Towards Adaptive Crowdsourcing for Complex Decisions

Maja Vuković and Roman Vaculin
IBM T.J. Watson Research Center
19 Skyline Drive, Hawthorne, NY, USA
{maja, vaculin}@us.ibm.com

ABSTRACT
Complex decisions – such as a city development project proposal, launch of a new product or a bid for a major outsourcing contract – necessarily rely on and impact large networks of humans. Such decisions endure in dynamic and multifaceted settings, and may reshape over time. In this position paper we examine crowd’s role in sensing, responding to, and solving elements of complex decision processes. Using the development project proposal example as a reference, we derive a set of new requirements for our crowdsourcing service. These include support for adaptive crowdsourcing workflows and mechanisms for modeling cost and time tradeoffs in crowdsourcing campaign.

Categories and Subject Descriptors
H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces

General Terms
Design, Human Factors, Management

Keywords
Crowdsourcing, Complex Decisions, Collaboration

1. INTRODUCTION
Emerging technologies are changing the way complex decisions are tackled. Organizations and individuals nowadays have instant access to sheer volume of data online. Advances of knowledge extraction and management capabilities have accelerated delivery of key insights. Furthermore, Web 2.0 has spurred the design of computing applications that harness the intelligence of humans, engaging them as sensors [1] or actors within a decision process.

This suggests a vision of systems for complex strategic and tactical decisions that integrate human and digital intelligence. With the ultimate goal of efficiently enabling human aspects of decision making, such systems bring together technologies from adaptive business process management, analytics, crowdsourcing and unstructured information analysis.

We define complex decisions as processes of performing a set of knowledge discovery, opinion gathering and deliberation activities to ultimately reach an agreement on a given proposal, often given an incomplete picture of the domain. These time-sensitive decisions are of high cost and uncertainty, and require extensive time and collaboration amongst multiple stakeholders who stick to industry and government regulations.

Information about the decision elements and current sentiments of stakeholders are buried in a myriad of unmanaged data distributed in traditional and social media, such as newspapers, fliers, ad-hoc online communities, etc. Moreover, these sources may contain misleading information affecting stakeholders’ viewpoint.

Collaborative decision-making processes engage knowledge experts, both in public and private sector. However as these decisions may affect the external crowds, such as citizens, product users or customers, their opinions need to be included. The traditional approach employed by e.g. city councils may include town hall meetings to enable local community to express their concerns about or support for proposed development projects.

Governments are increasingly employing on-line tools to reach out to their citizens, soliciting not only information about city infrastructure and current conditions, but also ideas and feedback on its budgeting process [2]. Available platforms [3] support online deliberations on policies. Similarly enterprises are increasingly using social media to engage customers [4]. Yet all these crowd-driven activities are still isolated efforts, disconnected from the overarching decision making process. An expert has to design and compose the crowdsourcing campaign and trigger it based on the outcome of deliberations or as a response to a newly discovered insight. Similarly, an expert manually manages the crowd, timing and how to run crowdsourcing campaigns at budget.

In this paper, we identify a set of activities that require crowd engagement in the context of the development project proposal that city council has to evaluate, and use it to classify automation gaps that improve the complex decision-making.

2. CROWDS AND COMPLEX DECISIONS
Consider challenges that the city council face when a new development proposal has been submitted. Whilst ultimately the governing board will make the decision on whether to go ahead or reject the proposal, citizens need to be engaged as this impacts their everyday life directly. Any changes also affect the neighboring cities, and governing board must remain impartial to any external consultants that are expert advisors.
Figure 1 presents a high-level view of an envisioned human-digital-decision (HDD) system that coordinates the decision making process. The core components include a deliberation platform [5], a crowdsourcing service [6], and an adaptive process orchestrator [7] that steers the decision flow, engaging the different crowds as decision evolves, and providing an interface to deriving key insights from multitude of digital repositories.

BizRay[6] is a crowdsourcing service that captures knowledge requests in the distributed questionnaire artifact consisting of one or more sections, each of which contains one or more questions about a specific entity. To efficiently and timely engage the crowd, we expose the interfaces to BizRay crowdsourcing service, enabling automated crowdsourcing campaign invocation, once the deliberation sub-process completes. For example, as the team of experts derives possible alternatives to a proposed development plan, we tap into the crowd to understand concerns and priorities, such as safety, aesthetics, cost or time.

Figure 2. shows a user interface from BizRay. Users can forward the questionnaire to other people in their social network, by simply selecting “delegate all questions” and entering their e-mail address. A notification is then triggered to the assigned user(s).

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3. PROPOSED EXTENSIONS

At present existing crowdsourcing systems still rely on expert administrators to design crowd tasks, price them, and engage the right crowd. Complex decisions are multi-step, sometimes repetitious processes, which require iterative understanding of stakeholders’ viewpoints. With that in regard, we identify a set of future challenges for extending our crowdsourcing service, facilitating further HDD system integration.

3.1 Context-aware crowdsourcing workflows.

Crowd activities are elements of larger processes, which need to be orchestrated. Can we automatically create, manage and reuse crowdsourcing campaigns, as the decision evolves? Existing systems fall short of supporting crowdsourcing processes. For example, Amazon Mechanical Turk [8] enables developers to create own wrappers around the crowdsourcing task thereby defining processes. These are typically used and sufficient to certify pre-qualifications of crowd workers for posted tasks. Decision processes, however, introduce additional intricacies.

Figure 4. shows participatory workflows in the context of our user cases, which demonstrates some of the research challenges. Firstly, the crowdsourcing campaigns and their flow cannot always be predetermined. Say for example the expert advisors are able to propose an updated plan on bridge closure this may call for another crowd polling. Secondly, how can we successfully engage participants in multiple crowdsourcing campaigns during the decision lifetime. What would make public continuously involved in the different stages of the decision process?

We group the challenges in developing context-aware crowdsourcing workflows into three types: 1) process integration 2) stakeholder interaction and 3) campaign aggregation.
Process Integration. Following types of interactions are required in HDD to support context-aware crowdsourcing workflows:
- Automated launch of campaigns as part of the main process
- Progress tracking capabilities
- Event-driven termination of the crowd polling
- Activation of new process steps when a milestone is reached

Stakeholder interaction challenges. HDD system requires control and coordination capabilities to regulate a distributed crowdsourcing campaign, by providing:
- Controls trigger, pause and contact the non-respondents, based on the status of crowdsourcing, parent process and context
- Ability to add new and substitute existing crowd contributors

Campaign aggregation challenges. To enable interactive crowdsourcing campaigns, mechanisms are needed to allow for merging, reusing and splitting campaigns.

3.2 Routing of crowdsourcing tasks
Whilst crowdsourcing is associated with a low-cost, timely delivery and quality are often uncertain. Crowd may often quickly and hastily respond to crowdsourcing task and thus introduce inaccurate and incomplete responses and opinions. Moreover, in such open settings there may be also crowd members intentionally generating malicious responses. Furthermore the cost of missing or incomplete responses increases the impact on the decision as the time progresses. Dai et al. [9] propose a decision-theoretic framework for assigning tasks based on time and cost tradeoffs. We plan to extend their approach to provide capabilities for adaptive crowdsourcing campaigns based on the tradeoffs in time and cost of the completion of the overarching decision process.

We identify a set of technical capabilities that HDD system would require to support decision-aware crowdsourcing campaigns:
- Identifying when to trigger or terminate the campaign
- Detecting the saturation point
- Discovering a stagnant or inefficient campaign (e.g. based on one or more metrics, such as the minimum number of responses, low activity, % covered issues, etc.)
- Action templates to respond to stagnating campaigns, such as, ability to selectively notify people, involve new, etc.
- Fine-grain crowd-task specification, by reaching out to crowd if a condition holds or by pre-selecting a crowd

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REFERENCES