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Editorial

Mobile and situated crowdsourcing

1. Introduction

During the past years, crowdsourcing has grown from a number of purpose-built initiatives, such as Wikipedia and Mechanical Turk, to a technique that today that today is used by corporations and academics alike for a plethora of different purposes. While online crowdsourcing is still the most commonly used way of gathering crowd contributions, people are increasingly engaged through mobile devices to capture, share and validate different kinds of data. Similarly, embedded ubiquitous technologies, such as public displays, have recently presented themselves as promising media to conduct crowdsourcing experiments. As computing systems become more intimately embedded in physical and social contexts, crowdsourcing can more easily take new forms by leveraging the capabilities of these technologies. This special issue is devoted to the recent developments and research outcomes addressing the different aspects of mobile and situated crowdsourcing.

2. Alternatives to online crowdsourcing

Crowdsourcing work, and the associated distribution of micro-tasks across large numbers of individuals, is becoming increasingly popular in settings beyond the desktop, thus enabling a wide range of applications. Ubiquitous technologies, such as smartphones and public displays, are now mature and ubiquitous enough to allow users to contribute to crowdsourcing tasks wherever and whenever.

While online crowdsourcing markets (such as Amazon's Mechanical Turk, CrowdFlower and Upwork) make it convenient to pay for workers willing to solve a range of different tasks, they can suffer from a number of limitations. For instance, these online platforms do not always attract workers with desired background or skills. Thus, it can be a challenge to recruit workers that speak a specific language or live in a certain city (Ipeirotis, 2010). Mobile and situated crowdsourcing can help fill in the gaps where online platforms are not ideal. Such mobile and situated crowdsourcing systems offer new possibilities for conducting crowd work. A big advantage of *mobile crowdsourcing* is that many people almost always have their mobile devices with them and are thus capable of gathering real-time information. This information can then be aggregated and presented in a useful way to other people (e.g. traffic information, detailed airport information). Furthermore, networked smartphones are rapidly proliferating also in developing countries that might not have ubiquitous access to traditional desktop computers to participate in crowdsourcing efforts (Gupta et al., 2012).

On the other hand, *situated crowdsourcing* consists of embedding input mechanisms (e.g., public displays, tablets) into a physical space and leveraging users' serendipitous availability (Goncalves et al., 2016; Hosio et al., 2014; Müller et al., 2010) or idle time ("cognitive surplus" (Shirky.Shirky, 2010)). The use of these situated technologies means that this type of crowdsourcing does not require much deployment effort from workers, thus benefiting from a lower barrier to participation (Goncalves et al., 2015; Goncalves et al., 2014). Further, it allows for a geo-fenced and more contextually controlled crowdsourcing environment, thus enabling targeting certain individuals, leveraging people's local knowledge, cognitive states, or simply reaching an untapped source of potential workers (Hosio et al., 2015; Hosio et al., 2014).

With this Special Issue we hope to highlight these two forms of ubiquitous crowdsourcing. Our ultimate goal is to raise awareness within the community to not automatically default to online platforms for their crowdsourcing needs, but instead also consider other types of crowdsourcing that might better suit their objectives and applications. We build on previous successful workshops on ubiquitous crowdsourcing lead by the editors of this special issue (Goncalves et al., 2015; Goncalves et al., 2016; Vukovic et al., 2010; Vukovic and Kumara, 2011).

3. Summary of accepted papers

We accepted a total of eight papers following a thorough review process with domain experts in the area of crowdsourcing. This includes papers exclusively investigating aspects of mobile crowdsourcing or situated crowdsourcing, as well as both types simultaneously.

The first paper, "**Incentivizing Social Media Users for Mobile Crowdsourcing",** by Panagiota Micholia, Merkouris Karaliopoulos, Iordanis Koutsopoulos, Luca Maria Aiello, Gianmarco De Francisci Morales, and Daniele Quercia, investigates the important challenge of appropriate task assignment within mobile crowdsourcing. The paper proposes a novel framework that leverages social media information to identify users with a certain domain expertise and then incentivize them to complete relevant crowdsourcing tasks. The approach was tested using a Flickr dataset, which showed its potential to gather high levels of task quality without sacrificing fairness.

Next, the paper **"TaskMe: Toward a Dynamic and Quality-Enhanced Incentive Mechanism for Mobile Crowd Sensing",** by Bin Guo, Huihui Chen, Wenqian Nan, Zhiwen Yu, Xing Xie, Daqing Zhang, and Xingshe Zhou, also investigates improvements to incentive mechanisms within mobile crowdsourcing. The paper highlights the limitations with existing monetary-based incentive crowdsourcing studies, which are

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typically designed with a quantity- or cost-priority without much concern for quality concerns. To address this problem the paper proposes and evaluates *TaskMe*, a novel incentive mechanism that leverages a location-based social network-based model to dynamically adjust task budgeting and ensure appropriate worker selection.

Yun Huang, Corey White, Huichuan Xia, and Yang Wang authored **"A Computational Cognitive Modeling Approach to Understand and Design Mobile Crowdsourcing for Campus Safety Reporting"**, which leverages computational cognitive modeling and mobile crowdsourcing for the purpose of improving campus safety. The paper adopts drift-diffusion models to investigate the effect of different factors on workers' reporting tendency. Based on the finding that location context significantly impacts the reporting decisions regarding public safety, a novel location-based nudge mechanism was developed and evaluated. The paper concludes by emphasizing the potential value of applying computation cognitive modeling to crowdsourcing and HCI research.

Tomoyo Sasao, Shin'ichi Konomi, Vassilis Kostakos, Keisuke Kuribayashi, and Jorge Goncalves propose **"Community Reminder: Participatory Contextual Reminder Environments for Local Communities"**, a smartphone-based platform that assists community members to design and use context-aware reminders. Members of a local community were able to use *Community Reminder* to crowdsource safety-relevant information. Those interested in this information were then able to access it easily and then deliver this information to those interested. The work presented in this paper highlights the inherent benefits of using crowdsourcing within local communities, particularly when the outcomes are useful to the contributors themselves.

The paper **"Understanding the Potential of Human-Machine Crowdsourcing for Weather Data",** by Evangelos Niforatos, Athanasios Vourvopoulos, and Marc Langheinrich, investigates the possibility of leveraging crowdsourced weather data for reliable weather estimation instead of requiring a dense network of meteorological measuring stations. The paper presents and evaluates *Atmos*, a crowdsourcing weather application that automatically collects relevant sensor data from the smartphone as well as crowdsourced estimates from users regarding current and future weather conditions. The results show that the crowdsourced input was more accurate than the combination of both types of sensing results, highlighting the potential for a purely crowdsourcing-powered weather estimation platform.

Yun Huang, Alain Shema, and Huichuan Xia contribute a survey of mobile and situated crowdsourcing systems in **"A Proposed Genome of Mobile and Situated Crowdsourcing and Its Design Implications for Encouraging Contributions"**. The paper proposes a genetic model based on the MIT's genetic model of collective intelligence and identifies six fundamental questions about user contributions that system designers pose when building new crowdsourcing systems of evaluating existing ones. This novel approach of analysing mobile and situated crowdsourcing systems allows designers to make interesting observations regarding the identified questions and genes, and reflect on how they can promote new design opportunities.

"An Investigation of Using Mobile and Situated Crowdsourcing to Collect Annotated Travel Activity Data in Real-Word Settings", by Yung-Ju Chang, Gaurav Paruthi, Hsin-Ying Wu, Hsin-Yu Lin, and Mark W. Newman, investigates the potential of mobile and situated crowdsourcing to collect annotated activity data in the wild. Three different approaches to collect this information were used: Participatory, Context-Triggered in Situ, and Context-Triggered Post Hoc. The results suggest that a Participatory approach led to more complete and less noisy recordings, while also being highly valued by the users due to the control over what and when to record and annotate. The paper then concludes by offering actionable insights regarding the design of mobile crowdsourcing experiments that collect annotated activity data.

Finally, Thomas Ludwig, Christoph Kotthaus, Christian Reuter, Sören Van Dongen, and Volkmar Pipek co-authored **"Situated Crowdsourcing during Disasters: Using Public Displays to Manage the Tasks of Spontaneous Volunteers"**, which explores leveraging situated crowdsourcing during disasters as a facilitator for the coordination between affected citizens, spontaneous volunteers and emergency services. Based on a literature review on current coordination practices during disaster situations, and an empirical study with 18 different stakeholders involved in disaster management, a technical concept is derived that supports the task and activity management during these events. This concept was then implemented as a public display application called *City-Share*, which was shown to improve a community's disaster resilience, particularly between official stakeholders and spontaneous volunteers or affected citizens at a local level.

To conclude, we hope that this special issue will contribute to the advancement of these emerging crowdsourcing paradigms and that it will provide inspiration for new research within these areas.

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Jorge Goncalves*, Simo Hosio, Maja Vukovic, Shin'ichi Konomi
Center for Ubiquitous Computing, University of Oulu, Finland
IBM TJ Watson Research Center, USA
Center for Spatial Information Science, University of Tokyo, Japan
Department of Computing and Information Systems, The University of Melbourne, Australia

* Corresponding author.