

HOT RESEARCH

Improving the Quality of Software using Testing and Fault Prediction

Software will always have bugs, and as software continues to become a more and more pervasive part of our lives, software bugs will continue to affect more people than ever. If we don't engineer for quality, over time software quality decreases. Prof. **Iftekhar Ahmed's** research interests are fundamentally driven by a desire to build less error prone systems, not only by identifying bugs through effective testing, but also by helping developers write better code from the start.

RESEARCH BRIEFS

Prof. **Cristina Videira Lopes** has been named an IEEE Fellow for her contributions to ubiquitous and immersive programming. This honor is bestowed to nominees whose accomplishments have contributed importantly to the advancement or application of engineering, science, and technology, bringing the realization of significant value to society. Congratulations to Prof. Lopes!

Prof. **Bonnie Nardi's** paper "Interaction and Outeraction: Instant Messaging in Action," which was presented at the 2000 ACM Conference on Computer-Supported Cooperative Work (CSCW '00), has been awarded the Lasting Impact Award at the 21st ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW '18). The paper was co-authored by Prof. Steve Whittaker, UC Santa Cruz, and alumnus Dr. **Erin Bradner** (Ph.D. 2001, advisor: Gloria Mark), Autodesk.

Prof. **Hadar Ziv** and Prof. **Sameer Patil** (Indiana University Bloomington) have been awarded a \$283,961 National Science Foundation (NSF) grant for their research on "Incorporating Sociotechnical Cybersecurity Learning Within Undergraduate Capstone Courses."

ISR Director Prof. **Sam Malek**, Prof. **Joshua Garcia**, and Prof. **Nenad Medvidović** (USC) are part of a multi-institution team that has been awarded a \$1.66 million research grant from the National Science Foundation (NSF) for "Constructing a Community-Wide Software Architecture Infrastructure."

Prof. **Cristina Videira Lopes** and Prof. Jens Palsberg (UCLA) have been awarded a \$1.1 million National Science Foundation (NSF) grant for their work on "NJR: A Normalized Java Resource" in which they will work with collaborators from five countries to build a community resource of executable Java programs.

More Research Briefs on page 6.

scale real world data to identify problems and propose solutions.

"Broadly, my research can be categorized

under two thrusts: (1) Identifying factors that are associated with faults in software. For example, will the code be more bug prone in the future if it was something that multiple developers worked on in parallel? (2) Improving code quality by making testing more efficient. For example, can we scale testing techniques such as mutation analysis for complex high impact systems like Linux kernel."

Elaborating on his first thrust of research, Ahmed explains that although there has been much research on predicting failures, those predictions usually concentrate either on the technical or the social side of software development. However, software development is not an isolated activity, it requires coordination between individuals and technology.

Development activity traces left behind in

IN THIS ISSUE

- 2-Message from the Director
- 4-Alums at ICS 50th Anniversary
- 4-50-year History of SE in ICS
- 5-Taylor Graduate Award in SE
- 6-Taylor Co-Edits Handbook of SE
- 6-Research Briefs
- 6-7, 10-11-Student News
- 7-Kobsa and Nardi Retire
- 8-ISR Sponsorship, Alumni News
- 9-Visitor from Norway Investigates Impact of Video Games
- 10-Tech Reports
- 11-Int'l Visiting Ugrad Students
- 11-UCI Visiting Distinguished Prof. Marian Petre
- 12-ISR Events



Prof. Iftekhar Ahmed

Ahmed explains, "Collecting and analyzing software engineering data across hundreds of thousands of software projects is easier than ever thanks to advances in cloud computing and the availability of Open Source software repositories. We should seize this great opportunity to test old assumptions, learn about factors that impact code quality, and reason about software ecosystems at large. Thus I focus on performing empirical studies on large

MESSAGE FROM THE DIRECTOR

It is my great honor to take over leadership of ISR from Prof. **Cristina Lopes**. Crista has moved on to take up the directorship of a new Professional Master degree in Software Engineering, MSWE, within the school of ICS. Crista served as director of ISR from July 2017 through June 2018. I am grateful for her leadership during that time. A change in directorship always brings with it both new challenges and opportunities. As before, ISR plans to continue to support important research in software engineering and give its faculty, students, alumni, industry, and friends a sense of community. Moreover, ISR aims to explore a tight collaboration with the upcoming MSWE program, serving as a liaison between the students in the program and high-tech industry partners.

While there have been many noteworthy news items over the past few months, I am particularly excited about one: the establishment of the Richard N. Taylor Graduate Award in Software Engineering. This award was made possible by donations from Dick's former students and several ICS alums. The award honors the everlasting contributions of the founding director of ISR to the field of software engineering. It will be bestowed annually to a Ph.D. student pursuing software engineering at UCI. See the article on page 5 for more on the award.



As in previous years, ISR will continue to have its Distinguished Speaker talks throughout the year and the ISR Research Forum at the end of the academic year, this year on June 7. I look forward to seeing many of you at these events.

The blurring line between journals and conferences in software engineering

Premier software engineering journals and conferences have taken up several initiatives over the past few years, intended to address a variety of problems in the way research results are peer-reviewed, published, and disseminated. In the process, they have further blurred the lines between journals and conferences.

As the primary publication venue in software engineering, conferences are faced with the challenge of scaling the review process to hundreds of submissions, yet maintain the quality of reviews. Both conferences and journals also face difficulty with finding qualified reviewers willing to volunteer their time. Journals are struggling to remain relevant in light of the top conferences, such as ICSE and FSE, that provide more visibility to the authors and achieve a timelier dissemination of research results.

In light of all this, top conferences have been experimenting with several initiatives. Notably, to reduce the service load and to remain environmentally friendly, top conferences, such as ICSE and FSE, are no longer holding physical program committee meetings, rather opting for asynchronous discussion of papers online. In addition, to improve the review process, conferences now incorporate a rebuttal phase, as part of which the authors get to respond to reviewers' criticism. In turn, the review process for a conference submission is more than ever similar to the process a journal submission goes through.

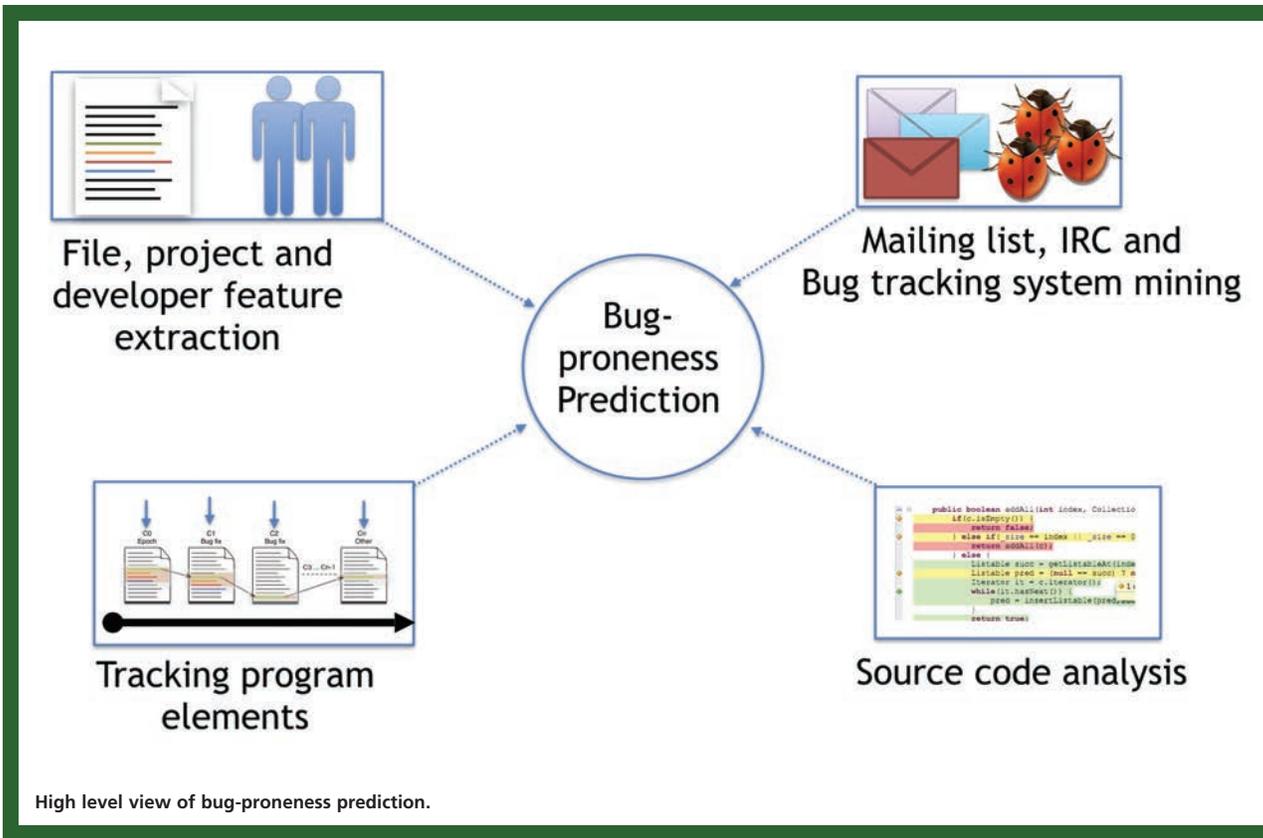
In parallel, premier journals in the field have adopted an initiative known as "journal first," where just like conference papers, accepted submissions that are not extensions of previously published work are given presentation time at the meeting of top conferences. Additionally, some of the journals in the field, such as TSE, no longer publish papers beyond a certain length without the authors having to pay hefty fees. Not having a page limitation was generally considered to be one of the key differentiating factors between journals and conferences, allowing journal papers to delve into the details and provide a more comprehensive description of the research.

Arguably, prior to these changes, it was not clear what distinguished publications in conferences from journals. For instance, for promotion and merit review, most universities gave a top conference publication the same weight as a top journal publication. The new initiatives have further morphed the two—similar page limits, review processes, and dissemination mediums—begging the question as to why we need both.

It is time for the software engineering research community to revisit the role of conferences and journals. What do we like to achieve through journals? What about conferences? If the two are indeed overlapping, do we need both? If the two are different, what is that difference? There are a number of interesting possible ways forward. One possibility is to follow an approach similar to that in the database community. The VLDB conference accepts papers continuously throughout the year. The accepted papers appear in the PVLDB journal. Papers accepted by a certain deadline are presented at the conference. Another possibility is to follow what is typically done in basic sciences and other engineering disciplines. Conferences primarily serve as a place to meet colleagues, exchange half-baked ideas, and receive feedback from other experts, while journals become the primary venue for publication of mature, peer-reviewed research.

While it is heartening to see a willingness to experiment with and change well-established processes within the governing body of conferences and journals, a more concerted effort is needed to fundamentally reconsider the role of these publication venues in our field.

Prof. **Sam Malek** can be reached at malek@uci.edu.



in understanding “successful” verification results and determining when a test harness is flawed. In correcting said harness, the harness is mutated in order to determine if there exist any similar harnesses having an equal (or better) mutation kill rate. Most importantly, his techniques also determine how to modify the model checker, the harness, and mutants to automatically produce successful high-

the artifacts involved in the software development lifecycle such as code base, version control systems, issue trackers, and discussion forums allow us to understand these complex interactions. Therefore, to attain the best possible predicative capability, we need to analyze the complex interactions between socio-technical factors. With this goal in mind, Ahmed has been focusing on the impact of collaborative work and developers’ interaction in the software development process on software quality. Ahmed has also investigated the evolution of design quality and its impact on the bug-proneness of software. Through these research endeavors, he has identified various factors related to code, developer experience and interests, and development processes that affect the quality of software, in terms of bugs and design issues.

The second thrust of Ahmed’s research is in testing. According to Ahmed, “our confidence in software systems depends on our confidence in the exhaustiveness of our testing.” His testing related work has helped to improve the quality of the Linux Kernel by efficiently applying mutation testing and identifying bugs. This work has so far identified four bugs and the associated fixes have been incorporated in the mainline Linux distribution, which

has more than one billion instances running across the world, from data centers to mobile devices. Ahmed has successfully developed novel techniques to answer open questions such as how to measure the effectiveness of testing, and has successfully developed novel techniques to improve the efficiency of using model checkers in real-world settings. Ahmed strongly believes that software engineering research is most useful when it has real world applicability and industry relevance. He states, “I have tried to make sure that my research has quantifiable benefits for working developers. My collaboration with developers at IBM in identifying bugs in the Linux Kernel primarily used mutation analysis, a technique that has been around for decades. However, this technique hasn’t been adopted by industry due to the computational requirements and large number of false positives associated with it. By successfully applying this technique in the Linux kernel together with an industry partner, we have opened up opportunities for wider industry applications.” As a part of his effort to help developers write better code by providing tools that are scalable, Ahmed, using mutation analysis, developed novel techniques to improve the efficiency of model checkers. His techniques aid developers

coverage executions covering mutated code.

Ahmed believes that due to the ever-increasing presence of cyber-physical systems (e.g., self-driving cars, Internet of Things) and the growing complexity of software, quality of software is more important than ever. Reliable software is essential and has compelling safety implications for both the users and the people surrounded by such cyber-physical systems. Using traditional testing methods for these systems is expensive, time consuming or, in some cases, infeasible. This is due to the systems’ continuous interactions with the environment and the deep intertwining of software with hardware. Ahmed plans to continue developing tools and techniques for identifying faults in software running in cyber-physical systems through testing and analysis to help developers build more reliable software.

To learn more about Prof. Ahmed and his research, visit his website:

<https://www.ics.uci.edu/~iftekha/>

Prof. Ahmed can be reached at iftekha@uci.edu.



ISR faculty and alums at ICS 50th Anniversary Celebration. Dr. Jose Romero-Mariona, Prof. Hadar Ziv, ISR Programmer/Analyst Kari Nies, Dr. Owen O'Malley, Dr. Arthur Hitomi, Prof. Ray Klefstad, Dr. Kristina Nasr, Dr. Roy Fielding, Prof. Emeritus Richard N. Taylor, Dr. Eric Dashofy, Prof. Emeritus Debra J. Richardson, Dr. Jie Ren, Dr. Jason Robbins, Prof. Sameer Patil, Prof. David Redmiles, Prof. André van der Hoek, ISR Assistant Director Debra Brodbeck, and Research Prof. Emeritus Walt Scacchi.

ISR Alums and Faculty Participate in ICS 50th Anniversary

On October 16th, the Donald Bren School of Information and Computer Sciences celebrated its 50th anniversary! ICS was founded in 1968 as a free-standing department, and became the University of California's first computer science school in 2002.

More than 400 people attended this day-long commemorative event, which was held at the Arnold and Mabel Beckman Center. Numerous software alums attended, enjoying the opportunity to reunite and look back on their time at UCI.

UCI Chancellor Howard Gillman praised ICS for being the only independent computer technology school in the University of California system. ICS Dean Marios Papaefthymiou noted that the event was not just about reflecting on the past, but also looking ahead to the next 50 years.

Prof. Emeritus **Debra Richardson**, the Founding Dean of the School of ICS, and Prof. Emeritus **Richard N. Taylor** participated on a panel on the topic of "How We Got Here" which addressed: ideas the school was founded upon and how they evolved over time; ways in which ICS has contributed to promoting the responsible and equitable use of technology; and impactful contributions, for example from collaborations with industry.

Alumnus Dr. **Owen O'Malley** (Ph.D.

1996, advisor: Debra Richardson), co-founder and technical fellow of Hortonworks, served on a panel on "Industry and Entrepreneurship." O'Malley reflected on the day, "The ICS 50th anniversary event was a wonderful chance to get together and share the stories of where we have been and where we are going. I loved the opportunity to reconnect with people that I haven't seen in 30 years."

A highlight of the event was the announcement of the establishment of the Richard N. Taylor Graduate Award in Software Engineering, made as Prof. Taylor stood and the audience cheered enthusiastically! See the article on page 5 to learn more about the Graduate Award.

Software Engineering in ICS – A 50-year History

Inspired by the ICS 50th anniversary, Prof. Emeritus **Richard Taylor** documented the history of Software Engineering in ICS at UCI. Taylor reached out to faculty members and graduate students from across the past five decades, gathering information – as well as fun anecdotes and fond recollections. The resulting document captures the key events, topics, technical impacts, achievements, activities, and people who have contributed to software engineering's rich legacy from ICS at UCI.



A hallmark of SE research at UCI has been its interdisciplinary character; many of the key results were the consequence of looking at key software challenges in applied circumstances, such as the Internet, or as the result of working with researchers in other fields, such as HCI.

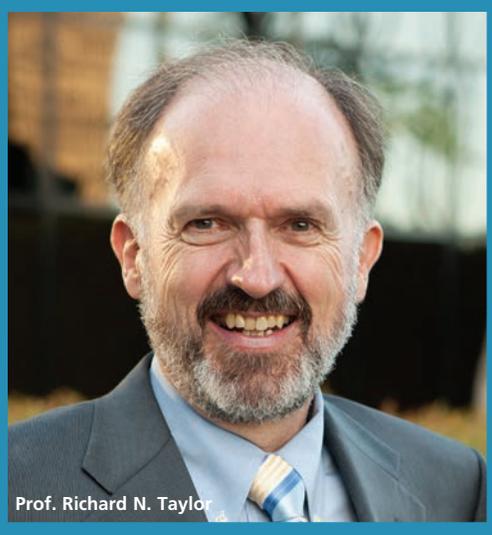
Software for the Internet has a long and strong history in ICS - from the creation of DNS through to the HTTP/1.1 protocol, REST architectural style, and Apache web server. Major SE topics at Irvine have included software reuse, programming environments, integrated software engineering environments, process, software safety, analysis and testing, security, design methods and tools, open source software, and software architecture. SE topics have been pursued by two dozen faculty over

the 50 years of ICS and have been the topic of over 100 Ph.D. dissertations.

Our diverse pursuits were enabled by strong grant support from government agencies and many corporate friends and sponsors, and institutional support from ISR and its predecessor, the Irvine Research Unit in Software (IRUS). Community events became a hallmark, ranging from one of the first software process improvement networks (SPIN), to topical workshops, to leadership and hosting of major international software engineering conferences. New companies have sprung from UCI SE work, and a legion of developers and researchers have graduated.

Read all about it in the "History of Software Engineering in ICS at UCI," available on the ISR website. Look under Publications/Tech Reports, or go directly to:

<http://isr.uci.edu/sites/isr.uci.edu/files/techreports/UCI-ISR-18-5.pdf>



Prof. Richard N. Taylor

Richard N. Taylor Graduate Award in Software Engineering Established

In October, the UCI Donald Bren School of Information and Computer Sciences (ICS) announced the establishment of

the Richard N. Taylor Graduate Award in Software Engineering. This is the first award in ICS specifically dedicated to software engineering, and it is altogether fitting to have it dedicated to the most influential software engineering faculty member that ICS has had: Prof. Emeritus **Richard N. Taylor**.

Taylor was a mentor, teacher, and thought leader—a true inspiration to all. As a mentor, he groomed his graduate students to be independent, think ‘big’, and feel comfortable in their role as researchers. As a teacher, he introduced thousands of students to the virtues and realities of software engineering. As a thought leader, he fostered extensive relations between the Institute for Software Research—which he established and directed for 18 years, industry, and other partners, to the clear benefit of the impact that UC Irvine has had on the real world and its practices today.

Taylor has had a distinguished career few, if any, can parallel. He has garnered every award imaginable in the field, including the ACM SIGSOFT Outstanding Research

Award, the ACM SIGSOFT Distinguished Service Award, the ICSE Most Influential Paper Award, the ACM SIGSOFT Impact Paper Award, and more. He took great satisfaction from advising and working with his graduate students, and pride in seeing them grow into their own and become full-fledged contributors in the community, whether as professors themselves, educators, serial entrepreneurs, or thought leaders in industry.

It is this legacy that is being honored in the establishment of this permanent graduate student award in his name.

To date, 23 alumni have contributed to the award, with donations and pledges of just over \$100,000—making this wonderful tribute a reality. A heartfelt thanks to all for the important role they played in enabling Prof. Taylor’s legacy to be perpetuated with each new student who receives the award.

“I was both surprised and honored to hear of this effort by the University and the many donors,” said Prof. Taylor. “My chief joy in all my years at UCI has been working with brilliant, hard-working graduate students, and this Graduate Award will aid in producing future generations of leaders in software engineering.”

Informatics Department Chair Prof. **André van der Hoek** remarked, “For Prof. Richard N. Taylor to be honored by his former graduate students and other alums through the formation of the Graduate Award is truly amazing. Any and all expectations I had for the responses were blown out of the water with the generosity of everyone involved. I am beyond thankful, and look forward to each year recognizing a Ph.D. student for their outstanding research!”

About the Graduate Award

The Richard N. Taylor Graduate Award in Software Engineering will be bestowed each year to a Software Engineering graduate student who has made an outstanding contribution to the field of software engineering. The award funds will not be restricted, be directed to tuition, or replace any regular funding; the award funds will be in addition to any other funding a student receives. The Graduate Award can thus have an incredibly positive impact on the recipient’s life and education.

How to Contribute to the Graduate Award

To give online:

- Start at UCI Giving page: give.uci.edu
- Click on the “Make a gift to UCI” button:
- Choose the “See All / Schools & Units” button.
- Type **Taylor** in the search box.
- Select the Richard N. Graduate Award in Software Engineering.



If you prefer to send a check, make it out to “UCI Foundation” and mail it to:

University of California, Irvine
5200 Engineering Hall
Irvine, CA 92697-2700
Attn: Catherine Rupp

Please indicate in the note area that the check is for the Richard N. Taylor Graduate Award in Software Engineering.

Does your company match donations? If so, please apply for the match to make your donation go farther!

Questions? Contact:

ISR Assistant Director Debra Brodbeck, brodbeck@uci.edu, (949) 824-2260
ICS/Eng. Assistant Dean for Development Ed Hand, elhand@uci.edu, (949) 824-6563
Informatics Dept. Chair Prof. André van der Hoek, andre@ics.uci.edu, (949) 824-6326

ISR STUDENT NEWS

Wen Shen (C. Lopes, advisor) is presenting his paper “Multi-Winner Contests for Strategic Diffusion in Social Networks” at the Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-19), in Honolulu, HI in late January. The paper is co-authored



by Ph.D. student **Yang Feng** and Shen’s advisor Prof. **Cristina V. Lopes**.

Daniel Gardner (B. Nardi and W. Tomlinson, advisors) is the ICS recipient of the 2018-2019 Achievement Rewards for College Scientists (ARCS) Foundation Award. ARCS Scholar Awards are intended to recognize and reward UC Irvine’s most



academically superior doctoral students exhibiting outstanding promise as scientists, researchers and leaders.

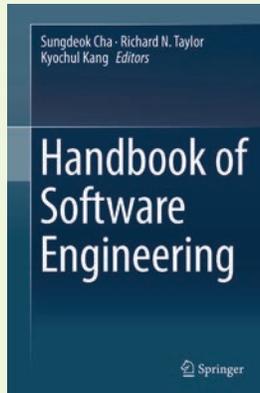
Rohan Achar (C. Lopes, advisor) presented the paper “Toward Understanding the Impact of User Participation in Autonomous Ridesharing Systems” at the 2018 Winter Simulation Conference (WSC 2018) held in Gothenburg, Sweden in December. The paper is co-authored



by Ph.D. student **Wen Shen** (first author) and their advisor Prof. **Cristina V. Lopes**.

Taylor Co-Edits *Handbook of Software Engineering*

Prof. Sungdeok Cha of Korea University, Prof. Emeritus **Richard N. Taylor**, and Kyo C. Kang, Executive Vice President at Samsung Electronics, have co-edited the book titled *Handbook of Software Engineering*, published by Springer International Publishing in February 2019.



This handbook provides a unique and in-depth survey of the current state-of-the-art in software engineering, covering its major topics, the conceptual genealogy of each subfield, and discussing future research directions. Subjects include foundational areas of software engineering (e.g. software processes, requirements engineering, software architecture, software testing, formal methods, software maintenance) as well as emerging areas (e.g., self-adaptive systems, software engineering in the cloud, coordination technology). Each chapter includes an introduction to central concepts and principles, a guided tour of seminal papers and key contributions, and promising future research directions.

Two chapters are authored by ISR faculty members:

- “Software Architecture and Design” by Prof. Richard N. Taylor; and
- “Security and Software Engineering” by Prof. **Sam Malek**, Prof. **Hamid Bagheri** of University of Nebraska-Lincoln, Prof. **Joshua Garcia**, and alumnus Dr. **Alireza Sadeghi** (Ph.D. 2017; advisor, Sam Malek), Google.

RESEARCH BRIEFS

The paper “Observed Appropriation of IoT Technology: A Semiotic Account,” co-authored by Ph.D. candidate Bruno Azevedo Chagas, Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Prof. **David Redmiles**, and Prof. Clarisse S. de Souza (PUC-Rio), received the Best Paper Award at the 17th Brazilian Symposium on Human Factors in Computing Systems in October.

ISR Director Prof. **Sam Malek** gave a Keynote Address titled “The Threat in your Pocket: Trends, Challenges, and Solutions in Mobile Application Security” at the 25th Australasian Software Engineering Conference (ASWEC) and Australasian Software Week (ASW) in Adelaide, Australia in November.

Prof. **David Redmiles** is hosting Prof. **Tayana U. Conte** from the Federal University of Rio de Janeiro, Brazil. Conte will be spending a year long sabbatical at UCI starting in February 2019. Here research interests are in software engineering and HCI.

Prof. **Iftekhar Ahmed** presented his paper titled “Towards Understanding Code Readability and its Impact on Design Quality” at the NL4SE workshop at the ACM International Symposium on the Foundations of Software Engineering (FSE 2018), held in November in Florida. The paper is co-authored by Ph.D. student Umme Ayda Mannan (Oregon State University) and Prof. **Anita Sarma** (Oregon State University).

Prof. **Hamid Bagheri** (University of Nebraska-Lincoln) presented his paper “Efficient, Evolutionary Security Analysis of Interacting Android Apps” at the 34th IEEE International Conference on Software Maintenance and Evolution (ICSME 2018), held in Madrid, Spain in September. The paper is co-authored by Jianghao Wang (UNL), Jarod Arets (UNL), and ISR Director Prof. **Sam Malek**.

Prof. **Richard N. Taylor** has published “Only the Architecture You Need” in *The Essence of Software Engineering*, edited by Volker Gruhn and Ridiger Striemer. Springer International Publishing, 2018, pp. 77-89.



Prof. Emeritus Alfred Kobsa



Prof. Emeritus Bonnie Nardi

Professors Alfred Kobsa and Bonnie Nardi Retire

Congratulations to Prof. **Alfred Kobsa** and Prof. **Bonnie Nardi** as they retire from UCI! Kobsa and Nardi have both led distinguished careers with numerous accomplishments along the way.

During his 19 years at UCI, Kobsa conducted research in the areas of user modeling and personalized systems, privacy, usable security, and support for personal health maintenance.

Earlier, Kobsa was an Institute Director at the German National Research Center for Information Technology (GMD-FIT), a Professor at the University of Essen, an Associate Professor at the University of Konstanz, and a Senior Researcher at the University of Saarbrücken, all in Germany. He was the founding editor of *User Modeling and User-Adapted Interaction: The Journal of Personalization Research*, and the founding president of User Modeling Inc. Kobsa edited several books and authored numerous publications in the areas of user-adaptive systems,

privacy, human-computer interaction and knowledge representation. He co-founded the Adaptivity and User Modeling in Interactive Software Systems workshop series and the International Conference on User Modeling.

Kobsa graduated four Ph.D. students from UCI. Including his years prior to joining UCI, he supervised a total of eleven Ph.D. students and co-supervised another nine. His UCI alums gathered at the 2018 ISR Research Forum to help Kobsa celebrate his retirement. “I couldn’t ask for a better advisor than Alfred Kobsa,” said Prof. **Yang Wang**. “He gave me the space and freedom to explore what I wanted to do research on. Without Alfred, I wouldn’t be a researcher today.” Profs. **Bart Knijnenburg**, **Xinru Page**, and **Sameer Patil** echoed that sentiment, adding that Kobsa was patient and flexible, helped them find the essence of their research, cultivated a tight-knit community among his students and alums, and guided them on the path to becoming professors.

During Bonnie Nardi’s 14 years at UCI, her research focused on activity theory, interaction design, games, social media,



Prof. Emeritus Alfred Kobsa (center, rear) with his alumni and current Ph.D. students. Left to right: Prof. Sameer Patil (Indiana Univ. Bloomington), Yao Li, Hosub Lee, Eugenia Ha Rim Rho, Prof. Bart Knijnenburg (Clemson Univ.), Prof. Xinru Page (Bentley Univ.), and Prof. Yang Wang (Syracuse Univ.).

ISR STUDENT NEWS

Yao Li (A. Kobsa, advisor) is first author on two journal articles



appearing in *Proceedings of the ACM on Human-Computer Interaction*, Vol. 2, Issue CSCW. The first is titled “When SNS Privacy Settings Become

Granular: Investigating Users’ Choices, Rationales, and Influences on Their Social Experience” and is co-authored by Ph.D. student Xinning Gui, Informatics Prof. Yunan Chen, Prof. Heng Xu (Penn State) and Li’s advisor Prof. **Alfred Kobsa**. The second article is titled “Tell Me Before You Stream Me: Managing Information Disclosure in Video Game Live Streaming” and is co-authored by alumnus Dr. **Yubo Kou** (Purdue Polytechnic), Ph.D. student **Je Soek Lee** and Prof. Alfred Kobsa.

Hosub Lee (A. Kobsa, advisor) interned last Summer and part-time in Fall quarter at Samsung Research America in Irvine, CA where he



worked on a research project that aims to automatically identify groups of existing users who share similar behavioral patterns and figure out how a new user will be

classified into a certain group. Lee applied deep learning techniques to large-scale human behavioral data composed of implicit user feedback about smartphone apps and/or websites.

For more student news visit:

isr.uci.edu/happenings/student-updates

Alumni News

Vaibhav Saini (Ph.D. 2018; advisor, Cristina Lopes), defended his dissertation in November, and



has accepted a position as a Software Engineer II at Microsoft in Redmond/Bellevue, WA. Saini will join the “Tools for Software Engineers” (TSE) Team,

specifically working with the CloudTest team. Additionally, Saini’s paper “Oreo: Detection of Clones in the Twilight Zone” received a Distinguished Paper Award at the 26th ACM Joint European Software Engineering Conference and Int’l Symp. on the Foundations of Software Engineering (ESEC/FSE 18), held in Lake Buena Vista, FL in Nov. The paper is co-authored by Ph.D. student **Farima Farmahinifarahani**, Ph.D. student Yadong Lu, Lu’s advisor, Prof. Pierre Baldi, and Saini’s advisor, Prof. **Cristina Lopes**.

Mahmoud Hammad (Ph.D. 2018; advisor, Sam Malek) defended his dissertation in August, and is now



an Assistant Professor at Jordan University of Science and Technology. Hammad also presented his paper “SALMA: Self-Protection of Android Systems from

Inter-Component Communication Attacks” at the IEEE/ACM Int’l Conf. on Automated Software Engineering (ASE 2018) in Montpellier, France in Sept. The paper is co-authored by Prof. **Joshua Garcia** and Hammad’s advisor Prof. **Sam Malek**. Hammad received a SIGSOFT CAPS travel grant to attend the conference.

WANT TO GET INVOLVED?

Sponsoring ISR has many benefits. It enables your company to form closer ties with our faculty and students, puts you on the fast track to our leading edge research, and gives you first crack at our experimental software tools. Choose from multiple levels of sponsorship:

Support Level	Annual Contribution	Contribution goes to:
Friend	\$10,000	ISR’s general research fund.
Affiliate— Collaborative	\$20,000	Collaborative efforts.
Affiliate— Research	\$30,000	Designated ISR research area.
Affiliate— Visiting	\$40,000	Visitor at UCI.
Affiliate— Grad Student	\$60,000	Graduate student research.
Partner	\$100,000 or more	Large-scale research project.

For more information about ISR Sponsorship, please contact:

Debra A. Brodbeck
brodbeck@uci.edu
(949) 824-2260

and society and technology. In 2014, Nardi was awarded an honorary doctorate, “Doctor Honoris Causa,” from the University of Umeå in Sweden. She was elected to the CHI Academy in 2013.

Nardi co-authored and co-edited numerous books during her time at UCI. Recent books include: *Heteromation and Other Stories of Computing and Capitalism* by Hamid Ekbia and Bonnie Nardi; *Ethnography and Virtual Worlds: A Handbook of Method* by Tom Boellstorff, Bonnie Nardi, Celia Pearce, and T.L. Taylor; *Activity Theory in HCI Research: Fundamentals and Reflections* by Victor Kaptelinin and Bonnie Nardi; and *Materiality and Organizing: Social Interaction in a Material World*, co-edited with Paul Leonardi and Jannis Kallinikos. Nardi continues to co-edit the MIT Press Acting with Technology Series which has many award-winning titles. She is a founding member of the ICS Center for Research on Sustainability, Collapse-preparedness and Information Technology at UCI and of the Computing within LIMITS Workshop.

Prior to joining UCI, Nardi spent time at HP Labs, Apple, AT&T Labs, and Agilent Labs. As noted on page 1, her paper “Interaction and Outeraction: Instant Messaging in Action,” published in 2000 while she was at AT&T Labs, won the Lasting Impact Award at CSCW 2018. Nardi was elected to the CHI Academy in 2013.

Nardi graduated seven Ph.D. students during her time at UCI.

Become Part of the ISR Family

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.

Be part of the ISR Family—a Friend, Affiliate, or Partner.

For more information, visit:

isr.uci.edu/partnerships/sponsorship/ or contact:

Debra A. Brodbeck
Assistant Director
brodbeck@uci.edu, (949) 824-2260



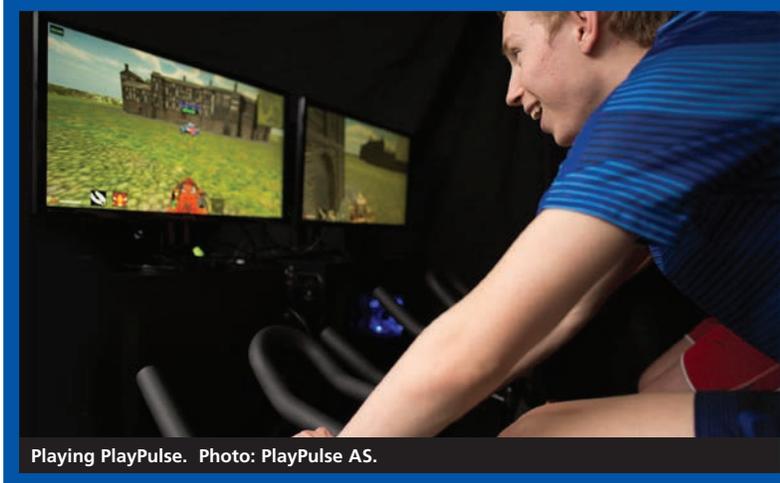
Prof. Alf Inge Wang

Visitor from Norway to Investigate the Impact of Video Games

From August 2018 through July 2019, ISR is hosting Prof. **Alf Inge Wang**, on invitation by his ISR faculty host Prof. **Richard Taylor**. Wang is a professor in game technology at the Department of Computer Science at the Norwegian University of Science and Technology (NTNU) in Trondheim Norway. At his university in Norway he teaches programming, software architecture and game development, conducts research in software engineering and

game technology, and advises and launches start-ups. His most successful project is Kahoot! which is a game-based learning platform with over 70 million monthly active users across the world. In the US, half of K-12 teachers use Kahoot! in their teaching. The idea behind Kahoot! is to transform the classroom into a gameshow where the teacher is the gameshow host and the students are the participants using their own mobile devices.

Wang is also the co-founder of another start-up named PlayPulse, where the goal is to provide a fun way of doing physical exercise for those who do not like traditional physical training. PlayPulse is a new gaming platform where exercise bikes equipped with special-designed sensors and game controllers are used to play engaging multiplayer games. When playing a PlayPulse game, the players will execute high-intensive interval training resulting in a high pulse without realizing it (stealth training). PlayPulse is currently



Playing PlayPulse. Photo: PlayPulse AS.

used in gyms, at a hospital, at a university, and at high schools in Scandinavia.

Another important project Wang has been involved in is EduApp4Syria, where Syrian refugee children get the opportunity to learn their mother-tongue through fun and educational learning games. The EduApp4Syria project was organized as an international multi-phase innovation competition where developers from across the world were invited to submit their ideas in the form of a prototype, a short YouTube video, and some required documents. The total amount of prize money was \$1.7 million. Wang served as the chair of the jury and the technical coordinator of this project, which was initiated and supported



Norwegian Prime minister Erna Solberg, Foreign minister Børge Brende and Crown Princess Mette Marit with Syrian Children promoting EduApp4Syria on prime-time TV. Photo: NRK.

ISR STUDENT NEWS

Farima Farmahinifarahani (C. Lopes, advisor) gave a talk titled “Towards Automating Precision Studies



of Clone Detectors” at the Normalized Java Resource (NJR) workshop, collocated with SPLASH 2018, held in Boston, MA in Nov. Others working on the project include

alum Dr. **Vaibhav Saini**, Ph.D. students Yadong Lu and **Di Yang**, Dr. Pedro Martins (Microsoft, Portugal), alum Dr. **Hitesh Sajnani** (Microsoft Research), Prof. Pierre Baldi, and Prof. **Cristina Lopes**.

Rahmadi Trimananda (B. Demsky, advisor) presented his paper “Vigilia: Securing Smart Home Edge Computing” at the Third



ACM/IEEE Symp. on Edge Computing (SEC 2018) held in Bellevue, WA in Oct. Trimananda received a Student Travel Grant Award to attend.

The paper is co-authored by alum Ali Younis (Tyvak Nanosatellite Systems), Ph.D. students Bojun Wang and Bin Xu, Prof. **Brian Demsky**, and Prof. Guoqing Xu (UCLA).

Reyhaneh Jabbarvand (S. Malek, advisor) attended the Google Ph.D.



Summit in August in Mountain View, CA where she presented her dissertation work, for which she was awarded a Google Ph.D. Fellowship.

directly by the Norwegian government. EduApp4Syria received 79 submissions from over 30 countries, and after an elimination process ended up with two winning games: Feed the Monster and Antura and the Letters. Both games are available for free on Google Play and App Store, and have been downloaded and used by Syrian children living in many countries. Independent studies of children playing both games have been conducted over a long period of time in refugee camps in Jordan, where the results showed significant improvement related to literacy and psychosocial well-being.

This is the third research visit Wang has made at ISR. Wang chose to visit UCI and ISR for several reasons. Firstly, he wanted to continue collaboration with Prof. **Walt Scacchi**, where the focus this time will be on entrepreneurship and applying game technology in areas such as learning and physical training. Secondly, UCI has many strong research groups and excellent faculty in areas that perfectly match Wang’s research areas, such as software engineering, software architecture, learning technology, game-based learning, game technology, and entrepreneurship. Thirdly, Professor Wang, his wife and youngest daughter wanted to come back

to the nice living environment in Southern California and to reconnect with good friends.

While at UCI, Wang plans to investigate the impact of video games and video games research, and study and analyze the process of going from an idea for using game technology, through developing prototypes, to developing a product and establishing a start-up company based on the initial idea. One example of his current work is analysis research conducted on the game Pokémon Go and the impact of this game. Further, Wang plans to analyze data from existing projects, as well as explore ideas for new research and products. Wang will also give presentations about his research at various venues such as at high schools, conferences, workshops, colleges and universities. Wang’s research visit at ISR is supported by a grant from the Fulbright Scholar Program.

To learn more about Prof. Wang’s research, visit:

<http://www.idi.ntnu.no/~alfw/>

Wang can be reached at: alf.inge.wang@ntnu.no.

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:

“Architectural Decay Prediction from Evolutionary History of Software”

Joshua Garcia, Ehsan Kouroshfar, and Sam Malek
UCI-ISR-18-7, November 2018

“Towards Ubiquitous Privacy Decision Support: Machine Prediction of Privacy Decisions in IoT”

Hosub Lee, Alfred Kobsa
UCI-ISR-18-6, October 2018

“A History of Software Engineering in ICS at UC Irvine”

Richard N. Taylor
UCI-ISR-18-5, October 2018

“Detection and Repair of Architectural Inconsistencies in Java”

Negar Ghorbani, Joshua Garcia, Sam Malek
UCI-ISR-18-4, October 2018

All ISR technical reports are available at: isr.uci.edu/publications/



Undergraduate students YoungJae Kim, MyeongSoo Kim, KaHye Ahn, SeungEon Lee, SeonKyu Kim, Sooyoung Baek, JaeEun Choi, ChaeYeon Han with Prof. André van der Hoek (center).

A Conflict Detection Chatbot – A Story of International Visiting Undergraduate Students

Mix eight visiting undergraduates from Korea, a second-year Ph.D. student from Iran, and a Dutch professor of Software Engineering in ISR and what do you get? One amazing international collaboration resulting in a fully-functioning Slack-GitHub chatbot that notifies software developers of conflicts among changes being made in parallel, that is!

The story starts in Spring 2017, when Said Shokair – Director of Undergraduate Research Opportunities for UCI – approached Professor **André van der Hoek** about the possibility of advising a small team of visiting undergraduates from select universities in Korea. Building upon the highly successful Undergraduate Research Opportunities Program (UROP) that every year sees nearly a thousand UCI undergraduates engage in research,

Said wanted to broaden the program vision by creating a similar opportunity for foreign students. The program grew rapidly and that year saw 50 students join various research projects across ICS and Engineering. van der Hoek signed up and adopted a team that explored various crowdsourcing techniques for software design. This experience was so fruitful that for Summer 2018 he decided to once again be part of the exchange.

For this second exchange, van der Hoek hosted five undergraduates from three Korean universities (Kookmin University, KyungHee University, and Sogang University). He brought on **Elahe Paikari**, a graduate student who had just finished her first year as an advisee of van der Hoek, to co-advise the students in exploring the role that chatbots can play in software development. Much has been made about chatbots and how they are rapidly taking hold in all sorts of places—witness the chatbot that serves as the first response to online support requests or the chatbot that might help you make a reservation

Professor André van der Hoek Hosts UCI Visiting Distinguished Professor Marian Petre



Prof. Marian Petre

ISR welcomes Prof. **Marian Petre**, of The Open University in the UK, who is spending two months this year (spread over 4 two-week visits) as a UCI Visiting Distinguished Professor. Recognized for her remarkable contributions to the psychology of programming and design practices in industry, Petre’s core focus while at UCI is a new book with her close collaborator, ISR Professor **André van der Hoek**. In addition, she is hosting a series of lunchtime advising sessions with graduate students and also mentoring and interacting with other faculty in ISR and the Informatics Department.

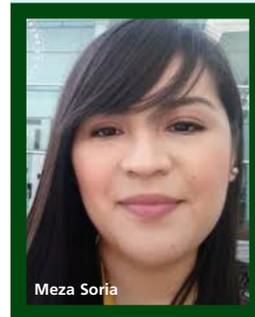
ISR STUDENT NEWS

Eugenia Ha Rim Rho (A. Kobsa, advisor) spent her summer as an intern at Nissan Research Center in Sunnyvale, CA where she focussed on autonomous vehicle work.



Rho

Adriana Meza Soria (A. van der Hoek, advisor) was on the team that won second place in the AMIA (American Medical Informatics Association) Student Design Challenge held at the AMIA 2018 Annual Symposium, in San Francisco, CA in Nov. Her teammate was Informatics Ph.D. student Yao Due; their



Meza Soria

submission title was “Designing Conversational Agents for Children Who Receive Speech and Language Therapy.”

at a restaurant. In software engineering, too, a wide variety of chatbots have emerged, working in concert with developers in platforms such as Slack, GitHub, or Atlassian.

Paikari’s first year was spent taking a close look at all these emerging software engineering chatbots and building a framework to understand, compare, and contrast them. This framework was published in the 2018 Cooperative and Human Aspects of Software Engineering (CHASE) workshop, and included several important observations. First, most chatbots in software engineering aren’t exactly ‘chatty’. Rather, they are merely small scripts or tools that integrate with a messaging tool (e.g., Slack) to be invoked or periodically provide some information in, e.g., a Slack channel. They definitely do not engage in any sort of meaningful conversation. Second, the functionality that is offered is

typically quite limited. While the chatbots can certainly be useful, the kinds of tasks for which they work best in practice thus far are, by and large, simple and repetitive. More complex tasks such as support for design or support for effective collaborative practices remain out of reach.

Paikari and van der Hoek tasked the Korean students to come up with a new, more conversational, and more challenging chatbot so as to understand what the potential of chatbots could be. Taking inspiration from Prof. and alumna **Anita Sarma**



(Oregon State University) and van der Hoek's prior work on Palantir—a tool that visualizes potential conflicts emerging from parallel development work—the students took on this task with vigor and over the span of less than ten weeks built a prototype that began to emulate Palantir's



functionality through Slack and GitHub. When developers make parallel changes on different GitHub branches that conflict, they are informed by the chatbot—which the students dubbed SayMe—and can subsequently also ask for more details about the nature of the conflict.

With the end of summer nearing, however, and the project just beginning to scratch the surface of possibilities, one of the students decided to stay for Fall and two other students from other summer projects joined the project (they had secretly already been informally contributing because they liked the chatbot project so much). During Fall, they not only polished the core prototype, but also extended

ISR EVENT SCHEDULE

Mark your calendar!



January 18, 2019

ISR Distinguished Speaker: Tevfik Bultan

Professor, University of California, Santa Barbara

"Software, Logic, and Automata: Automating Dependability of Software"



April 12, 2019

ISR Distinguished Speaker: Daniela Damian

Professor, University of Victoria

"Never Alone: How Collaboration has Changed and Is Changing in Software Development"

Friday, June 7, 2019

ISR Research Forum: *Where Research Meets the Real World*



February 25-28, 2019

Ground System Architectures Workshop (GSAW)

Held in cooperation with ISR. <http://gsaw.org>

For more information, visit: isr.uci.edu/isr-events

it significantly with conversational capabilities. SayMe now advises developers about a 'best' course of action when they encounter a conflict and also now predicts based on ongoing changes whether conflicts may occur in the future.

While the Korean students unfortunately had to go home at the end of Fall, Paikari and van der Hoek plan to take the project forward with lots of ideas for expansion of the chatbot and its functionality, and by performing a first set of experiments to determine how real developers on real projects look at SayMe as another tool available to them.

van der Hoek could not be happier about the experience: "The Korean students were outstanding, not only technically, but also in shaping the direction of the research and now outlining and actually writing a first workshop paper about SayMe. With ICSE 2019 in Korea, I definitely look forward to meeting the students again and celebrating what hopefully will be an accepted paper that they will be proud of and can look back on as the culmination

of their visit to UCI and ISR!"

For more information, visit van der Hoek's website:

<http://sdcl.ics.uci.edu/>

Contact Prof. van der Hoek at: andre@ics.uci.edu.

ISR

Follow **ISRUCI** on:



For more information:

isr@uci.edu

(949) 824-2260

isr.uci.edu

UCI University of California, Irvine