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研究課題名(和文) Measuring Group Interaction in Online Discussions and Application to Autonomous Agent Deliberation

研究課題名(英文) Measuring Group Interaction in Online Discussions and Application to Autonomous Agent Deliberation

研究代表者

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研究成果の概要(和文)：The achievements involve the discovery of interaction patterns in group discussions involving humans and agents. These findings were disseminated in journals (Scientific Reports, Social Network Analysis and Mining), and conferences, workshops, and tutorials (AAMAS, PRICAI, JSAI, IEEE ICA, etc.).

研究成果の学術的意義や社会的意義

The research leads to agents that can assist humans in addressing social problems. E.g., the study in "Scientific Reports", demonstrated that AI can enhance the social presence of women. Another application is the "Computational Social Choice Competition", which advances the research on democracy.

研究成果の概要(英文)：The research achievements involve the discovery various interaction patterns in group discussions involving both humans and agents. These findings have been disseminated through international journals (E.g., Scientific Reports, Social Network Analysis and Mining), as well as national and international conferences, workshops, and tutorials (E.g., AAMAS, PRICAI, JSAI, IEEE ICA, etc.). One significant achievement includes the development of an evaluation method published in the journal Social Network Analysis and Mining. The PI explored whether the structural complexity of online discussions could predict consensus. This method combines metrics from well-known readability tests with an entropy-based complexity metric applied to the tree structures of Reddit discussions. The findings indicate that the proposed metric effectively predicts consensus readability based solely on the complexity of discourse structure. These achievements are now being extended in other ongoing projects.

研究分野：Artificial intelligence

キーワード：Agents Conversational AI Decision-making Interaction Deliberation Similarity Metrics Online Discussion Entropy Methods

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1. 研究開始当初の背景 **Background of the study**

The project combines ideas from Natural Language Processing (NLP), agent-based development, information theory, and social sciences, to quantify group interactions in online discussions. The role of group interaction in collective intelligence was investigated in the past but the link to natural language and problem solving remains missing. To elucidate this link, we will apply information measures to natural language and study the interaction in groups composed of humans and/or artificial agents engaged in online discussions [2,6]. The implications of the study are both theoretical and practical. The practical implications are particularly important for society, and could improve collective decision-making.

2. 研究の目的 **Research Objectives**

The main research objective is to measure group interaction in online discussions, identify the interactions that lead to better deliberations, and use these insights to build artificial agents that could interact optimally with humans to ensure multifaceted and productive deliberations. This core objective is divided to two objectives:

Objective 1: Building measures of interaction between humans engaging in online discussions using information theoretic measures such as mutual information.

Objective 2: Testing the measures in online discussions involving humans and artificial agents with the goal of improving the capabilities of the agents in online deliberation.

The research objectives seek to understand how interactions within heterogeneous groups lead to enhanced problem-solving capabilities, a feat no current AI has fully accomplished. Thus, the outcomes of the research will have a novel, broad and important implications for AI, social sciences, and policy-making.

3. 研究の方法 **Research Methods**

For *objective 1*, the interaction measures will be defined to take as input a hierarchy of discussion posts or threads. The measure of interaction is mainly inspired from the “integrated information” theory and quantifies how humans and agents influence each other and contribute to discussions and optimal deliberation. For *objective 2*, we will develop artificial agents with various behaviors and interaction capabilities. They will then be tested in discussions with humans, measure the interactions, and assess the quality of the discussions. We will deploy the agents in an agent-based platform for online discussions developed by the Co-I [2]. We will observe the impact of agent-enabled interactions on the discussion quality by studying the interplay between interaction and quality, and then devising algorithms that improve the discussions [5].

4. 研究成果 **Research Results**

The central research results of this project revolve around the discovery and evaluation of various interaction patterns in group discussions involving humans and intelligent agents. These findings have been disseminated through international journals [1-2], as well as national and international conferences, workshops, and tutorials (E.g., AAMAS, PRICAI, JSAI, IEEE ICA, etc.) [3,7-11]. One significant result includes the development of an evaluation method published in the journal “Social Network Analysis and Mining” [1]. The PI explored whether the structural complexity of online discussions could predict consensus. This method combines metrics from well-known readability tests with an entropy-based complexity metric applied to the tree structures of Reddit discussions. The findings indicate that the proposed metric effectively predicts consensus based solely on the complexity of discourse structure. These achievements are now being extended in other ongoing projects in relation to collective decision-making [3]. Another key result is designing and implementing new metrics to quantify the interactions between multiple stakeholders working on producing textual content. The developed metrics were tested on the collaborative editing

activities of volunteer editors of the Wikipedia platform [5].

More practical and socially impactful results consist in the implementation of intelligent conversational agents that can assist humans in addressing various social problems (E.g., SDGs). For instance, one notable study, published in "Scientific Reports", demonstrated that intelligent agents can enhance the online presence of women in conservative and male-dominated environments, such as Afghanistan [2]. That is, this research investigated the integration of intelligent conversational agents into online debates among Afghans discussing the fall of Kabul in August 2021. The findings revealed that AI leads to quantitative differences in how genders contribute to the debate by raising issues, presenting ideas, and articulating arguments. This enabling character of intelligent agents highlights their potential to empower individuals and increase their agency on online platforms. Finally, a more recent and impactful social application of the research is the establishment of the "Computational Social Choice Competition" in 2023 and 2024, which continues to advance the research on democratic AI-powered platforms [3,4].

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〔産業財産権〕

〔その他〕

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6. 研究組織

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7. 科研費を使用して開催した国際研究集会

〔国際研究集会〕 計0件

8. 本研究に関連して実施した国際共同研究の実施状況

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