The Werewolf Among Us: Humans vs LLMs in Multi-Agent Games

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2025-05-06

Abstract TODO

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Introduction

- Social deduction games like *Werewolf* offer a clear way to evaluate how agents deceive, persuade, and reason in group settings(Wikipedia contributors 2024). In these games, players have limited information, hidden identities, and must convince others while trying to figure out who is lying. These challenges closely match real life situations involving trust, negotiation, and manipulation.
- We wanted to compare how humans and large language models (LLMs) handle these situations. To do this, we used two recent datasets:
  - *Werewolf Among Us* (Lai et al., 2022), a collection of real human gameplay annotated with persuasion strategies,
  - *Werewolf Arena* (Bailis et al., 2024), a simulated environment where LLM agents play the game autonomously.
  - While both studies show Werewolf generates complex strategic language, neither compares human and LLM behavior directly.
- Our project addresses this gap. We analyzed transcripts from both datasets, matched them by role, round, and persuasion strategy, and compared how humans and LLMs lie, persuade, and detect deception.
- By annotating utterances with the same set of persuasive strategies, we clearly show how synthetic agents differ from or resemble humans when navigating deception in adversarial group interactions.

Related Work

Multi-Agent LLMs

- Among us game (Chi, Mao, and Tang 2024)
- Collective problem solving (Du, Rajivan, and Gonzalez 2024)
  - "analyses indicate that LLM agent groups exhibit more disagreements, complex statements, and a propensity for positive statements compared to human groups"
- Govsim (Piatti et al. 2024)
  - "In GOVSIM, a society of AI agents must collectively balance exploiting a common resource with sustaining it for future use. This environment enables the study of how ethical considerations, strategic planning, and negotiation skills impact cooperative outcomes."
- All found similar themes
  - That LLMs are capable and good at understanding the rules
  - That they can cooperate and be sneaky

LLMs and Werewolf

- Examination of improving werewolf by LLMs (Xu et al. 2024)
    - “our agents use an LLM to perform deductive reasoning and generate a diverse set of action candidates. Then an RL policy trained to optimize the decision-making ability chooses an action from the candidates to play in the game. Extensive experiments show that our agents overcome the intrinsic bias and outperform existing LLM-based agents in the Werewolf game.”
- Werewolf Arena (Bailis, Friedhoff, and Chen 2024)
    - Used in this paper
- Explicitly discuss how none of the exisiting LLM+Werewolf papers examine the differences/compare from a human dataset

Methods

Data

Werewolf Among Us Human Dataset

- Human dataset description (Lai et al. 2022)
- Is specifically for a form of one-night werewolf
  - Describe key differences
- Used specifically for the text available
  - and annotations of persuasion strategy on the text

Werewolf Arena

- (Bailis, Friedhoff, and Chen 2024)
- Discuss the framework, how it works, prompts, etc
- Discuss what types of runs we did
- Discuss the data included in output
- Talk about how we had to annotate the LLM speech with persuasion strategies ourselves

Analysis

- Formatted data to match, performed various comparisons

Results

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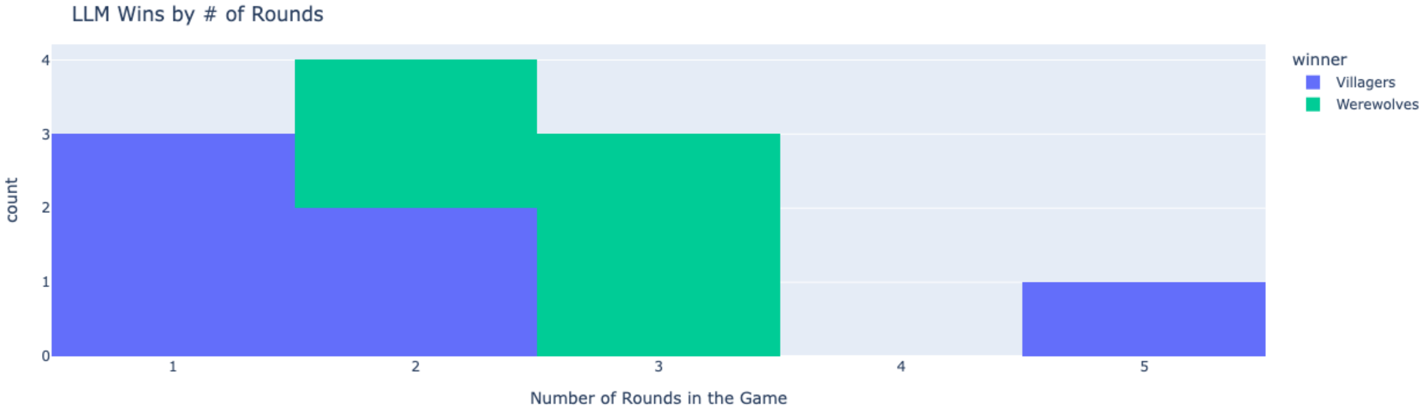
(a) The LLM wins, by how many rounds that partiticular game had.



(b)

Figure 1

Source: Werewolf Among Us: Human vs LLM Analysis

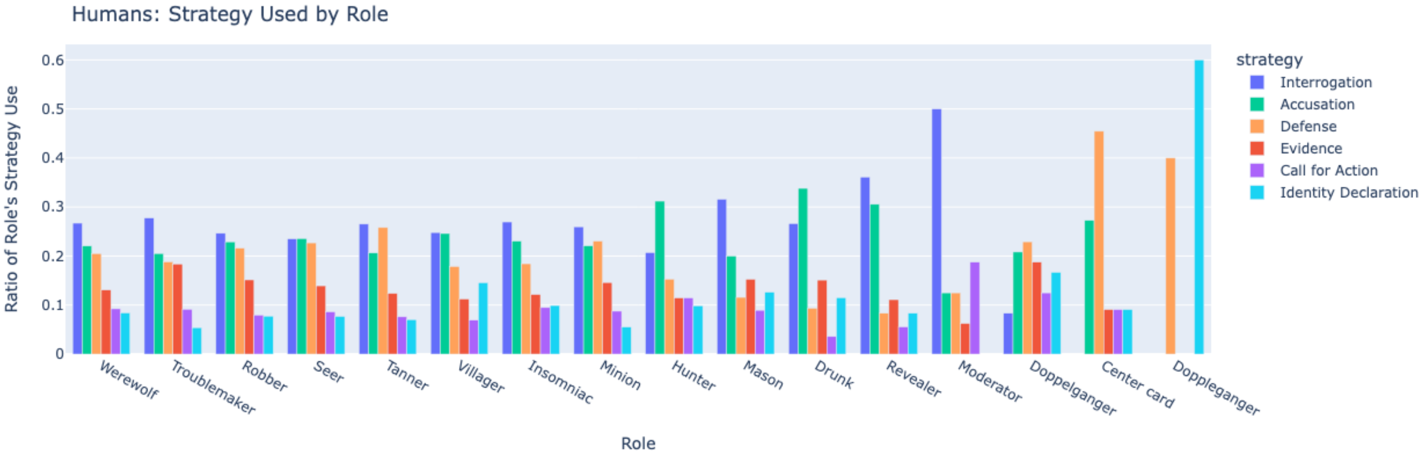


Figure 2

Source: Werewolf Among Us: Human vs LLM Analysis

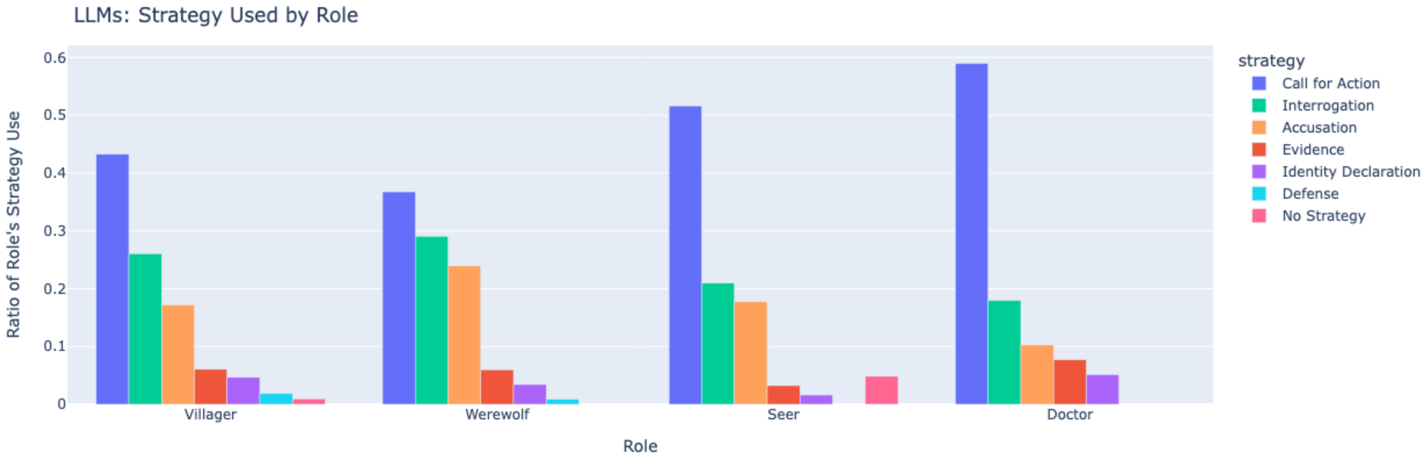


Figure 3

Source: Werewolf Among Us: Human vs LLM Analysis

Discussion and Conclusion

Interpret findings, discuss limitations, and propose future work.

Limitations

Future Work

Summary

Summarize contributions and insights from the project.

References

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Project Contributions

Bhavana Jonnalagadda:

- Paper framework (Quarto) setup
- Github repo management
- EDA on LLM dataset
- Final comparison EDA and results analysis
- Results section
- Discussion and Conclusion section
- Abstract

Riley Jones:

- EDA on human dataset
- Werewolf Arena LLM simulation running and data aquisition
- Introduction section
- Methods section