An experimental analysis of whispers' effect in Werewolf BBS by relational association rules

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Outline

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3, Purpose

4, Data

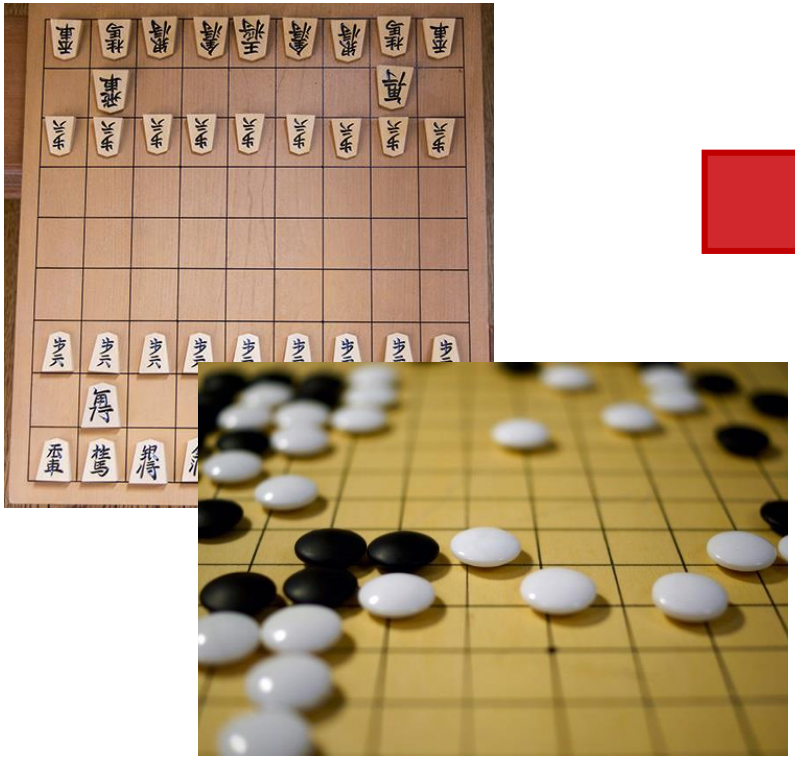
- werewolf BBS
- protocol
- predicate
- dataset

5, Result

6, Conclusion and Future work

Introduction

Complete information game



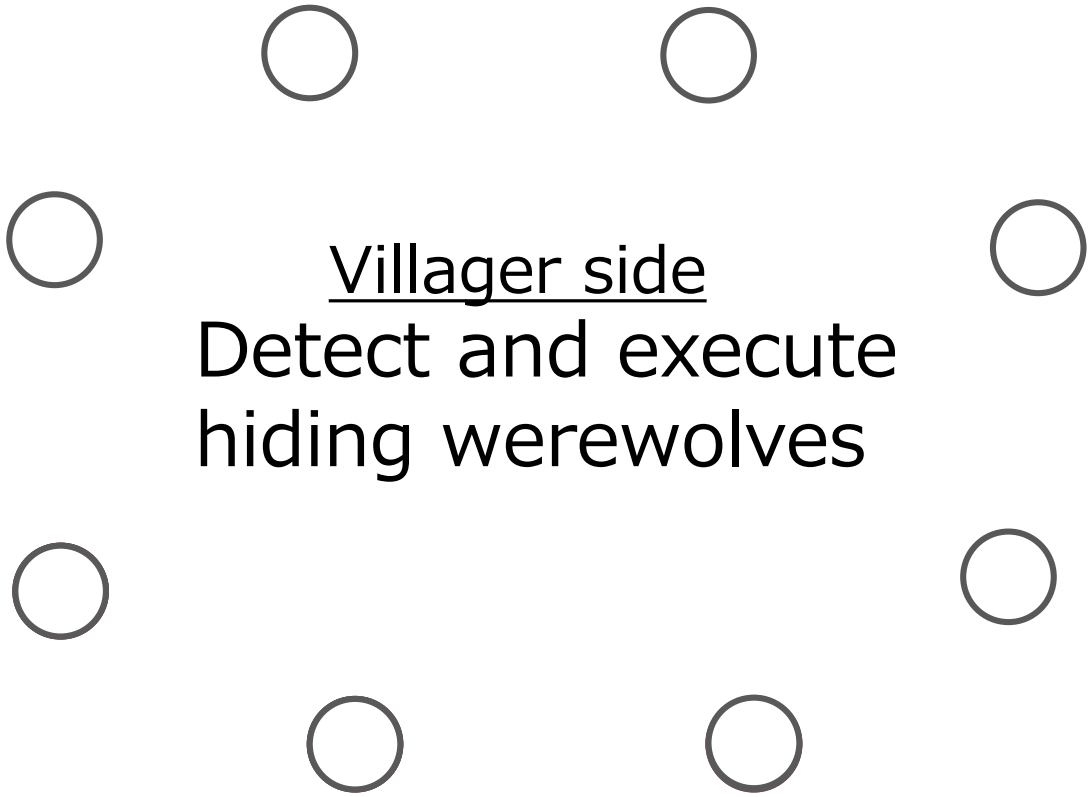
Shogi, Go

Incomplete information game

Werewolf game

Werewolf game

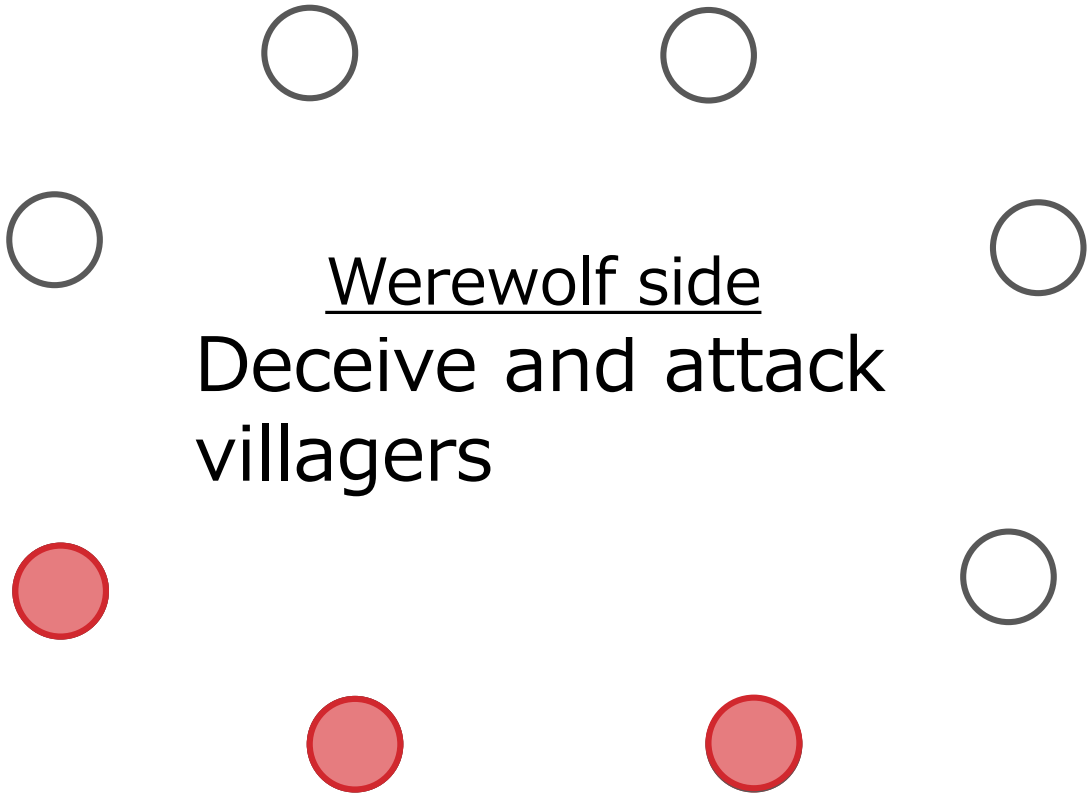
Werewolf game



villager side player

werewolf side player

Werewolf game



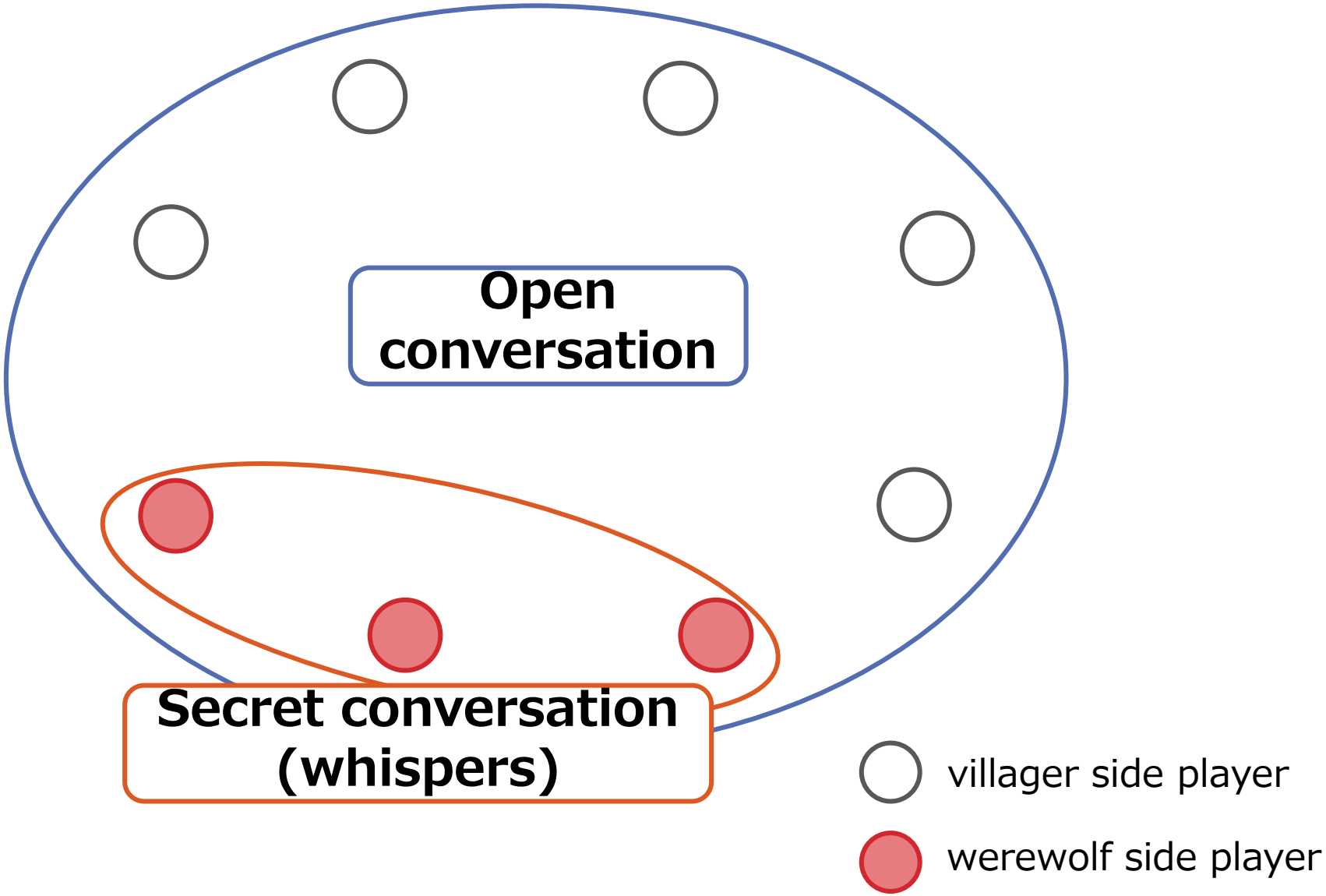
Werewolf side

Deceive and attack villagers

villager side player

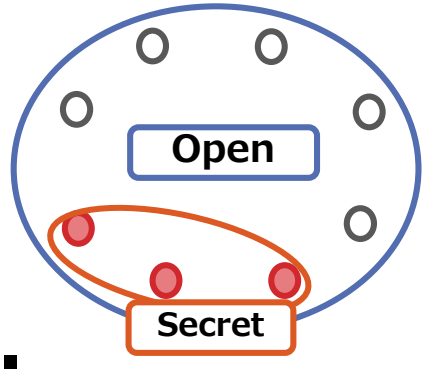
werewolf side player

Asymmetric information



Purpose

Try to capture a characteristic relationship between contents in the secret conversation and in open conversation



Method

Extract relational association rules.

fact_pred() :- open_pred1(), secret_pred2(), …

Head predicate : fact of real action or event

Body predicate : contents in open conversation
and at least in secret conversation

Werewolf BBS

- Online BBS website.
- Participate can play text-based werewolf game.
- Get many game logs.
- The same rules in original werewolf game with a few exception.

Ex)
- sudden death
- the number of mention restriction

Werewolf BBS：http://wolfg.x0.com/index.rb

Four types of utterances

Log	Description
White log (open)	All player can read and mention
Red log (secret)	Werewolf player can read and mention
Gray log	Exiled player can read and mention
Blue log	Monologue

Use **white log** and **red log** for analysis.

Protocol

White log

- comingout
- question
- answer
- estimate
- agree
- disagree
- vote
- request_divined
- inquested
- divined
- guarded

:

14 actions

Red log

- question
- answer
- estimate
- agree
- disagree
- adviced
- want_eat
- want_vote
- deceived
- disrelation

:

13 actions

Predicate

White log	w_question(Game:Day, Player, Player2). w_request_divine(Game:Day, Player, Player2).

Red log	r_question(Game:Day, Player, Player2). r_decieve(Game:Day, Player, Role).

Ex) r_question(A:1, wolf1, wolf2).

```
Pred(Game:Day, N, Player, Args…) :- Prev_days(N),
                                    Pday is Day-N,
                                    Pred(Game:Day, Player, Args…).
```

Dataset

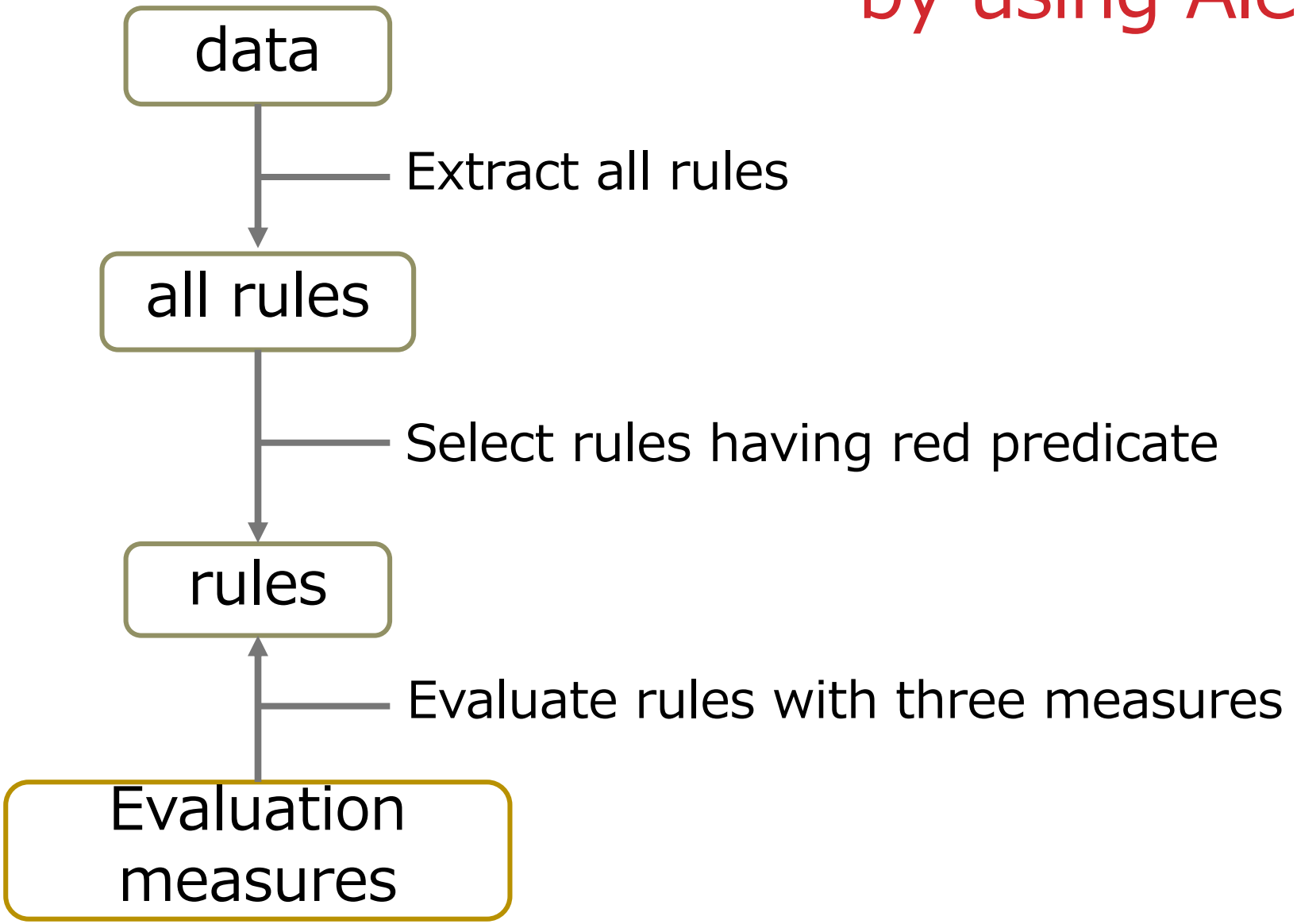
- Select 6 game logs

detail : Werewolf side won 3 games of 6 games and lost the rest.
Each game has twelve villager side players,
three werewolf side players,
no-sudden death and at least deceiving werewolf.

- Focus on 3 actions in the head predicate

1, attacked (27 cases)
2, executed (39 cases)
3, mislead_by_werewolf (53 cases)

Extract relational association rule by using Aleph



Three rule evaluation measures

- **support** : Joint probability
- **confidence** : Conditional probability
- **diff = P(Head|Body) – P(Head)**

  P(Head|Body) : the confidence value

  P(Head) : all possible instantiation of head predicate considering alive players and their roles

  diff>0 : the predicate has positive effect

Result

Head predicate	**The number of extracted rules**
attacked	4702
executed	3048
mislead_by_werewolf	3094

Result

Rates of diff

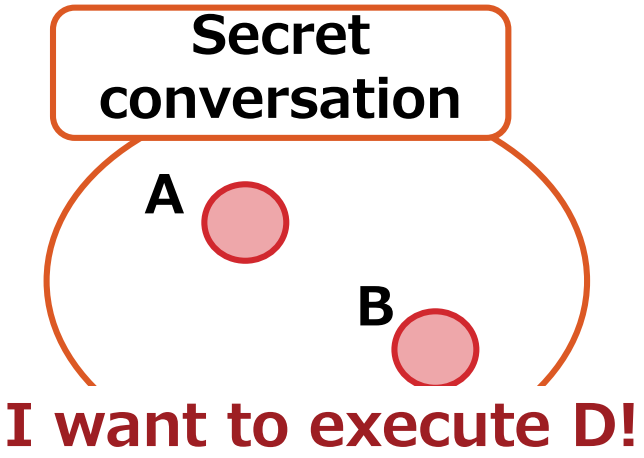
diff = P(Head|Body) – P(Head)

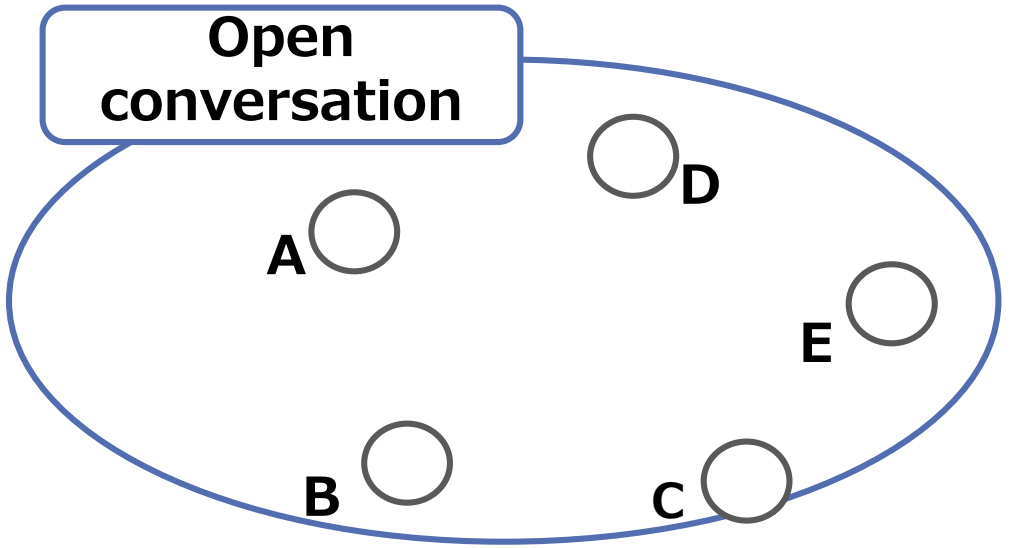
Predicate	attacked	executed	mislead_by_werewolf
r_question	0.97	0.94	0.61
r_answer	0.82	0.95	0.43
r_adviced	0.85	0.95	0.88
r_estimate	0.72	0.71	0.50
r_agree	-	1.00	-
r_want_eat	0.79	0.86	0.25
r_want_vote	0.81	0.62	0.77
r_disrelation	-	1.00	-
r_deceive	-	1.00	-

Result

- Most of the red predicates have **positive effect**.

- **werewolf prompts other players to vote a target player**
  by saying he/she is a werewolf in the open conversation.





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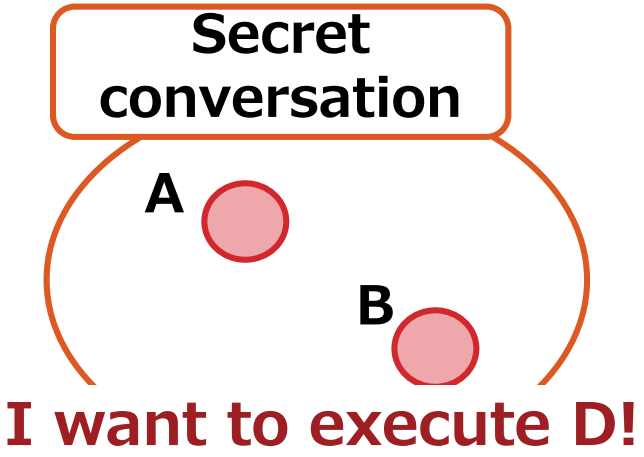

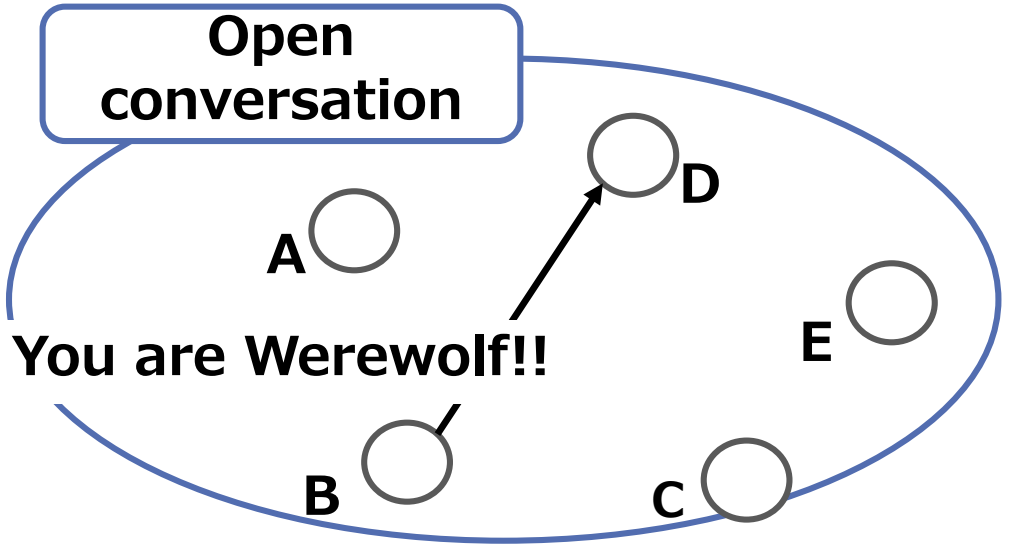

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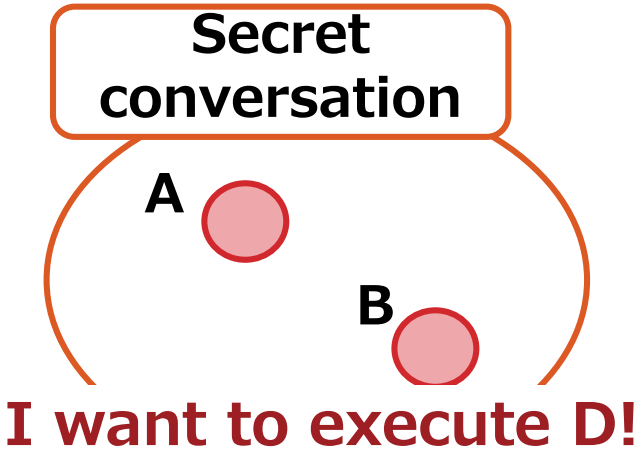
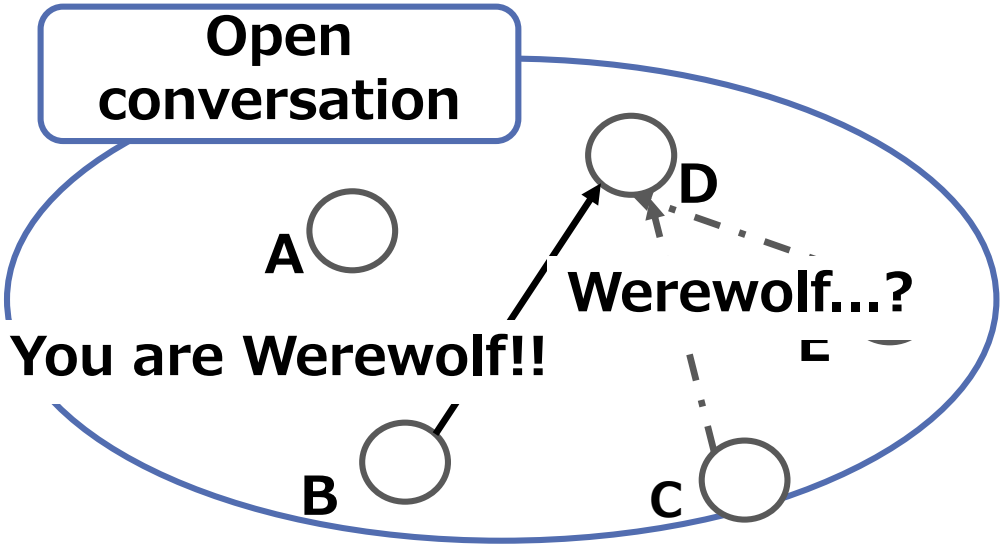
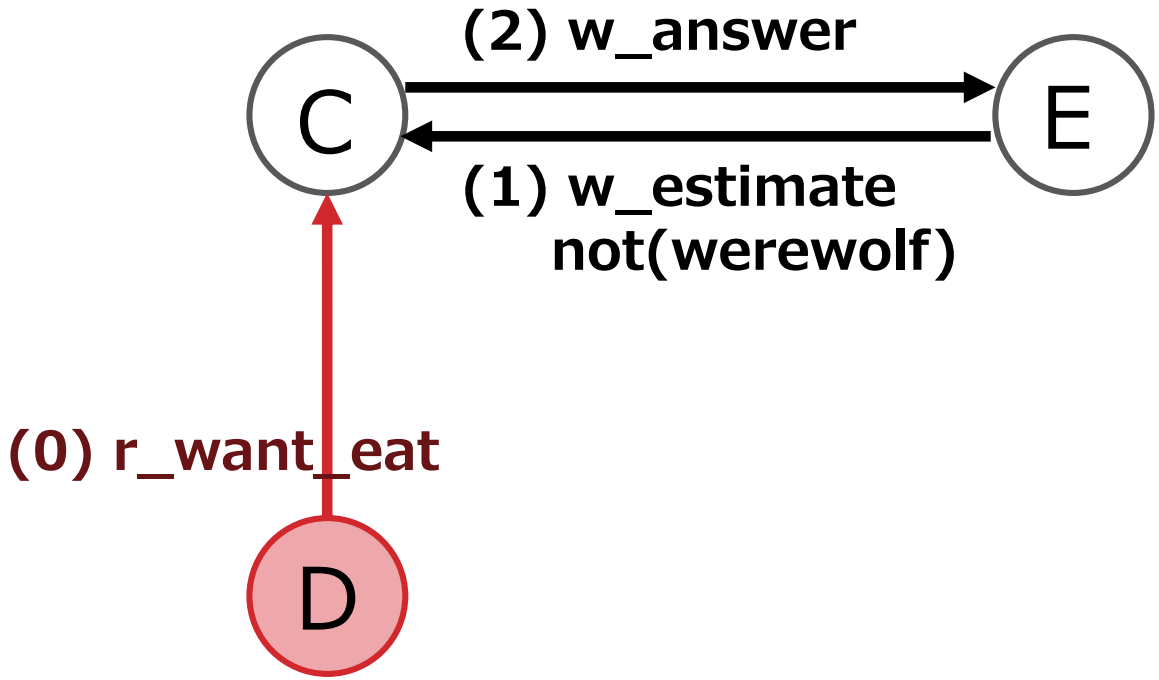




Result

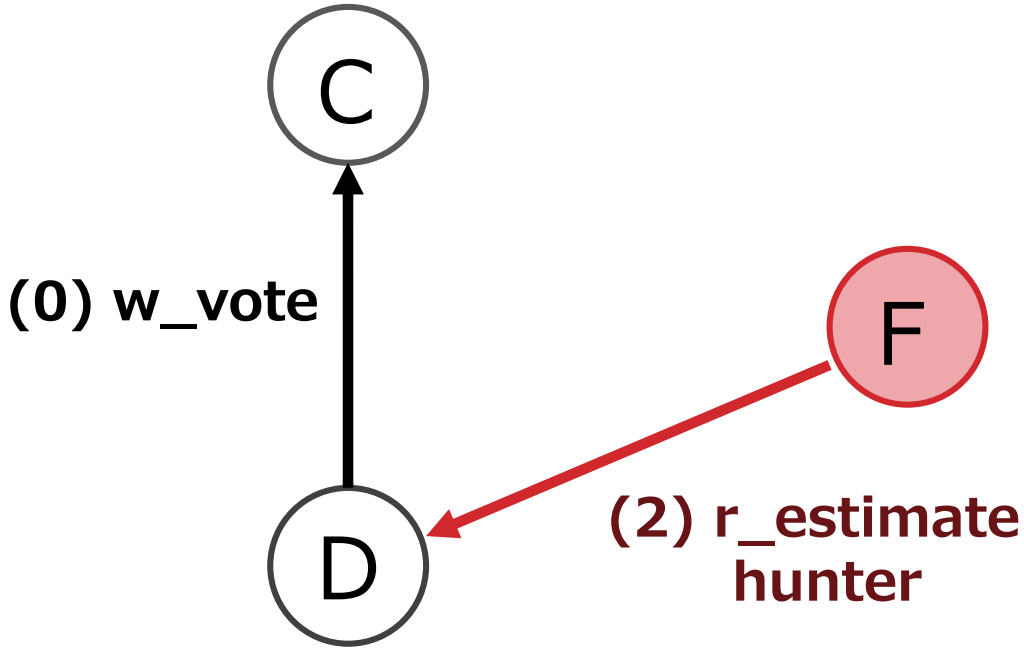
1, attacked



attacked(Game:Day, C) :- r_want_eat(Game:Day, 0, D, C),
w_answer(Game:Day, 2, C, E),
w_estimate(Game:Day, 1, C, E, not(werewolf)).

Result

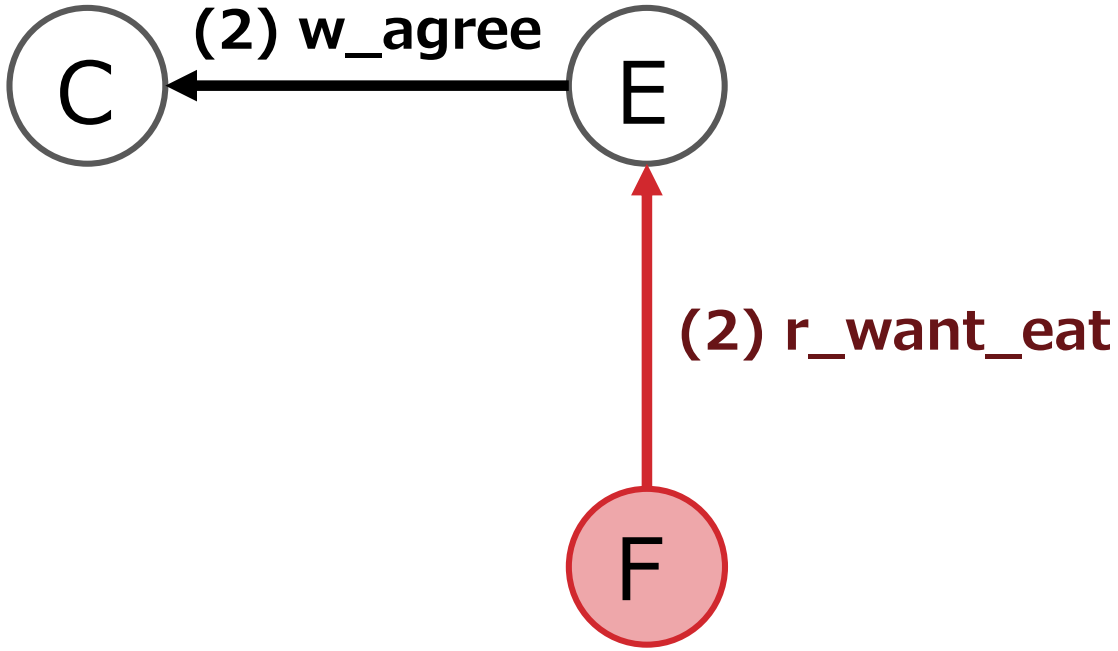
2, executed




```
executed( Game:Day, C ) :-
                        w_vote( Game:Day, 0, D, C ),
                        r_estimate( Game:Day, 2, F, D, hunter ).
```

Result

3, mislead_by_werewolf




```
mislead_by_werewolf( Game:Day, C ) :-
                        w_agree( Game:Day, 2, E, C),
                        r_want_eat( Game:Day, 2, F, E ).
```

Conclusion

- Extract relational association rules
  between secret conversation and real action.

Future work

- Precise evaluation of extracted rules
- Extract condensed representations
  of relational association rules, and evaluate them
- Investigate propensity score matching
  for relational data