Dialog-Based Online Argumentation

Tobias KRAUTHOFF [a,1], Michael BAURMANN [b], Gregor BETZ [c] and Martin MAUVE [a]

[a] *Department of Computer Science, University of Düsseldorf, Germany*
[b] *Department of Sociology, University of Düsseldorf, Germany*
[c] *Department of Philosophy, Karlsruhe Institute of Technology, Germany*

Abstract. In this position paper we propose a novel approach to online argumentation. It avoids the pitfalls of unstructured systems such as asynchronous threaded discussions and it is usable by any participant without training while still supporting the full complexity of real-world argumentation. The key idea is to let users exchange arguments with each other in the form of a time-shifted dialog where arguments are presented and acted upon one-at-a-time. We highlight the key research challenges that need to be addressed in order to realize such a system and provide first solutions for those challenges.

Keywords. online argumentation, dialog-based approach, computer science, collaborative argumentation, collaborative work, dialog games

1. Introduction

Argumentation, the rational exchange of positions, reasons and justifications, is a vital tool whenever a group of two or more persons needs to decide on a course of action, to determine what to accept as truth, to agree on a set of shared values or to simply reach a common understanding of what the positions of the members of the group are. The Internet has provided the basic infrastructure to enable argumentation for all kinds of groups, no matter how large these groups are, where the members of the group are located or at what time they choose to participate.

Unfortunately, this basic infrastructure has not yet led to the hoped for spreading of rational exchange of arguments. In fact, quite the opposite seems to be true. A quick glance at the discussion section of online-news-media as well as blogs and social media sites shows that the expression of opinions, disputes and controversies in the Internet are often anything but rational. They lack structure and clarity, suffer from frequent repetition of similar arguments, conflate diverse aspects of a subject or are biased, irrelevant, emotionally heated and ill-informed. Furthermore they encourage the balkanization of the participants and they do not scale to large numbers of users. It has been argued [1, 2] that this may be due to the predominant use of forum-based systems which rely on the input of free text.

As a consequence there have been several attempts to provide better support for online argumentation. However, so far, none of them has had really significant practical

[1] Corresponding Author: Tobias Krauthoff, Department of Computer Science, Universitätsstraße 1, 40225 Düsseldorf, Germany; E-mail: krauthoff@cs.uni-duesseldorf.de

impact. One important reason for this may be due to the fact that forum-based systems offer something that other systems do not: they allow for a highly complex exchange of arguments and counter-arguments with an intuitive statement-reply scheme. Other approaches to online argumentation either do not capture the full complexity of argumentation (e.g., pro/con lists) or they require that the user is trained in operating a rather complex technical tool (e.g., the cooperative creation of an argument map).

In this paper we describe a novel approach to support online argumentation, that does not require any prior knowledge or training from the user and avoids the shortcomings of forum-based systems while still allowing complex argumentation. The main idea is to guide participants through the arguments provided by other users so that they perform a time shifted dialog with those that have participated before them. The system is driven by a formal data structure capturing the full complexity of argumentation. The user interaction, however, has the structure of a regular dialog as it is performed in everyday life. It is the task of system – and not of the participants – to translate between those two views. We call this approach dialog-based online argumentation.

A full realization of dialog-based online argumentation requires the solution of several hard problems. We cannot hope to solve all of them in one pass. Therefore the contributions of the paper are limited to: (1) the presentation of how we envision that dialog-based online argumentation should work, (2) the identification of the main research challenges that need to be addressed to realize this approach, (3) a description of first ideas on how they can be addressed.

This paper is structured as follows. In Section 2 we give a brief overview of related work in the area of online argumentation. The general idea of dialog-based online argumentation is presented in Section 3. Section 4 defines the terms that we use in the remainder of the paper. The key challenges that need to be addressed in order to realize dialog-based online argumentation are described in Sections 5, 6 and 7. We concluding the paper with a summary and an outlook to future work in Section 8.

2. Related Work

Forum-based approaches, also called asynchronous threaded discussions, allow participants to exchange arguments by means of a sequence of text contributions. In the past those approaches have encountered much criticism: in particular they are believed to lead to a high degree of redundancy and balkanization while scaling poorly with the number of involved participants [1]. However, in practice they are, by far, the most commonly used approach to support online argumentation.

Online systems for argument mapping enable participants to structure their arguments and the relation between them in an argument map. Examples are Carneades [3,4], Deliberatorium [5] and ArguNet [6]. While those systems do avoid the shortcomings of forum-based approaches, they require the users to become familiar with their notation and the semantics of formal argumentation. Therefore, in practice, they are used by experts or students who want to learn about the logic of argumentation rather than by average participants that want to take part in an online argumentation.

It has been suggested, e.g. ConsiderIt [7], to use online pro and contra lists to aid collective decision making processes. These lists work very well for evaluating a given proposal. However, they are not suitable to deal with more general positions and alternatives since they do not support the exchange of arguments and counter arguments.

The idea of engaging in a formalized dialog to exchange arguments is used by so called dialog games. In these games the participants follow a set of rules to react to the statements of each other, e.g. [8]. They are commonly used as a teaching method and were originally developed without any computers in mind. However, with the ability to let computers enforce the rules, they gained significant attention. A good overview of the current state of development of digital dialog games is given in [9]. In contrast to our work, dialog games look at the real-time interaction between users in order to learn something about a subject at hand. They do not seek to provide better instruments for online argumentation.

In addition to the main classes of ideas presented above there are three individual systems that are related to our work. The first one is the *Structured Consultation Tool* (SCT) [10]. Its primary goal is to allow a government agency to elaborate and present a justification for a given action. Members of the public can then evaluate that reasoning in a step-by-step fashion. While the SCT explicitly seeks feedback on the arguments provided by the government agency it does so in a questionnaire kind of way. This is valid for gathering feedback on government proposals, but it is unsuitable for an online argumentation, where the dynamic exchange of arguments is the main focus.

The Carneades Opinion Formation and Polling Tool [11] is part of the Carneades argumentation mapping system. It allows participants to provide structured, questionnaire-style feedback on a given argumentation consisting of multiple arguments and positions put forward by - potentially - many agents. This tool can be regarded as a generalization of the SCT. As with the SCT the questionnaire-style feedback is well suited for an evaluation of government activities by citizens but it does not fit the idea of an online argumentation amongst peers.

The third system that is related to our work is Arvina [12] and its predecessor MAgtALO [13]. Both systems allow a user to conduct a dialog between robots and humans. As a basis they use an existing argumentation specified in a formal language [14] where the positions and arguments of some real-world persons are marked. A robot can use this information to argue with human participants. The participants can query the robots and each other. In contrast to the system we envision Arvina and MAgtALO are driven by the questions of the users. Thus there is no need for the users to react to replies from the system by providing their own arguments.

3. Large Scale Online Discussions as a Dialog between a System and many Users

The primary goal of dialog-based online argumentation is to enable any user without prior knowledge or training, to participate efficiently in a large-scale online argumentation. At the same time dialog-based online argumentation avoids or at the very least reduces the problems that plague unstructured online argumentation such as a high level of redundancy, balkanization, and logical fallacies.

The foundation of dialog-based online argumentation is a novel way to navigate an existing set of arguments pertaining to a given subject. Instead of presenting many arguments at once – in maps or lists of arguments – the user is shown only a single argument at a time. It is then possible to select a response from a list of alternatives. Based on this response and, possibly, the data gathered from the responses of other participants, the system selects the next argument that is shown to the user. In this way the user and

the system perform a dialog where the system selects arguments that are likely to be of interest to the user and the user provides feedback on those arguments.

Both, the user and the system, profit from the dialog. The user is efficiently guided towards those arguments that are particularly relevant for her. If done right, this should also eliminate redundancy and balkanization and reduce the occurrence of logical fallacies. The system, on the other hand, will increase its knowledge base with every response from a participant. This can then be used to improve the selection of arguments for the next user and to provide a summary of the online argumentation at hand.

There are at least two obvious research questions when considering the foundation of dialog-based online argumentation: How should the next argument be determined that is presented to the user? And: How should the list of responses look like that the participants can choose from? We will touch upon both questions later.

Dialog-based online argumentation, as described so far, requires a fixed set of arguments that is pre-constructed by experts. In many application scenarios this will be entirely sufficient. It will allow users to form their own opinion regarding the presented arguments and ultimately make a decision on which position to support. The system, on the other hand, will be able to learn about the popularity and perceived interdependency of arguments and positions.

However, for a genuine online argumentation the system has to allow participants to add their own arguments. This raises the question how user input can be integrated in a way that enables the navigation of arguments to operate on user-provided arguments. After all, the users are not schooled in argumentation (software) and will not articulate their views in a formally standardized language. This is the third main challenge for realizing dialog-based online argumentation.

The following sections will give an overview of the terms as well as the three challenges and potential solutions. We are are currently in the process of developing a first prototype of dialog-based online argumentation which can be accesses at `https://dbas.cs.uni-duesseldorf.de/`.

4. Terms and Data Structure

In the following we define the terms that will be used to describe the main aspects of dialog-based online argumentation. Their definition also describes the underlying data structure of our implementation.

Every online argumentation is identified by a **topic**. An example of a topic could be: “Our town needs to cut spending. Please discuss ideas how this should be done”. **Statements** are the most basic primitives used in an online discussion. Examples for statements are: “We should shut down university park”or “Shutting down university park will save $ 100,000 a year”. Individual participants might consider a given statement to be true or false. A **position** is a prescriptive statement, i.e., a statement which recommends or demands that a certain action be taken. “We should shut down university park” is an example for a position.

While experimenting with an early prototype we realized, that we need a somewhat unusual definition of the term “argument”. First of all, there is argumentation for or against statements. This leads to the well-known premise-conclusion-structure of an argument, where both premises and conclusions are statements or negations of statements.

For example: “Shutting down university park will save $ 100.000 a year, therefore we should shut down university park” would be an argument, where “Shutting down university park will save $ 100.000 a year” is the premise and “we should shut down university park” is the conclusion. With this structure it is straight forward to support attacks and rebuttals. An attack is an argument with a conclusion that is the negation of a premise of another argument, while a rebuttal is an argument with a conclusion that is the negation of the conclusion of another argument.

Furthermore, there are arguments that target the validity of other arguments by undercutting attacks. An undercutting attack is an argument that does not reason about statements in another argument but question that a certain statement really supports a conclusion. An example would be: “Yes, drug dealers are using the park to sell drugs but this is not a good reason for shutting down university park since we should not give in to criminals”. In this example the premise is “We should not give in to criminals” while the conclusion is the negative form of the argument “We should shut down university park because criminals use university park to sell drugs”.

As a consequence we use the following definition: an **argument** consists of one or more statements (or their negations) that form the **premise(s)** and one statement or another argument (or the negation of any of those two) that form the **conclusion**.

Together, arguments and statements form a (partially connected) *web of reasons* (WoR).

5. Challenge: Providing Feedback

The most basic building block of dialog-based online argumentation is gathering feedback from a user regarding a given argument. This is done by asking a question derived from the statements pertaining to the argument in the WoR. For example, if the premise of the argument is “Criminals use University Park to sell drugs” and the conclusion is “We should shut down University Park” the question generated by the system could be “What do you think about the following argument: ‚We should shut down University Park‘ because ‚criminals use University Park to sell drugs‘?”

The system then offers a set of answers from which the user can choose. This set has to be constructed in a way that enables an untrained user to provide precise feedback on the argument. A simple choice between: “I agree with this argument” and “I do not agree with this argument” could certainly be made by an untrained participant. However, both statements are not precise and have little significance. For example “I do not agree with this argument” might refer to several distinct scenarios: the user might disagree with the premise, the user might think that the conclusion is not supported by the premise or the user might consider this to be a valid argument but that it is weaker than other arguments supporting the negation of its conclusion.

In order to get precise and meaningful feedback from the user, the system has to differentiate between the scenarios by means of a set of answers that the user can choose from. Experiments with a prototype system that allowed users to react to arguments of a pre-constructed online-argumentation led us to two observations: (1) We need to add alternatives that are not commonly mentioned in argumentation theory, such as “I don’t care about this argument.” (2) We have to take into account that giving feedback on an argument is a two step process. The first step is mandatory and requires just a single

click from the user to determine his initial reaction to the argument. For example, the user could choose: "Yes, criminals use University Park to sell drugs, but I do not think that this is a valid reason to close down University Park." The second step is selecting or entering a statement that supports the choice taken in the first step. For the given example this might be "Because we should not give in to criminals." The second step is only available if the selection in the first step allows for a follow up statement and the user can choose to skip it. Separating the two steps facilitates very fast feedback and a clean user interface design.

On the basis of this general approach, the options can be examined that a participant should have in the first step of providing feedback. We propose the following: (1) Reject the premise. (2) Accept the premise and, as a consequence, the conclusion. (3) Accept the premise but disagree that this leads to accepting the conclusion. (4) Accept the premise but state that there is a stronger argument that leads to rejecting the conclusion. (5) Do not care about the argument.

Once the user has selected an answer the system can use this to update the internal information of the WoR and to select the next argument that is presented to the user.

6. Challenge: Navigating the Web of Reasons

The second major challenge for dialog-based online argumentation is how the system should select the arguments that are presented to the participant. We believe that addressing this challenge will have to be a competitive process between different approaches. Any navigation, however, will consist of two parts: (1) bootstrapping the dialog by identifying the first argument that should be presented to a given user and (2) selecting the next argument based on the prior actions of the user.

6.1. Bootstrapping

The first thing that the system needs to do when a new users wants to participate in the online discussion is to choose an initial argument to present to the user. This is challenging since the system has no information on the user, yet.

One fairly straightforward solution is to simply ask the participant for an initial position he is interested in. This is the starting point in the WoR. The user is then invited to indicate his attitude towards this position: he can support or attack the position or investigate existing arguments regarding this position.

If the supporting or the attacking option is chosen, the user is asked to select or provide a statement explaining his choice. This statement is used as the premise and the position (or its negation) is the conclusion. Thereby the first argument is complete and bootstrapping is finished. If the user chooses to investigating existing arguments, the system instead selects an initial argument from the WoR where the position (or its negation) under consideration is the conclusion. We have implemented this approach in our prototype and it works surprisingly well.

6.2. Selecting the Next Argument

The selection of the next argument that is presented to the participant can be based on many sources of information. In particular it could rely on the history of actions that

this specific participant has performed and the knowledge gained by the actions of other users. Different kinds of selection criteria could operate on this basis. Furthermore, the selection of arguments might be influenced by the need of the system to learn more about specific arguments or the desire to keep the participant interested in continuing the dialog.

At the moment we use a very simple approach which, nonetheless, illustrates the potential of our idea. We look at the participation history of a user to identify the most recent argument that she provided or supported. Then we search the WoR for an argument of prior users which challenges (attack, rebut or undercut) the argument of the current user. This argument is shown to the current user who then has the opportunity to react to it and thereby provides the next argument. This process continues until the WoR contains no counter argument to the argument of the current user. The overall intention is to simulate a real discussion where participants challenge the arguments of other participants.

7. Challenge: Accepting New Arguments

The key to incorporating new arguments in dialog-based online argumentation is to nudge the users to provide arguments themselves and to connect them with existing arguments in an appropriate way. Currently, we use four mechanisms for this purpose. First, users can enter their own statements only within the dialog. This ensures that whatever statement the user enters, it is automatically connected to the WoR in an appropriate fashion. Second, we apply sentence openers to frame the statements of the users. In this way the user is guided towards making structured and well-formed statements. Third, we automatically match the text entered by users with existing statements in the WoR by means of the Levensthein distance [15] and display the users the top results while they enter their statement. Users can then select one of these results instead of completing their own statement. Finally, whenever users employ the keyword "and" in a premise, the system asks the user if this is in fact a single statement or a sequence of statements. The reply to this question helps the system to identify arguments that have multiple premises.

8. Conclusion and Future Work

In this paper we have presented the idea of dialog-based online argumentation as a time-shifted dialog between the individual users participating in an online argumentation. We have identified the three main challenges that need to be solved in order to realize this idea: providing feedback on existing arguments, selecting the next argument that should be presented to the user and incorporating user input. For each challenge we have provided an initial solution and we have developed a first prototype implementing them.

While the work presented in this paper is sufficient to provide a first glimpse at dialog-based online argumentation, there is a multitude of further research questions that have not yet been addressed. We believe that in particular the selection strategies for the next argument provides a lot of research opportunities. New solutions and inspirations in this area might be derived, e.g., from argumentation theory, the studies on bounded rationality and fallacies of group deliberation, "wisdom of the crowd approaches" or the research area of recommender systems. We also expect that novel ways to embed dialog-

based online argumentation in regular web-content such as blogs or online newspapers will be part of the future work in this area.

Finally, and possibly most importantly, it will be pivotal to perform an empirical evaluation of dialog-based online argumentation in real-life settings.

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