Towards Deliberation Analytics: Stream Processing of Argument Data for Deliberative Communication

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Abstract. Participants in a deliberative discourse are expected to follow specific rules of communication to legitimise outcomes. This paper focuses on technology developed around streams of computational argument data which is intended to inform and improve deliberative communication in real time. The goal is to bridge the gap between long-established theoretical desiderata from the social science literature and objective analytics calculated automatically from computable argument data in actual public deliberations.

Keywords. Public Deliberation, Argument Analytics, Stream Data Visualisation

According to political science philosopher Jürgen Habermas [1,2], participants in a deliberative discourse are required to listen to each other, provide extensive reasoning for their positions, show mutual respect, and become convinced by the "unforced force of the better argument" [2, p. 306]. Public deliberations are a particular type of deliberative communication in which a group of citizens discuss a set of issues at events typically organised by governments and other large institutions. Increasing public demand to "have a say, get heard" in decision-making procedures has led to new methods and designs proposed to put citizens and public stakeholders in (partial) decision-making authority. These processes come with a cost on public spending [3], which makes the quality of public deliberation events and their outcomes critical to democracy and modern society.

Because of the social impact of deliberative communication, political science has extensively studied the subject – both theoretically as well as empirically (see e.g. [4,5,6]). One of the key goals of the recent empirical turn in deliberation research is establishing which dimensions of communication have an impact on the quality of deliberative discourse (see e.g. [7,8,9,10]). For instance, the relative amount of argumentation will – in theory – improve the deliberative quality [1]. Yet there is a lack of consensus as to how these measures should be assessed in practice (cf. [11,12]), let alone in real time. Technology based on computational models of argument can support public deliberations by analysing the quality of debates, providing instantaneous visual feedback to participants.

In order to address the challenge of putting theory into practice, we propose a Deliberation Analytics system in which we specify formally the existing dimensions and

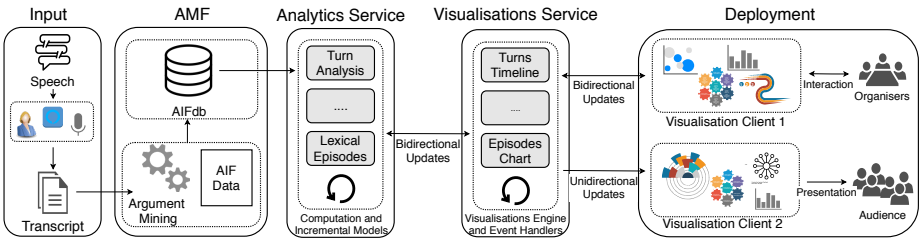

Figure 1. Deliberation Analytics Pipeline

measures from political science to capture specific argument phenomena in public deliberations, such as divisive issues (i.e. issues that attract a significant number of supports and attacks), making it explicit what parts of the discussion have higher argumentative content. Analytics are then visualised to make them easy to understand by participants, organisers and decision-makers, and evaluated in experimental user studies to ensure that they have a real (and positive) influence on the outcome of the deliberation. A key feature of the system is that it works in real time on stream data. This allows for dynamic updates of the analytics to be presented as the deliberations take place, rather than as an after-the-fact summary once the event has finished, effectively making Deliberation Analytics a participant aimed at improving the deliberative quality of the communication.

More concretely, the Deliberation Analytics pipeline (see Fig. 1) combines state-of-the art speech recognition, argument mining, visual data analytics to produce visualisations of public deliberations, which are deployed in real time to participants via large analytic displays, handheld devices or personal computers. The Input module takes the spoken deliberations and produces a stream of text, either using automatic speech-to-text services (e.g. Google's Cloud Speech-to-Text or Amazon's Alexa Voice Service) or a human stenographer. The text is processed by the Argument Mining Framework (AMF) [13,14] producing incremental argument structures in AIF, the Argument Interchange Framework [15,16]. These structures are then processed by a combination of analytics (Analytics Service): special-purpose variations of developments from two previous projects, Argument Analytics [17] and VisArgue [10]. This information is then turned into dynamic, interactive visualisations by a combination of data visualisation techniques (Visualisations Service), tailored to stakeholders[1], which update as new data becomes available throughout the event. Finally, these visualisations are presented live to participants, or made available interactively to organisers and moderators (Deployment).

By systematically turning discourse into visual interventions based on objective measures of deliberation quality, we aim to improve the development and outcome of critical public participation. It has been shown that problem-solving abilities increase when argumentation mapping software is used [18], and such software solutions can help finding a consensus [19]. So, in summary, we aim to transfer the advantages of visual support systems to face-to-face discussions. Arguably, each of the modules in the pipeline above is a matter of current research, so the effort has as much potential as it has challenges. Computational models of argumentation are the key to addressing many of these challenges, thereby transforming the potential and effectiveness of large scale civic engagement with deliberative democracy.

[1]Examples of such visualisations intended for the general public are available at `http://bbc.arg.tech`, and for experts at `http://presidential-debates.dbvis.de`.

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