Taking on the Challenges of Broadening Participation in Data Visualization and Analysis with FieldScope

Daniel Edelson - BSCS

FieldScope (http://fieldscope.org) is a turnkey technology platform for networked field studies. As such, it provides simple tools that enable citizen science project organizers to configure a website and mobile app for their project participants to use to contribute geo-referenced data. This functionality makes FieldScope and other tools like it (e.g., citsci.org) valuable resources for the citizen science community because they enable project organizers with limited resources to set up and manage crowd-sourced data projects. FieldScope has demonstrated its value for this purpose, currently supporting nearly two dozen projects collectively receiving more than 50,000 contributions per year. But FieldScope has a much more ambitious goal. Its long-term goal is to provide a platform that engages project participants and members of the general public in firsthand visualization and analysis of data. We see this as an important step toward citizen science's goal of empowering "ordinary citizens" to conduct science themselves. We also see this as a way to provide inquiry-based learning experiences to students. However, we face great challenges in attempting to engage students and members of the general public in data analysis. They range from helping people to understand the kinds of questions that they can ask with the available data to providing them with interfaces that enable them to conduct and interpret analyses. In this presentation, I will describe the challenges that we face, the solutions that we have attempted to date, the limited success we've achieved with them, and the new strategies that we plan to try next.

Patterns of Behaviour Across Online Citizen Science

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The Zooniverse hosts more than 50 projects which enable the classification of a wide variety of subjects, and thus provides a natural laboratory for investigating citizen and professional scientist behaviour in the 'wild'. This paper discusses findings from our research, with implications for those building and using such projects. As roughly half of the projects on the platform come from astrophysics or ecology, we contrast the patterns of behaviour observed in these domains, drawing out general rules which the crowd follows independent of the design of specific projects. The design of the user experience remains very important in determining the success of a project, and we can use comparisons across projects within the same research domain to understand this. For example, the recently launched project Supernova Hunters releases data to its community on a weekly basis. These data are quickly analysed, resulting in a project that is active for only a short period each week. We will present an analysis of this community compared to those which develop around astrophysics projects which are consistently active for longer. Understanding the benefits of each model will be critical in designing future citizen science experiences. A thorough analysis of participant behaviour must also include professional scientists, and so we will include recent studies of the roles adopted by professional scientists as participants in citizen science communities, identifying design features which maximise useful engagement from these teams. Taken together, this work will highlight best practice for online data analysis through citizen science.
Validated Dynamic Consensus Approach for Citizen Science Projects Employing Crowd-based Detection Tasks
Pietro Michelucci - Human Computation Institute
This presentation addresses the need for quality assurance of crowd-generated data by describing new, formally verified methods that inform the dynamic parameterization of consensus algorithms and specify probabilistic bounds on data quality. These methods are also expected to reduce the development burden and success likelihood for new citizen science projects. Many citizen science projects crowdsource a classification or detection task. The success of these approaches often relies on using a consensus algorithm to combine many non-expert responses into a single, expert-like result. However, the method by which crowd-based results are obtained and validated must be calibrated to each application’s utility tradeoff between false positives and false negatives. Moreover, such methods may not be robust to the vagaries of human behavior and time-based effects such as learning and fatigue. Approaches that do produce adequate data quality may not make the most effective use of human labor. We are developing and validating a general methodology for combining non-expert annotations in crowdsourced detection paradigms to obtain higher quality annotations with adjustable sensitivity and specificity, while minimizing human labor. Detection is a commonly crowdsourced analytic task that has been applied across domains, for assessing post-disaster building [1], for detecting parasites on a blood smear [2], and for finding dust particles in aerogel [3]. Thus, domain generality is sought by focusing on this shared analytic task type. This approach is being validated using Stall Catchers, an online citizen science platform used to detect stalled blood vessels from in-vivo mouse brain imagery.

Working Together: Developers and Project Leads
Robert Pastel - Michigan Technological University
This presentation focuses on the relationship between software developers and citizen science project leads during the development of citizen science applications. The goals of this presentation are to make explicit the attributes of the developer-project lead relationship and best practices for maintaining the relationship. Although building and maintaining a healthy relationship can be challenging, a productive relationship is essential for the development of successful citizen science applications. The attributes of the relationship are derived by analyzing stakeholders (Alexander & Robertson, 2004) and acknowledging the different characteristics and goals of the stakeholders. In essence, a good relationship will nurture communications, share common goals, and understand and recognize each other’s constraints and contributions to the project. The roles and needs of both the developers and project leads are applied to general and specific development processes (Pastel, 2016). Finally, best practices for maintaining the developer-project lead relationship are derived and applied to the example development processes.