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

Bhavana Jonnalagadda Riley Jones

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Abstract TODO

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# Introduction

- A description of the problem and its significance
- How do LLMs function in a multi-agent environment?
  - Each has limited information
  - Approximately the same ability, traits, skills
- We use LLMs to simulate whether synthetic agents can participate in complex, adversarial group dynamics
- Werewolf is a good candiate for testing multi agent systems of cooperation and secrecy
  - Need citation
  - The game tests adaptive reasoning, strategic alignment, and collective threat detection under special conditions

## 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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Unable to display output for mime type(s): text/html
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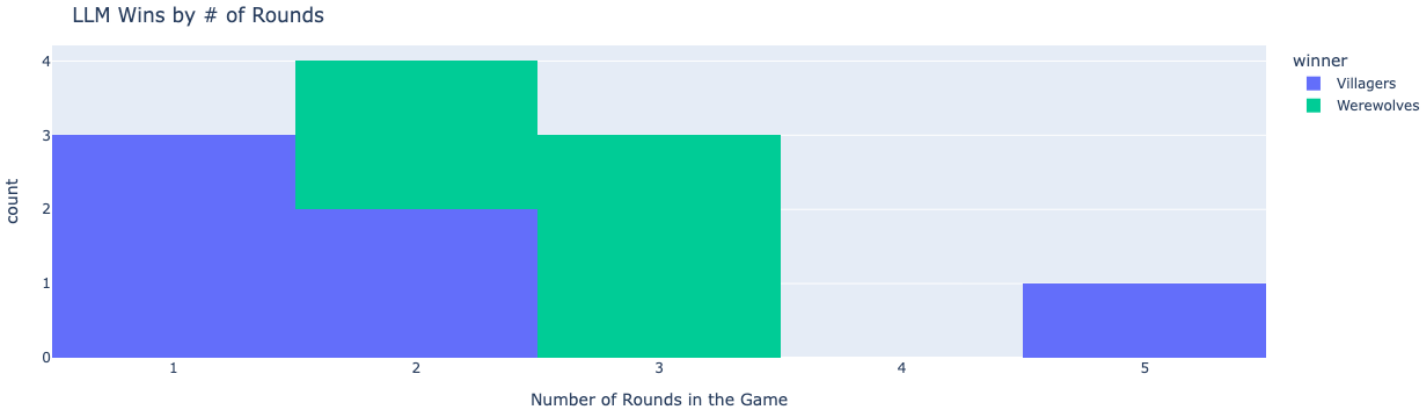
(a) The LLM wins, by how many rounds that partiticular game had.




(b)

Figure 1

Source: Werewolf Among Us: Human vs LLM Analysis

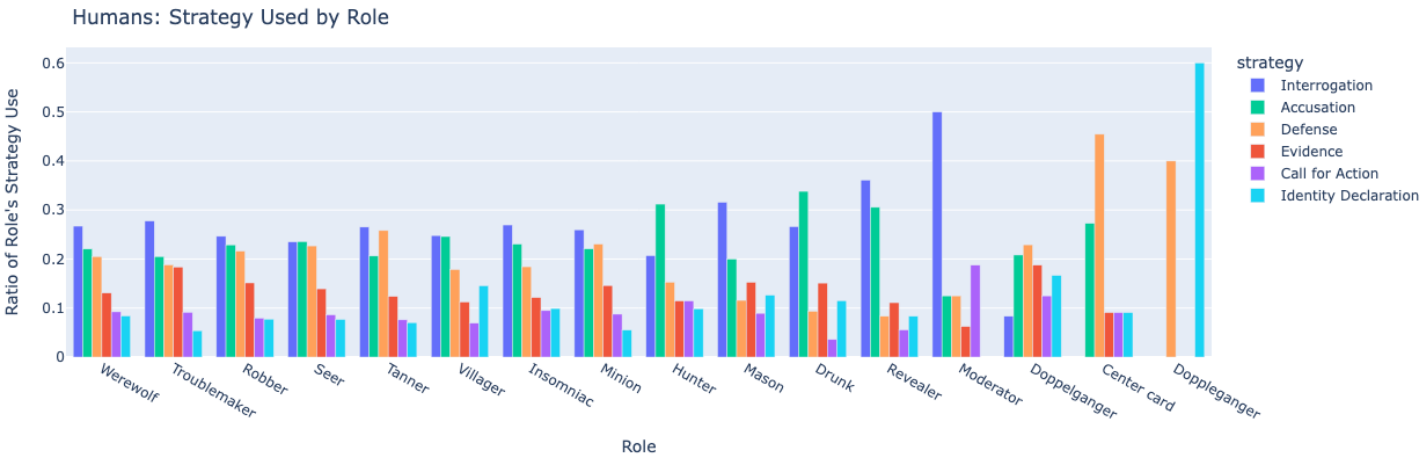



Figure 2

Source: Werewolf Among Us: Human vs LLM Analysis

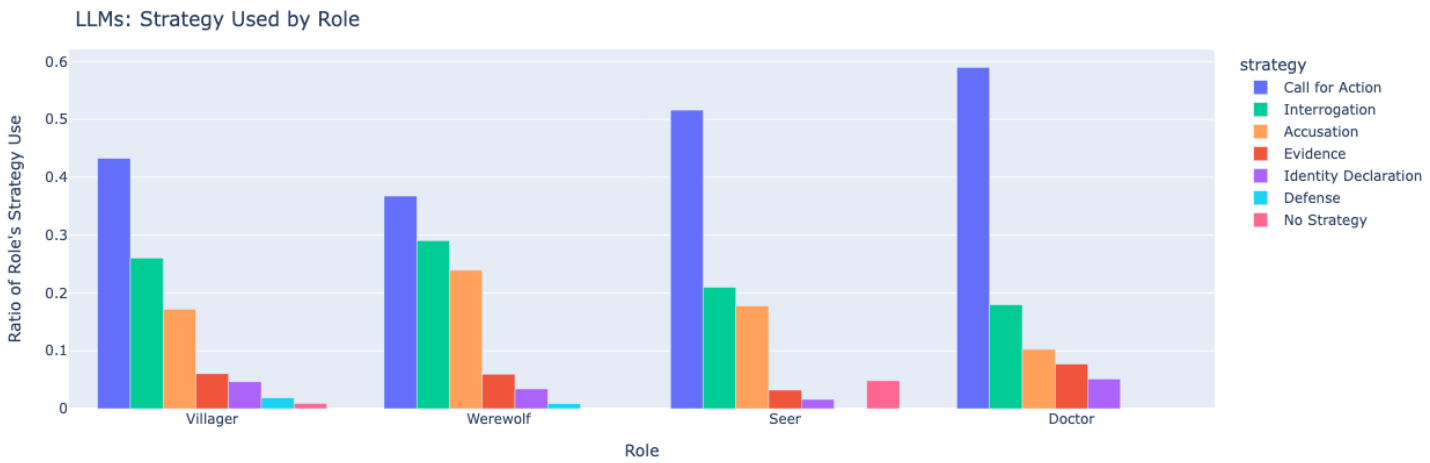



Figure 3

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.

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# 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