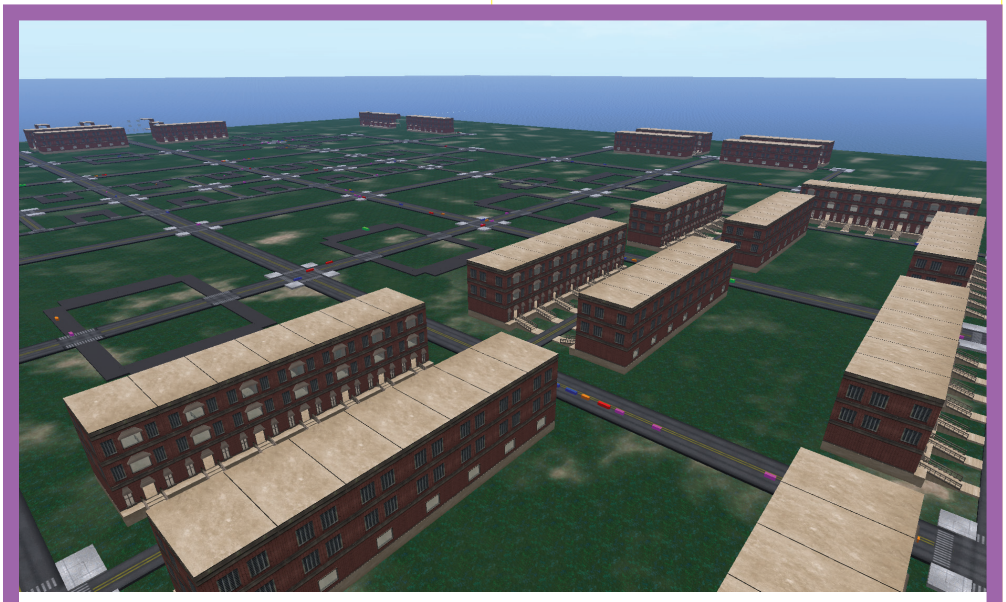
Aspects of Cities



AOP urban simulation architecture, a concrete realization of the canonical HLA.

synchronizing updates, but has some performance penalties, because data needs to be shared among simulators. Prof. Lopes and her team have been experimenting with partitioning the simulation load using AOP concepts. This architecture is inspired by the High Level Architecture military standard, but provides concrete design choices and a powerful expression mechanism (inspired by relational queries, in general, and dependent types, in particular) to reduce the technical complexity of distributing an urban simulation.

The framework they are developing is called "The Spacetime Framework," and consists of the framework itself, as well as a library (in fact, a domain-specific language, DSL) called "Predicate Collection Classes" (PCC) that lets developers declare their data models, as well as to reappropriate portions of other developers' data to fit their own sub-simulations. A simple example is a Car object and an ActiveCar object: a Car represents a common vehicle driven in cities, and its data model could be defined by a certain group of people; an ActiveCar (i.e. a Car whose velocity property is more than 0) is a specific view of the Car that might be needed for some simulations but not for all, therefore would be part of someone else's data model. The ActiveCar class is declared as a predicate on the Car class – hence the name Predicate Collection Classes. Whenever needed, a runtime classification collects all Car objects that are active, returning the collection of ActiveCar objects, statically marked as such, for a specific simulation to use. The PCC runtime maintains a synchronization between an object and its derivatives based on a primary key. This means that modifying the value of properties of ActiveCar implies the same modifications in the original Car object. The PCC DSL/runtime support is being developed by Ph.D. student **Rohan Achar**. A paper describing it, entitled "Predicate Collection Classes," will soon appear in the *Journal of Object Technology*.



View of the urban simulation platform prototype. The colored rectangles are vehicles, with each color indicating a different type of vehicle.

The Spacetime Framework is a time-stepped simulation framework that allows developers to declare which data to use, and how. So, for example, a certain simulation component might create Car objects, while another component might get ActiveCar objects, and a third component might get and update InactiveCar objects. All of this is done declaratively. The objects themselves are reclassified at every time step for every simulation component.

While the architecture and programming model of Spacetime are very simple, a simplistic implementation of the framework would lead to severe performance issues. Recently graduated Dr. **Arthur Valadares**, who defended his thesis in November,

ISR STUDENT NEWS

Alireza Sadeghi's (S. Malek, Advisor) paper, "A Taxonomy and Qualitative Comparison of Program Analysis Techniques for Security Assessment of Android Software," was recently published in *IEEE Transactions on Software Engineering (TSE)*. The paper is co-authored by **Hamid Bagheri** (University of Nebraska-Lincoln), Associate Project Scientist **Joshua Garcia**, and Sadeghi's advisor Prof. **Sam Malek**. This paper has also been selected for presentation at ICSE 2017 via a new initiative called Journal First, wherein a TSE paper that has never appeared at a conference before may be invited for presentation at a leading conference.


Sadeghi

Hosub Lee (A. Kobsa, Advisor) recently presented two papers. The first, "Personalized object recognition for augmenting human memory," was presented at the ACM Conference on Ubiquitous Computing (UbiComp '16) held in Heidelberg, Germany in September. The paper was co-authored by Cameron Upright and Steven Eliuk of Samsung Research America, and Lee's advisor, Prof. **Alfred Kobsa**. The second paper, "Understanding user privacy in Internet of Things environments," also co-authored by Kobsa, was presented at the *IEEE 3rd World Forum on Internet of Things*, in Reston, VA, in Dec.


Lee

For more information on students:
isr.uci.edu/happenings/student-updates

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has been working on the performance of Spacetime. The simple relational model of PCC allows multiple optimizations that dramatically reduce the amount of data that needs to be sent from the shared data store to all the simulation components at each time step. Benchmarks show that the Spacetime framework is comparable to hand-optimized code. A paper describing the Spacetime framework entitled "CADIS: Aspect-oriented Architecture for Collaborative Modeling and Simulation" has been published and presented at the 2016 Winter Simulation Conference in December.

The Spacetime Framework is currently under experimental deployment at an urban planning company, and is also being used as the basis for projects in a course Prof. Lopes is teaching in the Winter quarter.

See in Github:

https://github.com/Mondego/spacetime

and

https://github.com/Mondego/pcc

This work is currently supported by NSF grant #1526593.

For more information about Prof. Cristina Lopes research, visit:

http://mondego.ics.uci.edu/

Prof. Lopes can be contacted at lopes@ics.uci.edu.

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Rubbing elbows with ISR faculty, staff and students gives you a valuable window into the technology landscape of the future. But a relationship with ISR can be much more: Think of us as an extension of your company—a think tank, an R&D department, a research library, a consulting firm, a training department, and an employment agency, all rolled into one. More importantly, when you sponsor ISR you become part of a friendly group of folks who speak the same language and are eager to work with you to solve your current technical problems in the most cost-effective way possible.


Brodbeck

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Assistant Director

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Mr. Satoru Aihara, Software Engineering Project, NTT SIC; Dr. Shinobu Saito, Software Engineering Project, NTT SIC and ISR visiting researcher; and Mr. Hikaru Suzuki, Vice President, NTT SIC.

Visitor from NTT Software Innovation Center Explores Business Process Understanding

From July 1, 2016 through June 30, 2017, ISR is hosting visiting researcher Dr. **Shinobu Saito**, Senior Research Engineer at the NTT Software Innovation Center, Software Engineering Project, in Tokyo, Japan. Dr. Saito's research interests are in software requirements engineering, design recovery, business modeling, and business process management. He received his Ph.D. in systems engineering at Keio University in 2007.

NTT Software Innovation Center (NTT SIC) believes in fostering global research projects with overseas universities and institutes. When the opportunity arose for Saito to spend a year abroad, his colleague Prof. Mikio Aoyama at Nanzan University recommended he speak with ISR Director **Richard N. Taylor** about spending the year at UCI ISR. Saito was familiar with Taylor's software architecture work and with ISR through its support of ICSE 2011, and the match was made!

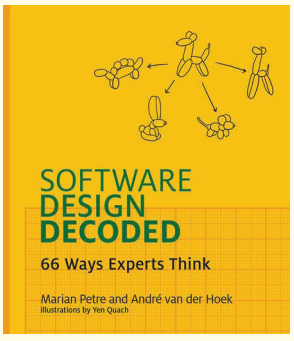
During his stay at ISR, Dr. Saito plans to focus on recovering business processes using information from enterprise system databases. Understanding business processes can be difficult as systems are often undocumented, or have documentation which no longer matches the system due to system changes over time. Saito is also interested in the challenges of automatic generation of business processes and analyzing and visualizing information in system databases. His goal is to streamline business/system comprehension.

Dr. Shinobu Saito with Director Richard N. Taylor

In September, Dr. Saito was honored by the Information Processing Society of Japan (IPSJ) Special Interest Group on Software Engineering, which bestowed on him the IPSJ SIG-SE Distinguished Research Award. IPSJ gives this award to Japanese researchers who publish at top-level software engineering conferences and journals. Saito was one of two people who received the award this year. The

van der Hoek Co-Authors New Book Software Design

Professor **André van der Hoek** and Marian Petre of the Open University have co-authored a new book entitled *Software Design Decoded* published by MIT Press.



This book explores the specific habits, learned practices, and observed principles applied by expert software designers. It offers sixty-six insights, distilled from years of studying experts at work, that capture what successful software designers actually do to create great software.

Vint Cerf, Internet Pioneer, calls it "pithy and relevant," and Grady Booch, IBM Fellow and Chief Scientist for Software Engineering, IBM Research states, "This is the book I wish I'd had around throughout my journey as a software architect. It's charming, approachable, and full of wisdom -- you'll learn things you'll come back to again and again."

For more information visit: *mitpress.mit.edu/software-design-decoded*

ISR STUDENT NEWS

Chris Wolf (P. Dourish, advisor) spoke on a panel on "Doing Good with Data: Human-Centered Data Science for Social Good" at the Grace Hopper Celebration of Women in Computing Conf. in Oct. in Houston, TX. Wolf is also a co-author on "Would You Be Mine: Appropriating Minecraft as an Assistive Technology for Youth with Autism" which was awarded Best Paper at the ACM SIGACCESS Conf. on Computers and Accessibility in Oct. Co-authors are Kathryn E. Ringland, LouAnne E. Boyd, L., Mark S. Baldwin, and Gillian R. Hayes, all from UCI.

Wolf

Thomas Kwak (A. van der Hoek, advisor) interned last summer at NASA Jet Propulsion Laboratory where he created a web application for modeling space mission constraints and scenarios using React and Redux to render and store data, implemented multiple interfaces, and created a testing suite using Karma and expect.js.

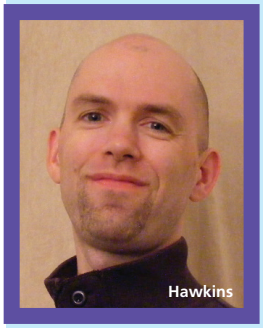
Kwak

Yiran Wang (G. Mark, advisor) gave a presentation titled "A Mixed-methods Study of College Students' Informal Learning on Facebook" at the 7th Annual Digital Media and Learning Conf. (DML'16), in Oct. at UCI.

Wang

ISR STUDENT NEWS

Byron Hawkins (B. Demsky, advisor) interned at Microsoft in Redmond, WA in Fall quarter. He focused on implementing a security feature for Visual Studio and Windows on ARM 64 which will be integrated into the mainline ARM 64 products. His mentor was Shishir Sharma and his manager was Ten Tzen.


Hawkins

Eugenia Ha Rim Rho (A. Kobsa, advisor) interned this summer at NORC, an independent research institution at the Univ. of Chicago that delivers reliable data and rigorous analysis to guide critical programmatic, business, and policy decisions. Rho was part of NORC's General Social Survey Data Explorer team and worked on analyzing online user behavior data to enhance site efficiency and identify performance issues.


Rho

Vaibhav Saini (C. Lopes, advisor) interned this summer at Microsoft in Bellevue, WA. Saini worked on enabling Stack-Trace Search functionality for Visual Studio Team Services. He prepared a proof of concept of the new feature and performed analysis to estimate the expected performance of the system once released. His supervisors were Stanislaw Swierc and Trevor Carnahan.


Saini

award was given for his paper "Visualizing the Effects of Requirements Evolution" which was published at ICSE 2016, in the Software Engineering in Practice (SEIP) track. The paper is co-authored by: Yukako Iimura, NTT SIC, Japan; Hirokazu Tashiro, NTT Data Corporation, Japan; Aaron K. Massey, University of Maryland; and Annie I. Antón, Georgia Tech.

In November, ISR was pleased to host Mr. Hikaru Suzuki, Vice President, NTT SIC and Mr. Satoru Aihara, Senior Research Engineer, Software Engineering Project, NTT SIC, who visited Saito and UCI ISR for a day. It was a great opportunity for ISR and NTT to exchange information on research projects and form a foundation for future interactions.

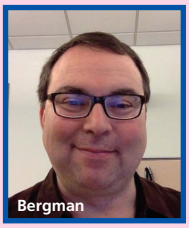
Dr. Saito is currently exploring means for collaborating with Prof. **André van der Hoek** and his research group, and interacting with Prof. **Walt Scacchi**, Assoc. Project Scientist **Joshua Garcia,** and fellow ISR visitor Prof. **Zhenyu (Charles) Zhang** from the Chinese Academy of Sciences.

"Visitors from influential companies such as NTT give ISR researchers the ability to hone their research objectives through regular interactions," says ISR Director Taylor. "Shinobu is an excellent researcher in his own right; we are privileged to have him resident in ISR this year."

Dr. Saito can be reached at saito.shinobu@lab.ntt.co.jp and, through June, at shinobus@uci.edu.

ISR ALUMNI NEWS

Mark Bergman (Ph.D. 2003; G. Mark, advisor) is now a Senior User Researcher at Blizzard Entertainment in Irvine.


Bergman

Arthur Valadares (Ph.D. 2016; C. Lopes, advisor) earned his Ph.D. in Fall quarter and started his new job in January as a Database Software Engineer at Rockley Photonics in Pasadena.


Valadares

Oliver Yi Wang (Ph.D. 2015; D. Redmiles, advisor) is now an Assistant Professor at Dakota State University, in the College of Business and Information Systems.


Wang


Williams

Amanda Williams (Ph.D. 2009; P. Dourish, advisor) is now a Business Unit Manager at Jabil.

ISR Technical Reports Available Online

ISR technical reports present information resulting from student and faculty research carried out under the auspices of the Institute. They showcase early results not available in print elsewhere. ISR technical reports are available in PDF on the ISR website. Recent reports include:

"Path-Sensitive Analysis of Message-Controlled Communication for Android Apps"
Joshua Garcia, Sam Malek
UCI-ISR-16-4, September 2016

"Computational State Transfer: An Architectural Style for Decentralized Systems (Doctoral Dissertation)"
Michael Gorlick
UCI-ISR-16-3, August 2016

All ISR technical reports are available at:

isr.uci.edu/publications/

Participants of the Int'l Conference on Global Software Engineering visit Google, Irvine.

Redmiles Reflects on ICGSE 2016

As reported in the Fall/Winter 2015 edition of the *ISR Connector*, the Eleventh Annual IEEE International Conference on Global Software Engineering (ICGSE 2016) was held at the University of California, Irvine, in Bren Hall, August 2-5, 2016. The conference series brings together researchers and practitioners interested specifically in the challenges faced by globally distributed, collaborative software engineering. As the reader might imagine, the "global" and "distributed" dimensions create particular challenges to communication and coordination, strategic planning, and process – especially, for example, scaling processes including agile software processes.

The week was filled with research workshops, tutorials, a doctoral symposium, keynotes, technical presentations, networking time, and concluded with a site visit to Google, Irvine. The photo above shows the conference attendees who participated in the Google site visit on the last afternoon of the conference. ISR alumnus **Jason Robbins** and Robert Murray of Google graciously hosted the conference attendees, with Murray giving a short lecture about software development at Google and the Irvine site in particular. Then volunteers – many of them UCI ICS grads (e.g. ISR alumnus Dr. **Chris Jensen** among others) – helped lead small groups on tours through the facility.

While the site visit to Google was a great capstone event to the conference, each day of the conference had something exceptional to offer. Workshops and tutorials comprised the first day-and-a-half. Of note and new this year was a workshop on educating software developers for globally

RESEARCH BRIEFS

Prof. **Zhenyu (Charles) Zhang** from the State Key Laboratory of Computer Science, Institute of Software, Chinese Academy of Sciences is visiting ISR from August 2016 to August 2017. His host at UCI is Prof. **Sam Malek**.

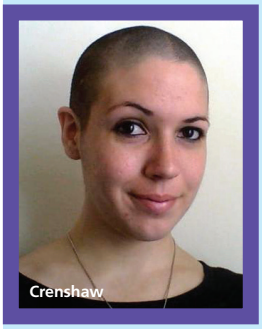
Associate Project Scientist **Joshua Garcia** gave a presentation at The Aerospace Corporation in July as part of their CSD Tech Forum series. His talk was entitled "Effective, Lightweight Analysis of Android Apps—A Security and Testing Perspective." Garcia also gave a presentation entitled "Lightweight, Obfuscation-Resilient Detection and Family Identification of Android Malware" in September as part of the IEEE OC Cybersecurity Technical Talk series.

The Best Paper Award at the International Conference on Software Maintenance and Evolution (ICSME 2016) has been given to Ph.D. student **Vaibhav Saini**, alumnus Dr. **Hitesh Sajnani**, and their advisor Associate Director **Cristina Lopes** for their paper "Comparing Quality Metrics for Cloned and Non-Cloned Java Methods: A Large Scale Empirical Study."

Prof. **Walt Scacchi** has two recent publications in IEEE Software, January-February 2017. The first, "Practices and Technologies for Computer Game Software Engineering," is authored by Scacchi. The second, "How Best to Teach Global Software Engineering," authored by Scacchi along with S. Beecham, T. Clear, D. Damian, J. Ball, and **John Noll** of ISR, follows from an Oxford style debate held at the International Conference on Global Software Engineering (ICGSE) Workshop on Global Software Engineering Education (GSE-Ed) at UCI in August 2016.

ISR STUDENT NEWS

Nicole Crenshaw (B. Nardi, advisor) presented her paper "'Something We Loved That Was Taken Away': Community and Neoliberalism in World of Warcraft" at the 50th Hawaii International Conference on System Sciences (HICSS), held in Waikoloa, HI in January. The paper is co-authored by undergraduate research assistant Jaclyn LaMorte and Crenshaw's advisor Prof. **Bonnie Nardi**.


Crenshaw

Arthur Valadares (C. Lopes, Advisor) presented his paper "CADIS: Aspect-oriented Architecture for Collaborative Modeling and Simulation" at the Winter Simulation Conference 2016 held in Washington, DC in December. The paper is co-authored by his advisor Prof. **Cristina Videira Lopes**, Ph.D. student **Rohan Achar**, and Mic Bowman (Intel Labs). Valadares defended his Ph.D. dissertation in November – congratulations Arthur!


Valadares

Reyhaneh Jabbarvand (S. Malek, advisor) was awarded a GHC scholarship by the Anita Borg Institute to attend the Grace Hopper Celebration of Women in Computing conference held in October in Houston, TX.


Jabbarvand

For more information on students:
isr.uci.edu/happenings/student-updates


Prof. David Redmiles

distributed software development (GSE-Ed). ISR's Prof. **Walt Scacchi** gave a tutorial about the relationship of open source software to globally distributed software engineering. The opening keynote of the conference on Tuesday was given by Sanjay Shirolé from the SAP Innovation Center Silicon Valley. He gave an inspiring talk on entrepreneurship and innovation in industry and how SAP fosters innovation through its HanaHaus project. Thursday's keynote was by Dr. Margaret-Anne Storey, a Professor of Computer Science at the University of Victoria, who gave a visionary talk on how conversational bots can facilitate communication in collaborative software development. In the final keynote, on Friday, Dr. Andrew Begel, a Senior Researcher at Microsoft Research, presented the latest research around using biometrics to monitor and help improve the performance of software developers. Video recordings of the keynote talks are available on the 2016 conference website.

The Best Research Paper award was given to "Hiring in the Global Stage: Profiles of Online Contributions" by ISR Prof. **Anita Sarma** (Oregon State Univ.), Xiaofan Chen (Newnerdy Enterprise Group, New Zealand), Sandeep Kuttal (Univ. of Tulsa), Laura Dabbish (CMU), and Zhendong Wang (Univ. of Nebraska-Lincoln). We are pleased to say that **Zhendong Wang** has since joined UCI ISR as a Masters student in Software Engineering. The winner of the Best Industry Paper was "Enabling Knowledge Sharing in Agile Virtual Teams," by Nils Brede Moe (SINTEF ICT, Norway), Tor Erland Fægri (SINTEF ICT, Norway), Daniela Soares Cruzes (SINTEF ICT, Norway), and Jan Edvard Faugstad (DNV GL, Norway).

Prof. **David Redmiles**, General Chair of the conference, remarked: "I was so pleased to see attendees from so many countries and to have a balance between industry and academic discussions. I could tell the conference was a success by all the wonderful expressions of gratitude by attendees as the week ended." Indeed, two goals of ICGSE are to bring together industry and academia and to bring together people from many countries and cultures. At the conference, 24 of the 76 attendees were from industry (about 30%), and attendees came from 28 countries.

Finally, the success of the conference is greatly due to the fantastic support of ISR, particularly the support of Assistant Director **Debra Brodbeck**, who served as Conference Manager and Finance Chair, working with the conference team on a multitude of issues, managing the budget, making local arrangements, overseeing registration, and serving as liaison to the IEEE professional society.

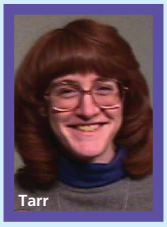
Further information about the conference, as well as the present edition and other past editions, may be found at icgse.org. The proceedings are available on the IEEE Xplore Digital Library. Prof. David Redmiles can be reached at redmiles@ics.uci.edu.

ISR EVENT SCHEDULE

Mark your calendars!


Miller

January 20, 2017
ISR Distinguished Speaker: Mark Miller
Research Scientist
Google
"The Elements of Decision Alignment: Large Programs as Complex Organizations"


Tarr

February 10, 2017
ISR Distinguished Speaker: Peri Tarr
Principal Research Staff Member
IBM T.J. Watson Research Center
"Cognitive Software Engineering: Helping Developers Work Successfully in a Cognitive World"


Orso

March 3, 2017
ISR Distinguished Speaker: Alessandro (Alex) Orso
Professor, College of Computing
Georgia Institute of Technology
"Software Debugging: Past, Present, and Future"

http://isr.uci.edu/isr-events/

March 13-17, 2017
Ground System Architectures Workshop (GSAW 2017)
Held in cooperation with ISR. *http://gsaw.org*

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