AI Debate Systems: Enhancing Structured Argumentation and Interactivity

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Abstract—A debate is a formal discussion where the participants form and support arguments. A good debate must include logical structure, reasoning from facts, counterarguments, persuasion, and interactivity. Therefore, AI debate systems must follow structured argumentation models to present clear and logical discussions. Falsified reasoning is also used to reinforce arguments based on more recent evidence, and rebuttal games are interactive. Nature Language Processing based reasoning also enhances the understanding and flexibility of AI arguments. Such approaches enhance the ability of AI systems to engage in relevant and interpretable dialogue.

Different types of conversational agents that are capable of debating include rule-based agents using pre-defined templates, retrieval-based agents that look up arguments from a database, and hybrid agents that combine structured reasoning with retrieval-based methods. Advanced systems, such as hierarchical persuasion agents, learn how to tailor arguments based on feedback from users, while explainable debate agents construct their reasoning via formal argumentation structures. AI-based debate systems are particularly precious in domains such as healthcare, law, and business, where the transparency of reasons is of significant importance. Advanced work must merge hierarchical argumentation, retrieval-based learning, and interactive user engagement to create more persuasive and transparent AI debaters.

Index Terms—AI, Debate Systems, Argumentation, Conversational Agents, Natural Language Processing

I. INTRODUCTION

This paper explores the application of AI in debate systems, focusing on how structured argumentation and interactivity can be enhanced through various techniques. We examine different types of conversational agents capable of debating and discuss their potential applications in various domains.

II. DEBATE DEFINITION AND WHAT MAKES A GOOD DEBATE

A debate is a structured conversation through the presentation of arguments by opposing sides with a view to expressing their positions, and justifications, and enabling the scrutiny of different perspectives [1][6]. It can also be viewed as an argumentative game where the interactions are governed by predefined rules, and players engage in structured moves [6]. A good debate consists of empirical evidence-based arguments that are well-supported, clear explanations that spell out reasoning using simple language, and an awareness of counterarguments to back persuasive attempts. Moreover, logical coherence between premises and the categorization of argument quality are elements that make the responses effective as a whole [6].

III. CONVERSATIONAL AGENT DEBATING TECHNIQUES AND APPLICATIONS

Conversational Agent Debate Debate or argumentation systems utilize a variety of approaches to structure, analyze, and reason arguments. Such approaches allow AI to handle complex reasoning, ambiguity, and interactive dialogue. Argumentation schemes and graphs help monitor and structure arguments and counterarguments. There are some techniques like fuzzy cognitive maps and falsifiable reasoning by which AI can be made decision-capable even in incompleteness or ambiguities. The most critical point of an effective AI argumentation system is that it must be capable of convincing and explaining, so its output will be believable and understandable, thus creating more trust and interaction from the users.

IV. EXISTING TYPES OF CONVERSATIONAL AGENTS CAPABLE OF DEBATING A SUBJECT

Several types of conversational agents are capable of participating in debates:

- **Rule-Based Agents:** Use predefined argument templates.
- **Retrieval-Based Agents:** Fetch arguments from a database.
- **Hybrid Argumentation Agents:** Combine retrieval with reasoning.
- **Hierarchical Persuasion Agents:** Adapt arguments based on user feedback.
- **Explainable Debate Agents:** Justify their reasoning using argumentation.

V. THE POWER OF SYMBOLIC METHODS IN CONVERSATIONAL AGENTS

Symbolic methods, commonly referred to as Good Old-Fashioned Artificial Intelligence (GOFAI), emphasize knowledge representation in the form of structured, human-readable symbols employing logical reasoning for problem-solving. These methods rely on formal logic, rule-based systems, and knowledge graphs. The applicability of this approach is due to:

- **The decision-making processes transparency:** The representation of knowledge achieved through the encoding of formal rules of debate and argumentative structures via logic-based frameworks permits artificial intelligence systems to systematically assess premises and deduce conclusions. GOFAI captures human reasoning and guarantees transparency in decision-making [7].
- **Explainable reasoning:** A very important feature in situations where an explanation is needed to support an argument and to explain the reasons for a decision. This enhances the user's confidence in the system and makes it user-friendly [8].
- **Ability to work with abstract concepts and logical relationships:** Abstract notions such as mental health and social interaction can be framed in rational hierarchies and structured relations within symbolic systems. These systems enable the capacity of artificial intelligence to discuss philosophical or ethical issues using predefined logical relations and concepts [7].

VI. RESOURCES AND TECHNOLOGIES

A. Resources for Information

Google Scholar, ResearchGate, IEEE Xplore, and IMT Library.

B. Technologies

GitHub, LaTeX.

VII. CONCLUSION

AI debate systems hold significant promise for enhancing structured argumentation and interactivity in various domains. By combining advanced techniques in natural language processing, argumentation theory, and machine learning, it is possible to create AI debaters that are persuasive, transparent, and capable of fostering critical thinking. Further research is needed to explore the full potential of these systems and address the challenges associated with building robust and reliable AI debaters.

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