Towards Better Understanding: Proposing Effective Visualization Methods for Analyzing Argument in Debate

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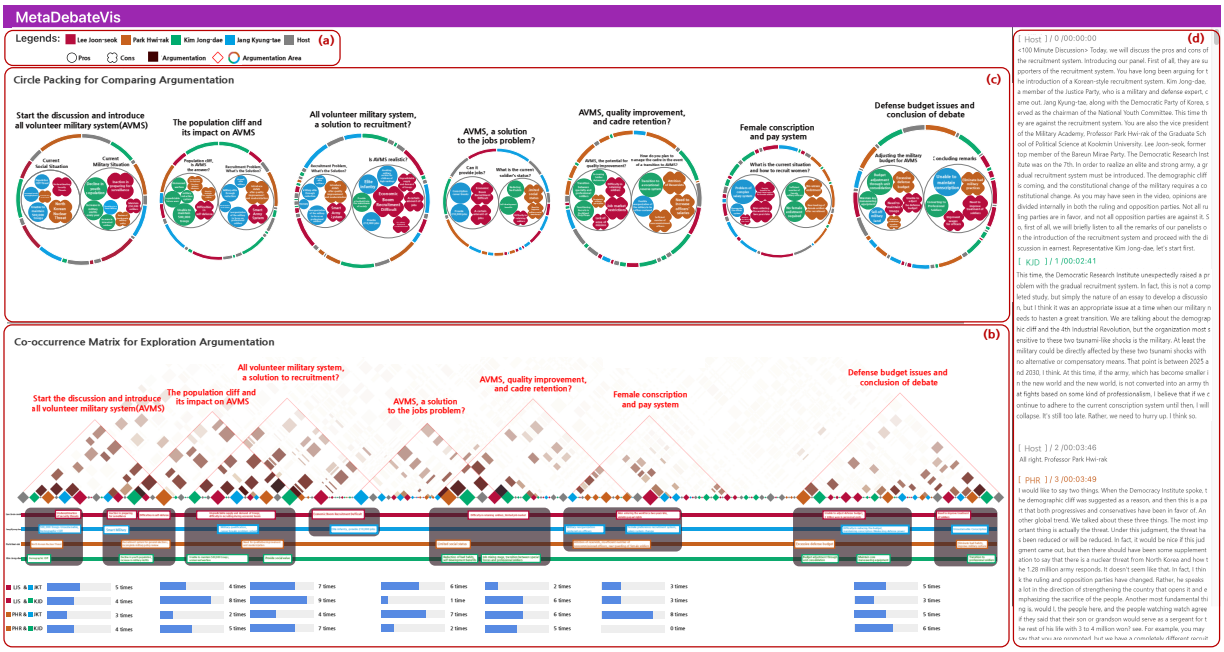

Figure 1: The interface of our visualization system. (a) Legends are provided to denote the information and argumentation representations of the debaters. (b) A co-occurrence matrix, which displays the relationships between the debaters' arguments. Below this, a section graph highlights the main keywords in the debate, and a bar chart indicates the number of arguments for and against each position, enabling users to identify areas of high and low contention. (c) A circle packing identifies the primary keywords for the issues within each debate topic, facilitating a comparison of the pros and cons positions on each issue. (d) A script viewer on the right side of the interface allows users to access detailed transcripts of the debate participants' contributions.

Abstract

Debate is a crucial process where participants exchange diverse perspectives and information, culminating in a reasoned conclusion. The task of understanding and analyzing the arguments that emerge during this process can be complex and challenging. To mitigate these challenges, we propose a visualization interface that intuitively illustrates the relationship between contentious sections and key debate points within a debate. The co-occurrence matrix identifies controversial sections, while the speech section graph highlights the primary contentious keywords in their respective contexts. Furthermore, the bar chart displays the frequency of arguments from both pros and cons positions within a contentious section. The circle packing provides a hierarchical representation of issues within a topic, showcasing and comparing the topical keywords between significant pros and cons groups. Through this system, we anticipate that users will be able to visualize the structure and flow of the argument at a glance, thereby facilitating a more comprehensive understanding of the entire debate.

Index Terms: Visual Analytics System, Natural Language Preprocessing (NLP), Debate Analysis, Human Computer Interaction

1 Introduction

A debate is a form of argumentative discourse where participants with differing viewpoints engage in debate on a specific subject. During a debate, participants communicate their perspectives and stances by refuting their opponents' arguments. This process creates a dynamic environment where the debate topic and ensuing arguments are constantly evolving. Detecting arguments that contain pivotal information and conducting a comparative analysis of the participants' viewpoints are essential factors in enhancing the effectiveness and value of the debate. Research on visualizing topics of debate on social media has shown that topics and issues emerge over time, and keyword conversion trends for each topic are tracked and interpreted [1]. However, it requires a certain learning effort for users to fully understand the design details, and it is designed around a clear branching pattern of community pairs, the overview of the entire community can be lost. Other proposals include visualizations that represent argumentative opinions for and against

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entities such as 'person', 'fact', and 'claim' [3]. Although these effectively express the comparison of argumentative opinions, they struggle to capture temporal continuity and the complexity of differing arguments. Therefore, in this study, we propose a system that enables swift detection of arguments and comparison of significant viewpoints within these arguments. This system aims to provide a more comprehensive understanding of the debate's structure and progression.

2 Design Goal

In designing a visualization system for argument analysis, we drew inspiration from previous studies [2, 4], which led us to establish the following visualization requirements:

- G1.Overview Accessibility: The system should provide an easy-to-understand overview of the arguments and context of a debate. It should offer information such as "what topics were discussed" and "who participated in the debate on a particular topic".
- G2.Argument Detection: The system should be capable of detecting arguments that have arisen in the debate and pinpointing areas where the debate is most intense.
- G3.Keyword Representation: The system should display the main keywords used in the debate. Rather than merely listing these keywords, the visualization should illustrate the relationship between them.

For more detailed design goals, (See Appendix, Fig. 2, Fig. 3 Design Goal).

3 Visual Interface

In this study, we utilized data from TV debates on the topic of conscription. The debate script data underwent preprocessing using natural language processing techniques and is represented in three main visualizations: a Co-occurrence Matrix for argument detection, a Circle Packing for argument comparison, and a Script View showcasing key utterances in the debate. The elements represented by each visualization are provided as legends in the upper left corner of the interface (See Fig. 1 (a)). The Co-occurrence Matrix identifies where the main arguments occur in the debate and can detect areas of intensified argumentation. The Speech Section Graph below this visualization displays the main debate keywords, while the accompanying Bar Chart illustrates the number of arguments for and against the debate. The Circle Packing indicates where key arguments occur in the debate and facilitates the comparison of debaters' keywords across topical issues. These visual interfaces aim to provide a comprehensive and intuitive overview of the debate, enhancing the user's understanding and analysis of the debate.

3.1 Co-occurrence Matrix

Co-occurrence Matrix is a visualization method that represents the correlation between two entities. In our system, the nodes listed at the bottom of the co-occurrence matrix represent debate participants, while their arguments are depicted as correlations (See Appendix, Fig. 2). The size of each node is determined by the volume of its utterances. Arguments are represented by cells in the matrix (depicted as brown squares), with the intensity of the argument based on the "argument conditions" outlined in (See Appendix, Table 1). This intensity is expressed as a contrast, with a higher contrast indicating a more intense debate (G2). The main debate areas are represented by red triangular areas, while the topics of debate are denoted by red text at the top of each. If there are numerous argumentative sections or mentioned keywords, these can be viewed in the speech section graph located below the co-occurrence matrix (G1, G3). And bar chart allows for an analysis of how many times each debate section was argued by pros and cons debaters.

3.2 Circle Packing

Circle packing is a potent tool for visualizing the structure of a debate (See Appendix, Fig. 3). It enables users to comprehend the hierarchy of topics, issues, and keywords within a debate, and swiftly identify the most significant elements (G1). At the top of the interface (See Fig. 1 (c)), a circle packing represents the keywords associated with the issues within the debate section (G3). Each circle symbolizes the stance of the debate participants on the issues within the debate section. The circles represent those in favor of each issue, while the 'X' shape represents those in opposition. The size of each element indicates the volume of debate surrounding that keyword. Furthermore, nodes collide when they either support an opinion or instigate an argument, visually representing the dynamics of the debate.

3.3 Script Viewer

A script viewer is provided to view the remarks made by participants during a debate (G1). This feature allows users to see the full transcript of the remarks made by participants in a debate (See Fig. 1 (d)).

4 Usage Scenario

The user aims to analyze the critical segments of the first and second debate topic sections, namely, "Initiating the Discussion and Introducing the All Volunteer Military System (AVMS)" and "The Population Decline and its Impact on AVMS". The pertinent visualizations can be referenced in (See Appendix, Fig.4), and the interpretation of specific nodes within the visualizations can be analyzed in tandem with the circle packing. For instance, the significant arguments in the debate section, such as Type1, Type2, and Type3, can be pinpointed through the interplay between the co-occurrence matrix and circle packing. This visualization interface offers a holistic and intuitive snapshot of the debate, bolstering the user's comprehension and analysis of the discussion.

5 Conclusion

Our system aids in recalling debates by enabling users to 'detect controversial sections, explore the most contentious sections, identify participants and their corresponding keywords that support or oppose the argument, and 'compare the volume of pro/con keyword mentions for each topic (argument). In future work, we aim to refine the granularity of debate analysis by allowing users to define debate zones using their own metrics. We also plan to conduct experiments to validate the effectiveness of our system in analyzing arguments in debates.

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