ARPHA Proceedings

Proceedings ECSA-ÖCSK-2024, 0191-0194
doi: 10.3897/ap.e126772

Change – The transformative power of citizen science

Leveraging data science for change: navigating perspectives in a world of rapid transformation

Zahra Farook* (a), Liubov Tupikina (b), Muki Haklay (c), Marc Santolini (d), Josep Perello (e), Karen Soacha (f), Francois Grey (g)

(a) Université Paris Cité, Paris, France

(b) Bell Labs, LPI, Paris, France

(c) UCL, London, UK, LPI, Paris, France

(d) Learning Planet Institute, Research Unit Learning Transitions (UR LT, joint unit with CY Cergy Paris University), F-75004 Paris, France

(e) Universitat de Barcelona, Barcelona, Spain

(f) CSIC, Barcelona, Spain

(g) University of Geneva, Geneva, Switzerland

Abstract

In today's interconnected world, data surged in volume. This exponential increase in data availability has sparked the rise of data science and artificial intelligence (AI), changing how we handle information (Aldoseri et al. 2023). In a world undergoing rapid change across various dimensions, it is important to involve data-driven methods to be able to assess and to follow, and assist citizens in their sustainable actions and projects. These methods help analyze, support, and motivate citizens in actions and projects, addressing complex issues like biodiversity loss, urban liveability, and local activism. With a focus on inclusivity and adaptability, the session aimed to discuss transformative potential approaches that integrate citizen science, data science, and human-computer interaction (HCI). Of particular importance was the focus on the ethical considerations of data science and AI, emphasizing fairness and equity in decision-making, and showcase real-world impacts. Additionally, we explored the conditions for cross-disciplinary collaborations among data scientists, citizen scientists, researchers, practitioners, within various citizen science projects. The current paper presents the session report, highlighting the main discussion points and conclusions.

Keywords: citizen science, data science, ethics, human-computer interaction

Published by NHM, BOKU and ECSA and peer-reviewed under responsibility of ECSA-ÖCSK-2024 (Change – The transformative power of citizen science)

* Corresponding author. E-mail address: fzahrafarook@gmail.com

Introduction

In today's interconnected world, data surged in volume. This exponential increase in data availability has sparked the rise of data science and artificial intelligence (AI), changing how we handle information (Aldoseri et al. 2023). In a world undergoing rapid change across various dimensions, it is important to involve data-driven methods to be able to assess and to follow, and assist citizens in their sustainable actions and projects. These methods help analyze, support, and motivate citizens in actions and projects, addressing complex issues like biodiversity loss, urban liveability, and local activism. With a focus on inclusivity and adaptability, the session aimed to discuss transformative potential approaches that integrate citizen science, data science, and human-computer interaction (HCI).

The session focused on four key topics. (1) Data-centric approaches in understanding open science, emphasizing the importance of participatory processes and complex network analysis in uncovering hidden dynamics and fostering relational well-being among participants. (2) The shift in data perspective in scientific research, the importance of tailored data collection and analysis methods to capture nuanced human behaviors in citizen science initiatives. (3) Ethical complexities of participatory technologies while emphasizing the collective responsibility to uphold individual rights and contributions. And (4) The role of data literacy in addressing Sustainable Development Goals(SDG).

Methodology – open discussions

The session was held during the ECSA conference in Vienna and facilitated by two of the co-authors of this paper. It brought together a diverse community of researchers, scientists, students, and public engagement practitioners. The session, organized for one and a half hours, followed an open-format structure, comprising four short presentations including interactive fishbowl discussions.

Summary of the presentation

The presentation session featured four speakers, each offering insights into the intersection of citizen science, data science, and ethical considerations.

The application of data science in engaging people and fostering new perspectives within citizen science initiatives is crucial. Marc Santolini emphasized the importance of leveraging data-centric approaches to analyze citizen science data, building a quantitative "science of citizen science". This endeavor focuses as much on measuring the quality of participation processes than the quantitative outcomes such as productivity and citations. Traditional data-driven methods in the science of science are indeed often not equipped in terms of data sources or measurable proxies to take into account the unique characteristics of citizen science projects, such as non-professional participation and perspectival diversity (Masselot et al. 2023). Using digital traces of participatory projects, such as interactions on social platforms, and constructs to measure the impact of participation, such as increases in Relational Well-Being, one can build integrative

data-driven approaches to help mobilize people and offer new perspectives within citizen science initiatives, fostering inclusivity and facilitating meaningful contributions from diverse participants. A recent example is the analysis of the OpenCovid19 community, where digital traces were used to understand collaboration networks and the evolution of roles and structural elements within the community. Finally, the talk raised an important question about ethical considerations, such as addressing privacy concerns of using individual traces to measure the participation process.

Josep Perelló highlighted the necessity for a shift in perspective when approaching data in scientific research, particularly in the context of citizen science. The standard data-driven methods may not provide the necessary insights into certain situations or phenomena that are of concern to citizen groups and communities involved in citizen science projects. For instance, the data methods may not be the most appropriate for a better understanding of social interactions in a mental health care community or for better capturing air quality levels (Perelló et al. 2021) in a neighborhood just to name a couple of examples. Hence, it is important to practice mixed-methods approaches from participatory action research, and ethnographic studies and find ways to better combine qualitative and quantitative data analysis (Perelló et al. 2023). Overall, citizen science initiatives should focus on gathering data that is meaningful and relevant to the people involved.

Karen Soacha addressed the ethical challenges surrounding data sharing in citizen science projects. Platforms and technologies play a significant role in shaping ethical practices in citizen science. Platforms like iNaturalist and MINKA should take into account addressing the ethical challenges in data governance in citizen science projects, particularly the challenges of sharing data while protecting the privacy and ensuring fair acknowledgment of participants (Resnik et al. 2015). Therefore, addressing ethical challenges within citizen science by integrating considerations such as data privacy, benefit distribution, and participant decision-making is essential. There is a need to rethink terms of use, informed consent, and data licenses to better suit citizen science projects, alongside developing data management plans and data integrity plans.

Overall, the aim is to create a governance model that empowers participants and promotes ethical practices within the platform.

Finally, Francois Grey provided insights into the dimension of data literacy and highlighted the hidden information behind icons, representing the gaps between those who own data and those who need it for utilization. Addressing complex issues requires a multifaceted approach, including leveraging various skill sets such as data science. Within Geneva, where UN agencies hold significant influence, involvement with a specific SDG may not be enough. That's where citizen science and data science can play a role in addressing the data gaps and helping for better decision-making. For example, events like the SDG Olympiad empower youth around the world to tackle environmental and health challenges related to the UN Sustainable Development Goals. Moreover, partnerships and collaborations across continents empower young individuals to contribute meaningfully to global change.

The presentation highlighted the critical role of data science in citizen science, adapting new approaches to diverse participants. Ethical considerations, including privacy and acknowledgment of participants in digital platforms while diverse data collection and analysis methods were promoted to capture complexity.

Moreover, empowering youth and global partnerships emerged as a key strategy for promoting inclusivity and meaningful contributions to global challenges

Insights – Fishbowl Discussion

This format provided participants to share insights, experiences, and best practices related to key themes. This included several topics such as **"Inequalities in data,",** focused on participation inequalities and biases, **"Data privacy,"** focused on privacy concerns and safeguarding participant confidentiality within data-driven initiatives. Finally, participants discussed "**Algorithms and tools transparency**," the importance of transparency in algorithms and tools utilized in citizen science applications.

The session highlighted modeling inequality in data, emphasizing the need to address biases and integrate data science into citizen science projects by valuing interdisciplinary collaboration, transparency in algorithms, balancing data privacy with access and local interventions. Participants recognized data science's potential for positive social impact.

References

Aldoseri A, Al-Khalifa KN, Hamouda AM (2023) Re-Thinking Data Strategy and Integration for Artificial Intelligence: Concepts, Opportunities, and Challenges. Appl. Sci. 2023, 13, 7082. https://doi.org/10.3390/app13127082

Masselot C, Jeyaram R, Tackx R, Fernandez-Marquez JL, Grey F, Santolini M (2023) Collaboration and Performance of Citizen Science Projects Addressing the Sustainable Development Goals. Citizen Science: Theory and Practice, 8(1), Article 1. https://doi.org/10.5334/cstp.565

Perelló J, Cigarini A, Vicens J, Bonhoure I, Rojas-Rueda D, Nieuwenhuijsen MJ, Cirach M, Daher C, Targa J, Ripoll A (2021) Large-scale citizen science provides high-resolution nitrogen dioxide values and health impact while enhancing community knowledge and collective action. Science of the Total Environment, 789, 147750.

Perelló J, Larroya F, Bonhoure I, Peter F (2023) Citizen science for social physics: Digital tools and participation. arXiv preprint arXiv:2312.16569.

Resnik DB, Elliott KC, Miller AK (2015) A framework for addressing ethical issues in citizen science. Environmental Science & Policy, 54, 475–481. https://doi.org/10.1016/j.envsci.2015.05.008