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# 2nd International Workshop on Crowd Sourcing in Software Engineering (CSI-SE 2015)

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**Abstract**—Crowdsourcing is increasingly revolutionizing the ways in which software is engineered. Programmers increasingly crowdsource answering their questions through Q&A sites. Non-programmers may contribute human-intelligence to development projects, by, for example, usability testing software or even play games with a purpose to implicitly construct formal specifications. Crowdfunding helps to democratize decisions about what software to build. Software engineering researchers may even benefit from new opportunities to evaluate their work with real developers by recruiting developers from the crowd. CSI-SE will inform the software engineering community of current techniques and trends in crowdsourcing, discuss the application of crowdsourcing to software engineering to date, and identify new opportunities to apply crowdsourcing to solve software engineering problems.

## I. OVERVIEW

A number of trends under the broad banner of crowdsourcing are beginning to fundamentally disrupt the way in which software is engineered. Programmers increasingly rely on crowdsourced knowledge and code, as they look to Q&A sites for answers or use code from publicly posted snippets. Programmers play, compete, and learn with the crowd, engaging in programming competitions and puzzles with crowds of programmers. Online IDEs make possible radically new forms of collaboration, allowing developers to synchronously program with crowds of distributed programmers. Programmers reputation is increasingly visible on Q&A sites and public code repositories, opening new possibilities in how developers find jobs and companies identify talent. Crowds of non-programmers increasingly participate in development, usability testing software or even constructing specifications while playing games. Crowdfunding democratizes choices about which software is built, broadening the software which might be feasibly constructed. Approaches for crowd development seek to microtask software development, dramatically increasing participation in open source by enabling software projects to be built through casual, transient work.

CSI-SE seeks to understand how crowdsourcing may revolutionize and shape software development, shedding light on the opportunities and challenges. In particular, CSI-SE will

- disseminate the key results and established approaches in crowdsourcing to the software engineering community, with invited talks from top researchers actively working on crowdsourcing,

- encourage dissemination and participation by software engineering researchers actively working with crowdsourcing through sessions with paper presentations, and
- encourage interaction, collaboration and discussion with a final session featuring a panel.

## II. WORKSHOP GOALS

This workshop will examine three key challenging questions related to crowdsourcing software engineering problems.

**What paradigms can be used to organize and coordinate workers?** Crowdsourcing suggests a range of paradigms for organizing workers into a human-based infrastructure, several of which have already been explored in crowdsourcing software engineering to date. For instance, software engineering tasks can be directly distributed to the crowd (task-based crowdsourcing such as Q&A sites); or software artifacts might be constructed through games that have a hidden purpose (game-based crowdsourcing such as crowdsourced verification). The workshop will discuss a range of paradigms explored by crowdsourcing approaches and examine their suitability to addressing software engineering problems.

**How to control the software development process while using a crowdsourcing computing infrastructure?** Development processes and methodologies discipline the activities of the engineers involved in the realization of a software product. Development processes usually assume a certain degree of control over the people, the activities, and the timing. When the development process takes advantage of a crowdsourcing infrastructure, the control over people, activities, and timing is definitely weaker, and sometimes completely absent. The workshop will discuss the impact of crowdsourcing infrastructures on the development process. The workshop will also consider the application of crowdsourcing techniques to increase quality and resilience in the face of work of varying quality or by malicious workers, including using redundant work, tasks with known answers, voting, reviews, reputation, and incentive systems.

**Which software engineering problems can be solved with a crowdsourcing infrastructure?** Crowdsourcing infrastructures provide new opportunities to the software engineering community, mostly related to the possibility of taking advantage of "computational units" that are smart and autonomous

by employing humans, but also generate new issues, as computational units may also become unreliable and untestable. The workshop will discuss how crowdsourcing infrastructures could be effectively exploited to solve SE problems that could not otherwise be effectively solved.

These questions will be addressed both through the invited talks and the interactive session at the close of the workshop.

### III. RELEVANCE TO SE

Crowdsourcing is beginning to have an increasing influence on software engineering. The possibility to assign tasks to a crowd of people who will solve the tasks exploiting their knowledge, intuition, intelligence and ability, opens up new possibilities for developers, software engineers, and researchers. Problems that might not be solved with regular computing infrastructures could be solved in the future exploiting *truly intelligent* computing infrastructures, such as the ones offered with crowdsourcing.

CSI-SE seeks to provide a forum where the researchers and practitioners in the area can meet, discuss, and collaborate to address the open challenges and influence the future of crowdsourcing.

### IV. WORKSHOP STRUCTURE

CSI-SE 2015 is a one day event with one session with invited talks, two sessions for paper presentations, and one interactive session with a panel discussion.

The invited speakers of the workshop are:

*Michael Ernst*, University of Washington.

*Shahram Dustdar*, Vienna University of Technology.

The paper presentation sessions will be two 90 minute sessions where the authors of accepted papers will present both ongoing and completed work in the form of position papers and full papers. We received 13 submissions for CSI-SE 2015, out of which we accepted 9. Each paper was reviewed by three PC members and evaluated according to the criteria of relevance, originality, soundness, maturity and presentation quality. Online discussions about the reviews took place in order to resolve conflict opinions after the reviews were completed. Decisions were made based on the review results as well as the outcomes of the online discussions.

The final session is a 90 minute session aiming at further eliciting collaboration and building a greater sense of community. The session will feature a panel on "Crowd development: a new model for software development?", intended to explore controversial aspects of the promise and perils of applying microtask crowdsourcing to software development.

### V. WORKSHOP ORGANIZERS

*Gordon Fraser* is a lecturer in Computer Science at the University of Sheffield, UK. The central theme of his research is improving software quality, and in particular automated testing, for which one of the avenues he is investigating is the use of crowd-sourcing. Gordon Fraser has chaired several workshops (A-MOST 2010, Mutation 2010, 2011, CSTVA 2010, 2011), including the first International Workshop on Crowd Sourcing in Software Engineering, and conferences (general chair of SSBSE 2013, PC chair of ICST 2015, SSBSE 2012, TAP 2010, TAIC-PART 2010), and is regularly involved in many different other roles (e.g., publicity chair ISSTA 2013, proceedings chair ESEC/FSE 2011, workshop chair ICST 2013, doctoral symposium chair ICST 2012). He is a member of the steering committees of ICST and SSBSE, and he is regular member of relevant program committees, e.g., ICSE 2016, FSE 2015, ISSTA 2014, ASE 2014, ISSRE 2013.

*Thomas LaToza* is a Postdoctoral Research Associate at the University of California, Irvine. His research focuses on human aspects of software development, with work in the areas of information needs in software development, code exploration, software design at the whiteboard, and crowd-sourcing software engineering. He has published in top software engineering journals and conferences, including TSE, ICSE, and ESEC/FSE, and HCI conferences such as CHI and UIST. He has served on various program committees, was co-chair of the First International Workshop on CrowdSourcing in Software Engineering, and was co-chair of the Fifth Workshop on the Evaluation and Usability of Programming Languages and Tools (PLATEAU).

*Leonardo Mariani* is an associate professor at the University of Milano Bicocca. His research interests include software testing and analysis, self-healing software, and crowdsourcing. He is the author of more than 50 papers, including papers published on top software engineering conferences, such as ICSE, ESEC/FSE, and ISSTA, and journals, such as TSE and TOSEM. He has been awarded with the ERC Consolidator Grant 2014. He is regularly involved in the Program Committees of top software engineering conferences, such as ICSE, FSE and ISSTA. He has been involved in the organization of several events related to software engineering. For instance, Leonardo Mariani has been co-chair of AST 2015; ICSE doctoral symposium 2014; CSI-SE 2014; WODA 2011; GT-VMT 2011; ISSRE Fast Abstract Track 2010.