日本―米国　国際共同研究 **新型コロナウイルス感染症（COVID-19）により求められる** **新たな生活態様に資するデジタルサイエンス** 2021 年度　年次報告書	
研究課題名（和文）	新型コロナウイルス・パンデミック・総合災害管理向けのマルチモーダルデータの統合解析
研究課題名（英文）	Multimodal Data Analytics and Integration for Effective COVID-19, Pandemics and Compound Disaster Response and Management
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１．日本側の研究実施体制

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２．日本側研究チームの研究目標及び計画概要

As a worldwide emergency response to COVID-19, governments have taken various measures and implemented policies, such as self-quarantine, travel restrictions, work from home, and regional lockdown, to control the rapid spread of this epidemic. These countermeasures' common intention is to restrict human mobility because COVID-19 is a highly contagious disease that is spread by human-to-human transmission. We will evaluate the effects of human restriction policies with the aid of big data and information technology, and periodically provide the results to Japan's Cabinet Office (CAO) and Tokyo Metropolitan Government (TMG) for decision-making and feedback gathering. Moreover, we will collaborate with US team to achieve the following goals: (1) Detecting communities in crisis via

social media data; (2) Detecting communities in crisis via mobility data; (3) Integral multimodal data analysis for in-crisis community detection; (4) Develop an automated tool to identify the causes and demands of communities in crisis.

3. 日本側研究チームの実施概要

Since 2019, the world has been seriously impacted by the global pandemic, COVID-19, with millions of people adversely affected. This is coupled with a trend in which the intensity and frequency of natural disasters such as hurricanes, wildfires, and earthquakes have increased over the past decades. Larger and more diverse communities have been negatively influenced by these disasters and they might encounter crises socially and/or economically, further exacerbated when the natural disasters and pandemics co-occurred. However, conventional disaster response and management rely on human surveys and case studies to identify these in-crisis communities and their problems, which might not be effective and efficient due to the scale of the impacted population. In this work, we propose to utilize the data-driven techniques and recent advances in artificial intelligence to automate the in-crisis community identification and improve its scalability and efficiency. Thus, immediate assistance to the in-crisis communities can be provided by society and timely disaster response and management can be achieved. A novel framework of the in-crisis community identification has been presented, which can be divided into three subtasks: (1) community detection, (2) in-crisis status detection, and (3) community demand and problem identification. Furthermore, the open issues and challenges toward automated in-crisis community identification are discussed to motivate future research and innovations in the area. The corresponding research achievement was published in IEEE CIC 2021.

Besides in-crisis community detection, we also explore how to integrate mobility and social media for compound disaster response. Human flow under big disasters such as hurricanes and pandemics deviates from its daily routine to a large extent, which makes the task more challenging. Existing works mainly focus on traffic or crowd flow prediction on normal situations. To tackle this problem, in this study, disaster-related Twitter data are incorporated as a covariate to understand the public awareness and attention about the disaster events and thus perceive their impacts on the human flow. Accordingly, we propose a Meta-knowledge-Memorizable Spatio-Temporal Network (MemeSTN), which leverages memory network and meta-learning to fuse social media and human flow data. Two large-scale nationwide multimodal datasets are developed with multi-month observations of tweet count and human flow volume in 2019 Pacific Typhoon Season and COVID-19 pandemic. Intensive experiments have been conducted and shown the superior performance of our proposed model over the state-of-the-arts. The corresponding research achievement was submitted to ICDE 2023.