

EVA: A Multimodal Argumentative Dialogue System

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ABSTRACT

This work introduces the first version of EVA, a multimodal argumentative dialogue system that is capable of discussing controversial topics with the user. The interaction is structured as an argument game in which the user and the system select moves in order to convince their opponent. EVA's response is presented as a spoken natural language utterance by a virtual agent that is capable of supporting the respective content using characteristic gestures and mimic.

CCS CONCEPTS

• **Human-centered computing** → **Interactive systems and tools; Visualization**; • **Computing methodologies** → **Discourse, dialogue and pragmatics**;

KEYWORDS

Computational Argumentation, Multimodal Dialogue Systems, Synthesis of Arguments

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1 INTRODUCTION

Many conversational tasks such as resolving conflicts or convincing an opponent of one's stance depend on the exchange of arguments, i.e. argumentation. Despite the importance of the semantic content of the employed arguments, the way to present them is also crucial in order to reach the respective goal. Most dialogue systems that are concerned with argumentative tasks (in short argumentative dialogue systems) are limited to one modality [5–7]. The synthesis of multimodal arguments is mostly unexplored.

This work presents a prototype of EVA, a multimodal argumentative dialogue system that is capable of presenting arguments to

the user via natural language and supporting them with mimic and gestures displayed by a virtual avatar. We focus on competitive persuasion and model the interaction as an argument game based on the formalism of Prakken [2]. The system extends the approaches of Rach et al. [3] by a virtual avatar that conveys the system's output and a graphical interface allowing the user to choose their input.

The remainder of this paper is as follows: Section 2 discusses the architecture of the system, including the dialogue model and the employed avatar whereas Section 3 concludes the work with a brief summary and outlook.

2 ARCHITECTURE

The architecture of the system is separated into two modules: the argumentative dialogue system which regulates the interaction, and the virtual avatar responsible for producing multimodal output. The interface for the user input is realized as a dropdown menu in which reasonable responses in the current state of the dialogue are presented. The system's reply is chosen by the dialogue system and presented to the user through the virtual avatar by different modalities that include natural language, mimic and gestures.

In the following, both modules of the system are discussed in more detail. A screen capture of the interface including menu, dialogue¹ and avatar is shown in Figure 1. An example video of a complete argumentative dialogue can be found at <https://youtu.be/h1br3S70iQc>.

2.1 Argumentative Dialogue System

The interaction between the user and the system is modeled as a dialogue game for persuasive dialogue (in short argument game) introduced by Prakken [2]. Thus, each utterance corresponds to a formal move in this game and the set of allowed moves in each state of the dialogue is given by the rules of the game.

The argument game includes five different types of moves: *argue*, *claim*, *why*, *concede*, *retract*. Each move either *surrenders to* or *attacks* a previous move. A binary status is assigned to each previously made move in order to determine whether or not it can be addressed in the current turn. This status is updated for every new move that was made. A player's turn consists of one or more moves.

Each argumentative dialogue system requires knowledge of arguments in order to respond in a reasonable manner. EVA encodes the arguments available to both players as well as their respective

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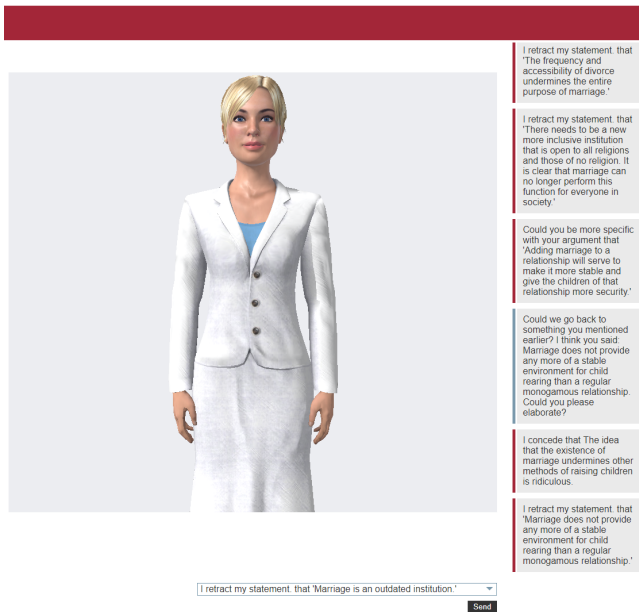


Figure 1: Screen capture of the EVA interface including a dropdown menu with possible answers, avatar and dialogue history.

relations as a graph in an OWL ontology. In order to enable natural language responses of the system, each component of this argument tree is assigned a natural language representation. At the time of publication, the database encodes 72 argument components about the topic 'Marriage is an outdated institution' extracted from the corresponding debate from the *Debatebase* of the *idebate.org*² website and 64 argument components concerning the topic 'Boxing should be banned' from the argument mining corpus presented in [1]. The data acquisition for the first argument structure including the employed annotation scheme as well as a detailed description of the natural language generation (NLG) template are discussed in [3].

The argument structure and the argument game formalism discussed above provide a set of possible moves in each state of the dialogue. The system then selects its next move according to a policy π that is either based on probabilistic rules or derived by means of Reinforcement Learning (RL). The rule-based approach relies on the following preferences: Prefer *attack* over *surrender* moves, *argue* over *why* moves and select between equally preferred moves randomly. Thus, the whole argument structure is explored as the strategy changes between the dialogues. In contrast, the RL approach models the argument game as stochastic game and derives an optimized policy in self play [4]. The respective optimal policy depends on the specific rules and the applied winning criterion. In

the current state, it is possible to load pre-trained policies achieved with $Q(\lambda)$ -learning and linear function approximation.

2.2 Web-Based Avatar

In order to provide our system with multimodal output capabilities, we employ the Charamel™ avatar³ being freely available for research institutes and students. It makes use of the Nuance TTS and all Amazon Polly Voices⁴ to enable the user to listen to their opponent rather than just reading the arguments. The arguments are being presented by the avatar in a natural way using speech, and additionally displayed as text. This allows the user to both read the argument while listening and read previous arguments. In the current prototypical state of the work, the avatar utilizes a pre-defined template of mimics and gestures that will be replaced by customized signals in the future. The template is generated from the available expressions (mimic and gestures) of the avatar and synchronized with specific formulations of the NLG.

3 CONCLUSION

We have presented a multimodal argumentative dialogue system that is capable of discussing controversial topics with human users. Whereas the user selects their response from a provided list of possible answers, the system introduces its utterances by natural language that is supported by the mimic and gesture of a virtual avatar. Future work will focus on a natural language understanding module that allows the user to both phrase their own response and to introduce their own arguments. In addition, the mimics and gestures of the avatar will be customized based on data from human argumentation and further optimized by means of RL. As a final extension, we will include additional topics into the database of arguments.

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²<https://idebate.org/debatebase> (last accessed 09 January 2018)

³<https://www.charamel.com/competence/avatare>

⁴<https://docs.aws.amazon.com/polly/latest/dg/voicelist.html>