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Artificial Intelligence

Laboratory activity

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Contents

1 Introduction....3
2 Werewolf game....3
3 Project Scenario....3
4 Simulation Settings....4
5 Player Conditions....4
6 Player Statements....5
7 Results....5
8 Conclusion....5

1 Introduction

The purpose of this project is to identify the possible roles of all the players in a werewolf game after the first night using MACE4, the logic behind the project is similar to the The Lady or the Tiger puzzle.

2 Werewolf Game explained

Werewolf game is a social deduction game played by 5 to 15 players, divided into two opposing teams: the Villagers and the Werewolves. Each player is secretly assigned a role, which can be a member of the Villager Team (e.g., Villager,Cop, or Doctor) or the Werewolf Team (Werewolf). The game alternates between two phases: day and night. During the day, players discuss and vote to eliminate a player, suspecting them to be a werewolf, while the Werewolves secretly eliminate a player each night.

Roles:

- ***Villagers*** *are regular players with no special abilities, and their goal is to help identify and eliminate the Werewolves through voting during the day.*
- ***Cop*** *(a member of the Villager Team) has the ability to investigate another player each night to determine if they are a Werewolf. The Cop's role is crucial for the Villager Team, as they can reveal a Werewolf's identity, providing valuable information for the group's discussions and votes.*
- ***Doctor*** *(also on the Villager Team) has the ability to protect one player each night, preventing them from being eliminated by the Werewolves. The Doctor can choose to protect the same player multiple nights or different players based on their suspicions.*
- ***Werewolf*** *is the antagonist role. Each night, the Werewolf secretly chooses one player to eliminate. The goal of the Werewolf is to survive and reduce the Villager Team's numbers until they are equal to or fewer than the number of Werewolves*

3 Project Scenario

In our scenario we have 6 players (2 villagers, 2 werewolves, 1 cop and 1 doctor), and the first night has passed with nobody dying, meaning the doctor has helped the same person chosen by the werewolves. We should consider are the claims of the villagers to see wat are there possible roles, we know that the werewolf lay while the others say the truth:

- Players P1,P4,P5 say they are villagers
- Player P2 says they are the cop and P1 is a werewolf
- Player P3 says they are the doctor and that they helped P1
- Player P6 says they are the cop and P5 is a not werewolf

4 Simulation Settings

Commands that tell the MACE4 in which condition to generate the simulation

- ***assign(max_models, -1)*** *: This sets the maximum number of models (possible game configurations or scenarios) that the solver should consider to -1, which typically means there is no upper limit. In MACE 4, this is a way of saying "try to find all models that satisfy the conditions."*
- ***assign(domain_size, 4):*** *This sets the domain size to 4. In this context, the domain refers to the number of different roles or players that can exist in the game. By setting the domain size to 4, you are likely limiting the number of roles or states that can exist within the model (in this case, 4 distinct roles: Villager, Cop, Doctor, and Werewolf). This means that each player in the game will have one of these four roles.*

5 Players Condition

In the werewolf game each player can have one of the 4 roles (werewolf, villager, cop or doctor), code example for P1:

werewolf(P1) | villager(P1) | cop(P1) | doctor(P1)

No Player can have more than 4 roles, code example for P1

- werewolf(P1) | - villager(P1)
- werewolf(P1) | - cop(P1)
- werewolf(P1) | - doctor(P1)
- villager(P1) | - cop(P1)
- villager(P1) | - doctor(P1)
- cop(P1) | - doctor(P1)

There can only be 2 werewolf, code example for P1 and P2, we need the same statement for each pair

(werewolf(P1) & werewolf(P2) & -werewolf(P3) & -werewolf(P4) & -werewolf(P5) & -werewolf(P6)) |

There can only be 1 cop and 1 doctor, example of code

(cop(P1) & -cop(P2) & -cop(P3) & -cop(P4) & -cop(P5) & -cop(P6)) |

(doctor(P1) & -doctor(P2) & -doctor(P3) & -doctor(P4) & -doctor(P5) & -doctor(P6)) |

Those are the conditions set before the game begins, and are the rules of the game.

6 Player Statements

The statement of a player can be weather true if they are a villager, cop or doctor or false if they are a werewolf

1. Player X claims they are a villager:

   -cop(PX)

   -doctor(PX)

   If they made this claim they can either be a villager if telling the truth or a werewolf if lying, eliminating the options of cop and doctor

2. Player P2 claims they are the cop and P1 is a werewolf

   cop(P2)->werewolf(P1).

   -cop(P2)->werewolf(P2).

   -werewolf(P1)->werewolf(P2).

   If they are a cop they are telling the truth meaning P1 is a werewolf, if P1 is not a werewolf means they are lying making them the werewolf

3. Player P3 says they are the doctor and that they helped P1

   doctor(P3)->-werewolf(P1).

   -doctor(P3)->werewolf(P3).

   -werewolf(P1)->doctor(P3).

   If the player is a doctor means that the person they helped is the one the werewolf tried to kill, so P1 is not a werewolf, if P1 is anyway a werewolf P3 was lying

4. Player P6 says they are the cop and P5 is a not werewolf

   cop(P6)->-werewolf(P5).

   -cop(P6)->werewolf(P6).

   werewolf(P5)->werewolf(P6).

   If the are a cop they are telling the truth meaning P5 is not a werewolf, if P5 is a werewolf means that P6 is also one

7 Results

MACE4 gives out the next results

- **Player 1**: villager
- **Player 2**: werewolf
- **Player 3:** doctor
- **Player 4:** werewolf
- **Player 5:** villager
- **Player 6**: cop

We see that we find ourselves in a case with only one solution, if the statements given by the players were different there could have been more coses.

8 Conclusion

In conclusion, the application of MACE4 to the Werewolf game scenario with the given roles and statements led to a successful identification of the roles of all players after the first night. By leveraging logical assumptions and the statements made by the players, we were able to deduce the roles of the six players, confirming the only valid configuration.

These logic can be apply to others scenarios the logic behind the statement of a player being the same

Bibliography

[1] https://publications.anl.gov/anlpubs/2003/10/48084.pdf
[2] https://playwerewolf.co/pages/character-roles
[3]https://github.com/APGroza/logic-games