Developing and Validating Tools for the Automated Analysis and Enhancement of Online Discussions

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Abstract. Online discussions play a vital role in today's society and recent advances in Natural Language Processing (NLP) demonstrate promising potential for analyzing and facilitating them. This paper proposes a comprehensive framework that involves developing NLP tools based on the latest advances in Large Language Models (LLMs), creating and automating measures to assess the quality of discussions, integrating these tools into online discussion platforms, and designing and implementing adequate experiments to evaluate their usefulness. We emphasize the importance of both user feedback and well-designed experiments to assess how the accelerated development of LLMs can contribute to society. By collaborating with various stakeholders in citizen science and deliberative democracy platforms, we seek to integrate our framework in a meaningful manner. Overall, our framework offers a roadmap for leveraging LLMs to enhance online discussions in a responsible and effective way.

Keywords. Online Discussions, Argumentation, Large Language Models, Natural Language Processing, Citizen Science, Deliberation

1. Introduction

Online communities allow users to express and discuss a wide range of opinions and topics. These discussions can take various forms, such as retweets and comments on Twitter, threads in subreddits on Reddit, questions and answers on Stack Exchange, and threads on discussion platforms like Discourse[2]. Through discussions in online communities, users participate in deliberative democracy, shape and share political opinions, plan their open-source software or organise their community based projects. However, as online communities grow in size and content, discussions can become more difficult to follow and are susceptible to misinformation, hate speech, and polarization [11,3]. Furthermore, as the number of users and discussions increases, it becomes increasingly challenging to facilitate and moderate these communities manually.

Therefore, given these and more challenges, recent advances in Natural Language Processing (NLP) demonstrate strong potential to enhance online discussion by facilitat-

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[2] https://meta.discourse.org/

ing the discussion process [6,5]. Furthermore, automatically analysing the available information in these discussions can help to identify political concerns of citizens or major points of conflict between users, providing useful insights for decision makers to make more inclusive and representative decisions [1,4]. As the rise of large language models (LLMs) like GPT-4 and ChatGPT accelerates, the question of how to integrate these technologies to enhance meaningful discussions becomes even more pressing. With their increasing capabilities, it is essential to consider how to integrate these tools in a way that contributes meaningfully to our society [2].

With this work we present an extensive framework for the analysis and enhancement of online discussions. A major focus of our research is to find ways to validate the different developed NLP techniques for their usefulness to actual discussions. In our perspective, the users, their opinions and the discourse between different opinions is the most important aspect of online discussions that we want to assist and facilitate through newly developed tools. Therefore, we emphasize the need for appropriate experiments to evaluate the usefulness of recent NLP-tools.

2. Framework

(1) Developing methods and designing tools for the automated analysis of online discussions. These tools allow among other things: A summarization of the ongoing debate, the identification of central arguments, the identification of opinion leaders and a representation of the opinion landscape [7].

(2) Using (1) to develop measures to assert the quality of discussions. One possible measure could be evaluating the polarization of a discussion based on the opinion landscape. Additionally, we need to translate existing discourse quality measures [9] into automated assessments.

(3) Integrating tools from (1) into online discussions with the aim of improving these discussions. For example, we have been working on including automated discussion summaries generated by LLMs in Citizen Science Discussion Platforms. Citizen Science (CS) is scientific research conducted with participation from the public to design and build new devices and knowledge creation processes that can transform the world [10]. Digital tools which allow for discussion and deliberation among citizens bring about proper self-governance and play an important role in the inclusive participation of all users to enhance the CS project and its impact[8]. Furthermore, we are collaborating with the decidim platform[3], a deliberative democracy approach to local politics in Barcelona, where citizens can discuss local government project proposals online and participate in the approval of projects.

(4) Designing and implementing experiments to evaluate the usefulness of integrated tools from (3) using measures from (2). Central to our research is the usefulness of (3) for the *users* and the improvement of deliberation and discussions. While we can develop metrics to measure the quality of discussions, we can only evaluate the impact of the developed tools through adequate experiments [6]. For example, we can test if the inclusion of an automatically generated summary of long discussion threads leads to the participation of more new users. Or if including an automated summary of the opinion

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[3]https://www.decidim.barcelona/

landscape reduces the polarisation or increases the diversity of opinions. We believe that such experiments will play an important role for validating the advances of current and future LLMs as well as reflecting on their usefulness for our society.

3. Conclusion

The main contribution of our research is the holistic approach, which places emphasis on the usefulness of developed tools for users and their discussions, designing novel experiments, while working with various stakeholders interested in integrating current technological advancements in a meaningful way. Overall, our framework offers a roadmap for leveraging LLMs to enhance online discussions in a responsible and effective way.

Acknowledgements

References

[1] Imene Ajala, Shanaz Feroze, May El Barachi, Farhad Oroumchian, Sujith Mathew, Rand Yasin, and Saad Lutfi. Combining artificial intelligence and expert content analysis to explore radical views on twitter: Case study on far-right discourse. *Journal of Cleaner Production*, 362:132263, 2022.

[2] Sébastien Bubeck, Varun Chandrasekaran, Ronen Eldan, Johannes Gehrke, Eric Horvitz, Ece Kamar, Peter Lee, Yin Tat Lee, Yuanzhi Li, Scott Lundberg, et al. Sparks of artificial general intelligence: Early experiments with gpt-4. *arXiv preprint arXiv:2303.12712*, 2023.

[3] Venkata Rama Kiran Garimella and Ingmar Weber. A long-term analysis of polarization on twitter. In *Proceedings of the International AAAI Conference on Web and social media*, volume 11, pages 528–531, 2017.

[4] Jawad Haqbeen, Sofia Sahab, and Takayuki Ito. How did discourse shift among afghan citizens during the fall of republic: Early insights using conversational ai platform. In *DG. O 2022: The 23rd Annual International Conference on Digital Government Research*, pages 480–482, 2022.

[5] Jawad Haqbeen, Sofia Sahab, Takayuki Ito, and Paola Rizzi. Using decision support system to enable crowd identify neighborhood issues and its solutions for policy makers: An online experiment at kabul municipal level. *Sustainability*, 13(10):5453, 2021.

[6] Takayuki Ito, Rafik Hadfi, and Shota Suzuki. An agent that facilitates crowd discussion: A crowd discussion support system based on an automated facilitation agent. *Group Decision and Negotiation*, pages 1–27, 2022.

[7] Sandhya Ramakrishnan and LD Dhinesh Babu. A study on deep learning frameworks for opinion summarization. *Proceedings of Emerging Trends and Technologies on Intelligent Systems: ETTIS 2022*, pages 217–230, 2022.

[8] Lea A. Shanley, Alison Parker, Sven Schade, and Aletta Bonn. Policy Perspectives on Citizen Science and Crowdsourcing. *Citizen Science: Theory and Practice*, 4(1):30, December 2019. Number: 1 Publisher: Ubiquity Press.

[9] Marco R Steenbergen, André Bächtiger, Markus Spörndli, and Jürg Steiner. Measuring political deliberation: A discourse quality index. *Comparative European Politics*, 1:21–48, 2003.

[10] Katrin Vohland, Anne Land-Zandstra, Luigi Ceccaroni, Rob Lemmens, Josep Perelló, Marisa Ponti, Roeland Samson, and Katherin Wagenknecht. *The science of citizen science*. Springer Nature, 2021.

[11] Isaac Waller and Ashton Anderson. Quantifying social organization and political polarization in online platforms. *Nature*, 600(7888):264–268, 2021.