

Conversational Agent Debating Capability

Mohamad Faraj Makkawi

IMT Atlantique

Rennes, France

mohamad.makkawi@imt-atlantique.net

Hassan Khan

IMT Atlantique

Rennes, France

hassan.khan@imt-atlantique.net

Abstract—

Index Terms—AI, Debate Systems, Argumentation, Conversational Agents, Argumentation Service Platform with Integrated Components (ASPIC).

I. INTRODUCTION

Various conversational agents are developed to argue, and various methodologies are applied in the development of arguments. Rule-based agents use pre-defined templates, and they provide structured responses, which are inflexible. Retrieval-based agents learn arguments from a database, and this enables them to respond rapidly, although the responses may be irrelevant contextually [3]. Hybrid argumentation agents use retrieval with reasoning mechanisms to produce more flexible arguments, while hierarchical persuasion agents refine their arguments through the utilization of user feedback, thereby improving interaction [5]. Explainable debate agents give explicit justification to their arguments, transparency enhanced and trust.

This work investigates the argumentation capabilities of dialogue agents with a special emphasis on how symbolic artificial intelligence techniques, in the form of ASPIC and defeasible logic programming, improve argumentation by using systematic reasoning and knowledge representation. We highlight the strengths of symbolic techniques in terms of explainability and abstraction manipulation [7], along with discussing problems such as managing uncertainty, very large datasets, and real-time adaptation limits [9]. By going through current architectures, we try to evaluate the potential and limitations of symbolic AI in creating successful debate-capable conversational agents.

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] [2]. 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

- **Argument graphs:** Argument graphs are graph representations employed to illustrate arguments and their interrelations. Under this paradigm of thinking, nodes are indicative of independent arguments, whereas the edges linking them are instances of relations among such arguments. Argument graphs enable agents to visualize the composition of arguments and their relations to one another, thereby determining appropriate contexts for the application of specific arguments [4] [6].
- **ASPIC framework:** ASPIC is a formal framework for constructing and analyzing arguments, with premises reflecting the fact domain over which the argument is being constructed, and inference rules under which conclusions are drawn from premises. Preference rules are then used to prefer some arguments over others, on both logical grounds as well as user-specific priorities [6].
- **Multi-Attribute Argumentation Framework:** The Multi-Attribute Argumentation Framework is concerned with assessment of arguments on various criteria such as cost, environmental impact, and feasibility. Each attribute is given a weight depending on its significance. Arguments are then compared by contrasting their scores on these various attributes, thus giving a formal methodology for decision-making and argument evaluation [6].

IV. COMPARATIVE ANALYSIS OF CONVERSATIONAL AGENTS IN DEBATE APPLICATIONS

V. THE POWER OF SYMBOLIC METHODS IN CONVERSATIONAL AGENTS

Symbolic methods 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 explainable reasoning ability; 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 [7].

TABLE I
COMPARISON OF DEBATING AGENT

Agent Type	Approach	Use Cases	Strengths	Weaknesses
Rule-Based	Predefined templates	Compliance systems [10]	Predictable outcomes	Rigid structure
Retrieval-Based	DB queries + RAG	Customer support chatbots [1]	Dynamic data handling	Retrieval dependency
Hybrid	Rule-retrieval integration	Legal argumentation [3]	Context-aware reasoning	Complex setup
Hierarchical	Feedback-driven adaptation [5]	Policy negotiation	Personalized arguments	Feedback latency
Explainable	Justification chains [11]	Diagnostics, Legal systems	Transparent explanations	Depth limitations

TABLE II
EVALUATION CRITERIA FOR DEBATING AGENTS

Criterion	Sub-Criteria	Metric	Data Source	Weighting
Argument Quality	Validity, Relevance, Diversity, Originality	Logical consistency score, Novelty index	Debate transcripts, Expert review	30%
Structural Integrity	Timing adherence, Signposting clarity, Rhetorical effectiveness	Flow analysis, Audience comprehension tests	Speech recordings, Peer feedback	20%
Team Cohesion	Role fulfillment, Consistency, Progression tracking	Inter-agent coordination score, Role-specific KPIs	Interaction logs, Team self-reviews	20%
Adaptability	Rebuttal effectiveness, Strategy adjustment speed	Counterargument success rate, Response latency	Debate flowcharts, Timestamp analysis	15%
Ethical Alignment	Bias detection, Fairness adherence	Ethical violation frequency, Diversity index	Content analysis, Third-party audits	15%

VI. LIMITATIONS OF CONVERSATIONAL DEBATING AGENTS

- **Uncertainty and Big Data Management:** AI Debate Systems may need to handle vast amounts of data from multiple sources, often containing noisy or inconsistent information [9].
- **Knowledge Acquisition Bottleneck:** Symbolic AI programs typically require hand-coded rules and knowledge, leading to high human effort and cost in translating real-world problems into system inputs [9].
- **Real-time Dynamic Assessments:** AI debate systems face challenges in reacting dynamically to emerging arguments or rapidly changing contexts in real-time scenarios [9].
- **Logical Inconsistencies:** Internal logical inconsistencies

present a major hurdle in designing secure AI systems, such as debate frameworks. This issue highlights the need to integrate constrained logical verification or consistency inference tools into the AI architecture [8].

VII. CONCLUSION ACKNOWLEDGMENT

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