**Argumentative Reasoning in Clinical Decision Support Systems**

**Title :** Why do humans reason? Arguments for an argumentative theory

**Authors :** Hugo Mercier and Dan Sperber

**Publisher :** Cambridge University Press

**Year :** 2011

**Summary :** This work challenges the traditional view of reasoning as a truth-seeking process, proposing instead that its primary function is argumentative—to devise and evaluate arguments to persuade others. The authors suggest that this function is evolutionarily adaptive, given humans' reliance on communication and susceptibility to misinformation. Many common reasoning failures, such as confirmation bias, are reinterpreted as features of reasoning viewed through an argumentative lens. People perform poorly on abstract reasoning tasks when they lack an argumentative context but do well when reasoning to defend a position. However, this kind of reasoning can lead to distorted evaluations, entrenched beliefs, and suboptimal decisions, as individuals favor arguments that support their views rather than seek objective truth. [1]

**Remark :** This perspective offers a provocative yet compelling redefinition of reasoning—not as a tool for discovering truth but as a social device for persuasion and justification. It reframes cognitive biases like confirmation bias not as flaws, but as adaptations aligned with the true function of reasoning. While this view raises concerns about epistemic reliability, it also opens new avenues for designing systems and interventions (e.g., in education, AI, and public discourse) that leverage or mitigate argumentative reasoning. Understanding reasoning as fundamentally persuasive may help explain not only individual biases but also broader phenomena such as polarization and ideological entrenchment..

**Title :** Explaining Qualitative Decision Under Uncertainty by Argumentation

**Authors :** Leila Amgoud and Henri Prade

**Publisher :** National Conference on Artificial Intelligence

**Year :** 2006

**Summary : S**uggested a framework for qualitative decision-making under uncertainty that is based on argumentation. Initially, arguments in favor and against decisions are developed and assessed using either an optimistic or a pessimistic criterion. Then, in order to determine which choice is optimal, decision alternatives are compared according to their arguments in favor or against.[2]

**Remark :** It is possible to design a logical system that directly processes arguments based on their strengths and determines both acceptable and optimal decisions.

**Title :** Using arguments for making and explaining decisions

**Authors :** Leila Amgoud and Henri Prade

**Publisher :** Artificial Intelligence, Elsevier

**Year :** 2009

**Summary :** The first general and abstract argument-based framework for making decisions is presented in this paper. This framework consists of two primary steps. First, classical acceptability semantics are used to construct and assess arguments for options and beliefs. Option pairs are compared using decision principles in the second step. The acknowledged justifications for each option serve as the foundation for decision principles.[3]

**Remark :** Unipolar, bipolar, and non-polar principles are the three different categories of decision principles based on whether they are used in i) only pros or only cons arguments, ii) both types, or iii) an aggregation of them into a meta- argument.

**Title :** [Dominant decisions by argumentation agents](https://link.springer.com/chapter/10.1007/978-3-642-12805-9_3)

**Authors :** PA Matt *et.al*

**Publisher :** International Workshop on Argumentation in Multi-Agent Systems, Springer

**Year :** 2009

**Summary :** Present a unique family of (assumption-based argumentation) frameworks for decision-making benefits. These models can be used to express the knowledge of intelligent agents capable of independently selecting the "best" decision, given the subjective requirements and preferences of the decision- makers they "represent."[4]

**Remark :** Instead of just categorizing decision alternatives as acceptable or unacceptable, the concept of degree of admissibility was introduced.

**Title :** Decision making with assumption-based argumentation

**Authors :** X Fan, F Toni

**Publisher :** Theory and Applications of Formal Argumentation: Second International Workshop Springer

**Year :** 2014

**Summary :** Present two distinct formal frameworks that are used to represent decision- making. Decisions satisfy distinct objectives and have multiple characteristics in both frameworks. Examine a family of decision functions that show choices with various criteria, such as choices that meet all, most, none of the other's goals, and the most desired reachable goals.[5]

**Remark :** A formal model for decision making with Assumption-based argumentation (ABA)

**Title :** An argumentation-based approach to modeling decision support contexts with what-if capabilities

**Authors :** Baroni *et.al*

**Publisher :** AAAI Fall Symposium Series

**Year :** 2009

**Summary :** In order to model the knowledge and reasoning patterns in decision-making, they introduced a set of argument and attack schemes. They used the preferred semantics to compute admissible decisions and mapped the schemes to an Argumentation Framework with Recursive Attacks (AFRA).[6]

**Remark :** The suggested method includes a range of attack and argument schemes meant to represent fundamental concepts and patterns of reasoning for decision assistance.

**Title :** ArgMed-Agents: Explainable Clinical Decision Reasoning with LLM Discussion via Argumentation Schemes

**Authors :** Shengxin Hong *et.al*

**Publisher :** IEEE

**Year :** 2024

**Summary :** This study introduces ArgMedAgents, a multi-agent system that facilitates explainable clinical decision reasoning by LLM-based agents through interaction. ArgMedAgents builds the argumentation process as a directed graph that depicts conflicting relationships after performing self-argumentation iterations using the Argumentation Scheme for Clinical Discussion, a reasoning mechanism for modeling cognitive processes in clinical reasoning. Finally, find several logical and cohesive reasons in favor of the decision using a symbolic solver. ArgMed-Agents allows LLMs to self-directly generate reasoning explanations, simulating the process of clinical argumentative reasoning.[7]

**Remark :** By leveraging directed graphs and the Argumentation Scheme for Clinical Discussion, the system provides a novel and interpretable approach to modeling cognitive processes in medical decision-making. The use of a symbolic solver to derive logical support for decisions enhances both transparency and reliability.

**Title :** Argumentative Large Language Models for Explainable and Contestable Decision-Making

**Authors :** Gabriel Freedman *et.al*

**Publisher :** arXiv (preprint)

**Year :** 2024

**Summary :** The author of this work presents a technique for adding argumentative reasoning to LLMs to balance their advantages and disadvantages. Specifically, provide argumentative LLMs, a technique that builds argumentation frameworks using LLMs and forms the foundation for formal reasoning in decision-making. Any decision made by the augmented LLM may be readily explained to and disputed by humans due to the interpretable nature of these formal reasoning and argumentation frameworks. They provide experimental evidence of the efficacy of argumentative LLMs in the claim verification decision-making task. Additionally, the technology automatically allows for human-computer collaboration and outputs precise uncertainty estimates.[8]

**Remark :** By constructing argumentation frameworks, the proposed technique enables transparent, disputable decision-making—an important step toward fostering trust in AI systems. The inclusion of empirical results on claim verification strengthens the work’s credibility, and the added capability for human-AI collaboration with explicit uncertainty estimation marks a significant advancement.

**Title :** Explanation–Question–Response dialogue: An argumentative tool for explainable AI

**Authors :** Castagna *et.al*

**Publisher :** Argument & Computation

**Year :** 2024

**Summary :** The new Explanation–Question–Response (EQR) dialogue and its characteristics are fully formalized in this paper. Its primary goal is to provide adequate information (i.e., justified by argumentative semantics) while guaranteeing a simpler protocol for both artificial and human agents when compared to other current approaches.[9]

**Remark :** This work addresses a critical concern in AI adoption—the opacity of deep learning systems—by proposing a novel, formally grounded dialogue protocol aimed at enhancing explainability and user trust.

**Title :** Can formal argumentative reasoning enhance LLMs performances?

**Authors :** Castagna *et.al*

**Publisher :** arXiv

**Year :** 2024

**Summary :** Study provides a pipeline (MQArgEng) and initial research to assess how adding computational argumentation semantics affects LLM performance[10]

**Remark :** The proposed engine is a simple plugin tool that has no restrictions on the underlying model or its architecture. The results demonstrate how this engine is sufficient to raise the MT-Bench scores than the baseline.

**Title :** Data-Empowered Argumentation for Dialectically Explainable Predictions

**Authors :** Cocarascu*et.al*

**Publisher :** IOS Press

**Year :** 2020

**Summary :** The paper introduces a novel approach to transparent AI called Data-Empowered Argumentation (DEAr), designed to produce dialectically explainable predictions. In contrast to opaque, black-box models, DEAr builds on the concept of argumentation debates derived from data. These debates involve data-driven arguments that may disagree on labels or interpretations, offering a dialectical structure to prediction and explanation. The authors test DEAr on three types of data: categorical, annotated images, and text, demonstrating that it performs competitively with decision trees (DTs) while inherently providing clear, argument-based explanations[11]

**Remark :** DEAr is a promising step toward interpretable and trustworthy AI, especially in high-stakes domains like healthcare and law where transparency and explanation are crucial. By framing prediction as a dialectical process, DEAr not only matches the performance of traditional transparent models like decision trees but also enriches the interpretability with logical reasoning structures. This approach could pave the way for more human-aligned AI systems, where decision-making is not only accurate but also justifiable and contestable.

**Title :** Improving decision-making performance through argumentation: An argument-based decision support system to compute with evidence

**Authors :** Joshua Introne*et.al*

**Publisher :** Elsevier

**Year :** 2014

**Summary :** This article explores the real-world utility of Argument-Based Systems (ABSs) by introducing a new system called PENDO, designed to aid decision-making—specifically, in predicting housing market trends. While prior research highlights ABSs’ benefits in enhancing thinking and learning, their effectiveness in practical decision-making tasks remains underexplored. PENDO addresses a key human shortfall—evidence-based reasoning—by helping users weigh and aggregate evidence through a computational engine. It also enables the creation of reusable knowledge artifacts. Interestingly, the study finds that an individual’s unaided decision-making ability does not predict their success with PENDO, suggesting that the skills engaged with the tool differ fundamentally from those used in unaided reasoning.[12]

**Remark :** The findings mark a significant development in the field of decision support systems. PENDO not only demonstrates the practical value of ABSs in improving decision outcomes but also reveals that such tools can unlock latent cognitive capabilities in users, independent of their baseline decision-making skills. This opens up new possibilities for designing ABSs that democratize expertise, making complex decision domains more accessible. The disconnect between unaided and tool-assisted performance also underscores the importance of designing intuitive, cognitively-aligned interfaces in decision-support technology.

**Title :** LLM-based Frameworks for API Argument Filling in Task-Oriented Conversational Systems

**Authors :** Jisoo Mok*et.al*

**Publisher :** Association for Computational Linguistics

**Year :** 2024

**Summary :** This paper investigates the use of LLMs for the argument filling task in task-oriented conversational agents. These agents operate in three main phases: API selection, argument filling, and response generation. The focus here is on improving how LLMs extract and supply the necessary information (arguments) from a conversation to call external APIs effectively. The study finds that LLMs struggle with this task unless they undergo a grounding process—a method to anchor their responses in the context of the API schema and dialogue history. To address this, the authors propose new training and prompting strategies that significantly enhance LLMs’ argument filling performance, laying the groundwork for more automated and accurate conversational systems.[13]

**Remark :** This work highlights a critical gap in deploying LLMs for goal-driven, real-world tasks—their need for contextual grounding when interacting with structured systems like APIs. By targeting the argument filling phase, the authors contribute to a more robust integration of LLMs in task-oriented dialogue systems. The proposed grounding techniques not only improve performance but also offer a scalable pathway to building more autonomous and reliable conversational agents, essential for applications in domains like customer service, healthcare, and travel booking.

**Title :** Building More Explainable Artificial Intelligence With Argumentation

**Authors :** Zeng*et.al*

**Publisher :** Proceedings of the AAAI Conference on Artificial Intelligence

**Year :** 2018

**Summary :** This work focuses on advancing explainable AI (XAI) through an argumentation-based approach to decision-making, inspired by how humans reason—by weighing arguments for and against a conclusion. Such an approach provides transparency and interpretability, which are especially critical in sensitive domains like healthcare. The author proposes a hybrid model that combines machine learning techniques (e.g., CNNs for feature extraction from brain images and cognitive tests) with an explainable reasoning framework, creating not only predictions (e.g., early dementia diagnosis) but also detailed, structured explanations.[14]

**Remark :** This work represents a thoughtful and rigorous integration of symbolic reasoning and data-driven learning, addressing one of XAI's core challenges: making machine learning outputs not only accurate but also intelligible. The proposed use of argumentation to mirror human deliberation enhances trust and usability in critical domains like medical diagnostics. Moreover, distinguishing between argument- and context-based explanations is a valuable conceptual innovation, paving the way for more nuanced, user-centered AI systems. The future direction—optimizing explanation quality and expanding application domains—positions this research at the intersection of AI, human cognition, and real-world utility.

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