AIWolfDial 2023: Summary of Natural Language Division of 5th International AIWolf Contest

INLG 2023 genChal @ Prague

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(AIWolf project organizers in alphabetical order)

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One calm, quiet night

- This is a story about a small, sleepy village.
- Werewolves have arrived, who can change into humans and eat them.
- During the day, the werewolves have the same form as humans, at night they attack the villagers, one by one.
- Fear, uncertainty, and doubt towards the werewolves begin to grow.
- The villagers decide that they must execute those who are suspected of being werewolves, one by one...

The cover story of Are You a Werewolf?

Are You a Werewolf?

- “Are you a Werewolf?” is a party game that models a conflict between an informed minority and an uninformed majority
  - Initially, each player is secretly assigned a role affiliated with one of these two teams: Werewolf and Villager
- There are two phases: night and day
  - At night, the werewolves “attack” the villagers
  - During the day, surviving players (of both teams) discuss the elimination of a werewolf-suspect by voting
  - i.e. talk -> vote -> attack -> … until either team remains
- The teams have different objectives:
  - Villagers (Humans): To ascertain who the werewolves are, and kill them by votes
  - Werewolves: To kill off all the villagers without being killed themselves

What is “AIWolf”?

- A project to create AI agents that can play Werewolf (aka Mafia)
- Ability of Werewolf agents:
  - Negotiate, Convince, Plan, Lie...
- Key characteristics:
  - Social game
  - Imperfect information Game
  - Cooperative, Multi player
  - Rules Light / Ability to manipulate social capital
- One of the most challenging task in text generation/dialog system
  - Also a new frontier on Game AI and HCI

Challenge of AIWolf Contests

- Need to estimate knowledge and intentions of other agents
- And everything through dialogue only
  - Human-played games can be face-to-face
- As an evaluation of dialog systems
  - AI werewolf requires to deeply understand conversation to be a game
  - By evaluating links between dialog-game rather than win/lose
  - Any conversation available in games but should be game oriented, thus both task-oriented and non-task-oriented
- We can reveal current achievements and limitations of the generative AIs!
- We have been holding our annual open shared task contests for years...

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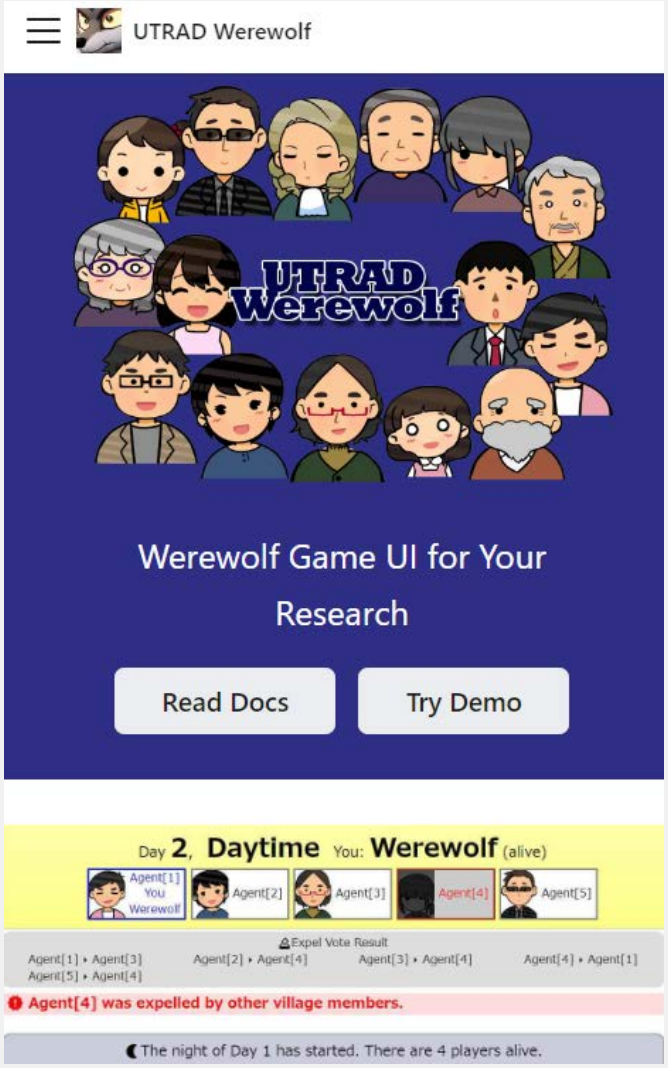
Three AIWolf Tasks (Divisions)

- Infrastructure Task
  - Submission of useful tools for the competition
- Protocol Task
  - Agents communicate using a fixed protocol; Evaluation by winning rate
- Natural Language Task (main report)
  - Agents communicate freely; Evaluation of communication quality by Judge panel
- Details in the following slides...

Infrastructure Division

This year's entries

- aiwolf-python by AIWolfSharp
  Python package for creating AIWolf agent.
- AIWolf Analyze by aiwolf team-ioh
  Web app for analyzing AIWolf game logs.
- UTRAD Werewolf by smikitky
  Web UI for the Werewolf game.
  - The Best Contribution Award
    voted by participants and organizers



Protocol Division

- Agents communicate via the AIWolf Protocol manually designed by the organizers
  - e.g. COMINGOUT Agent[03] SEER
- Evaluated on winning rate in 5- and 15-player games
- Top 15 from 33 teams selected in qualifying round
  - 2023-07-22/08-04, 244,000 games/team)
- Team pronto was the 1st in final round (summary table below)
  - 2023-08-19/09-01, 360,000 games/team)
  - The winning agent's tactic is not to take others' inappropriate statements seriously, and at the same time make inappropriate statements that mislead others.

Rank	Team	Winnig Rate	Programming Language
1	pronto	63.8%	Java
2	gotsumori	58.2%	Java
3	ddhb	57.1%	Python
4	ioh	56.5%	Java
5	TOT	53.5%	C#

Rank	Team	Winnig Rate	Programming Language
6	cash	52.9%	Python
7	Lunatic	51.4%	Python
8	mikami	49.4%	Java
9	Howls03	49.1%	Java
10	Howls	48.5%	Java
10	MayQueen	48.5%	Java

Natural Language Division

- Communicate via text only (English or Japanese)
  - except for game actions such as vote, attack, divine
- Participant systems played games automatically
  - 5 players (seer + werewolf + possessed + 2 villagers)
  - Self-matches and mutual-matches, each a couple of games
    - Thank Neo Watanabe and Kaito Kagaminuma for hosting games!
- Subjective evaluation performed on the game logs, by human evaluators (organizers), 5 levels for each item below
  - A. **Naturalness**: Did the sentences feel natural?
  - B. **Contextualitly**: Did the sentences feel appropriate to the context, and not a canned answer that can be applied to anything?
  - C. **Consistency in texts**: Did the sentences feel consistent with each other?
  - D. **Consistency with game actions**: Were the game actions (votes, attacks, etc) consistent with the sentences of this agent?
  - E. **Diversity**: Were the sentences interesting? Did the agent feel like having a rich personality?

Game log example by agents

#	Talk	Interpretaion
02	I will call myself a fortune teller. Agent[04] was a human	CO as another seer, divination result to Agent[04] to be a human
01	Agent[02], I am the true fortune teller. Avoid misunderstandings. We should find a werewolf.	Insists that he/she is the true seer
04	>>Agent[02] I see, you guessed that I was human. thank you. But even so, I'm surprised that two fortune tellers came out! Which result should I believe in? What do you guys think?	Consistent response to the divination result of Agent[04]
02	Agent[01] and Agent[02] are said to be fortune tellers, but if there are other fortune tellers among you, please let me know	It is correct that Agent[01] and [02] came out as seers, but [02] is this speaker itself so irrelevant

- # for agent ids. Please refer to our paper for details!

Teams in AIWolf NL 2023

- **5 teams in Japanese, 2 (3) teams in English**
  - **held in June, details in next slide**
- **am** (JP) Mikio Abe, and Akihiro Mikami @ Yamagata University discussion/power play awarded
- **ChatWolf** (JP) Hisaichi Shibata, Soichiro Miki, Yuta Nakamura @ University of Tokyo Hospital
- **HowlGPT** (EN)
- **k2b ara** (JP) Takuya Okubo, Kazuki Takashima, Tomoya Hatanaka, Mami Uchida, Rei Ito @ University of Tokyo character awarded
- **k2b shigemura** (JP) Soga Shigemura, Tomoki Fukuda, Masahiro Wakutani @ Unversity of Tokyo persuation awarded
- **kanolab** (JP/EN) Neo Watanabe, Kaito Kagaminuma, Yoshinobu Kano @ Shizuoka University
- **MIV** (EN) Jaewon Lee and Benedek Hauer @ University of Tokyo
- **sUper_IL** (JP) Zhiyang Qi @ University of Electro-Communications 1st ranked

Results of Subjective Evaluation

- A-E criterion in five levels (as mentioned)
  - Four Japanese organizers for JA
  - Three English fluent staffs for EN
- sUper_IL was the 1st team in total (average)

Team	L	Base Method	Ave.	A	B	C	D	E
am	JA	Rule-based	3.22	3.40	3.35	3.45	**3.80**	2.10
ChatWolf	JA	Original LLM	2.98	3.05	2.40	2.60	2.70	**4.15**
k2b_ara	JA	ChatGPT	3.53	4.07	3.82	3.25	3.07	3.42
k2b_shigemura	JA	ChatGPT	3.35	3.62	3.25	3.12	3.37	3.37
kanolab	JA	ChatGPT	3.77	3.57	3.90	3.75	3.50	**4.15**
sUper_IL	JA	ChatGPT	**4.01**	**4.45**	**4.20**	**4.05**	3.55	3.80
HowlGPT	EN	Various LLMs	2.46	2.66	1.66	2.66	2.00	**3.33**
MIV	EN	ChatGPT	**3.20**	**3.33**	**3.66**	**3.00**	**2.66**	2.33
kanolab	EN	ChatGPT	2.86	3.33	2.66	**3.00**	2.66	2.66

Analysis of Evaluation Results

- ChatGPT (GPT-4) showed good basic performance in sentence generations
  - but differs depending on the prompt and settings
  - Japanese<->English switch was easy by adding an instruction in prompt
- Issues using Generative AIs
  - LLMs other than ChatGPT better in diversity (E)
  - rule-based system was better in consistency with game actions (D)
  - we cannot ask ChatGPT to “tell a lie” directly
  - still difficult to hold “different personalities”
    - i.e. liar and real, other agent thinks me as a liar who would think another agent as a villager and ...
    - exceeds the number of combinations that generative AI could learn?

Summary: Challenging Evaluation for Dialog Systems

- GPT-based LLMs (e.g. ChatGPT) can generate very fluent sentences
  - cannot tell whether automatic generation or not in most cases
  - long context can be coherent, though not perfect
  - now it's time to leap this AIWolf project!
- Shared background knowledge? Deeper Semantics?
  - Coherency with predefined settings and contexts are sometimes broken
  - Contradictory responses suggest that there might be no underlying logic
  - "Aggregations" of LLM instances can solve these issues?
- "Mafia" requires players to carefully understand conversations
  - Evaluations of AIWolf is based on semantic links between game actions and dialogues, rather than just victory/defeat
  - AIWolf contest can reveal the capabilities and limitations of generative AIs

Join in the AIWolf contest 2024!

Questions and Discussions

 # Interactive demo play
with a human (you)
planned in the next poster session

Hamamatsu City, Shizuoka

Self Introduction: Yoshinobu Kano

- Associate Professor (PI) at Faculty of Informatics, Shizuoka University
  - Phd at University of Tokyo (superviser: Prof. Tsujii)
  - JST PRESTO
- Human-like NLP system
  - Spoken language, speech-text integrated parser
  - White-box approach not just end-to-end ML
  - Psychological plausibility
  - Dialog system as an ultimate goal including all human intellectual processing
- Applications on the way of the goal above
  - Question answering, sentence generation, examination solver, legal/medical document processing, automatic diagnosis
- Details at http://kanolab.net/kano/index.en.html

Research Topics

- Human-like NLP/Sentence Generation/Dialog System
  - Sentence generation by psychologically plausible NLP model (MEXT)
  - AI werewolf ("Mafia" game agent) dialog system
  - Ad copy generation (with Dentsu co.)
  - News headline generation (with Chunichi newspapers)
- Medical NLP/Spoken Language
  - Mental disease diagnosis by NLP from conversation and SNS (JST CREST)
  - Developmental disorder (ASD) diagnosis in ADOS by NLP (JST CREST)
  - Side-effect extraction from EHRs
- Text mining for scientific literature in neuroscience (JST CREST)
- Legal NLP/Question Answering
  - Legal Bar Exam Solver in COLIEE (MEXT Kakenhi S)
  - Automatic court judgement
  - Todai Robot to solve university entrance exams
- Public opinion inference and intervention/Political NLP (SECOM, Kakenhi)
  - Prediction and intervention of deceptions in SNS, news articles, perlimament records