Thesis Project Portfolio

AI Agency in Information Retrieval: Advancing Data Access Through Natural Language Interfaces

(Technical Report)

Enhancing Global Accessibility and Information Flow: Bridging Language Divides with Natural Language Processing and Deep Learning

(STS Research Paper)

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Sociotechnical Synthesis

Introduction

This Executive Summary provides a comprehensive synthesis of the STS research paper "Enhancing Global Accessibility and Information Flow" and the development of the Capstone project of implementing a Natural Language Processing Agent into the Floodwatch platform. Both initiatives are joined by their common goal to enhance accessibility in disaster management through innovative technological solutions and sociotechnical approaches. While each project employs distinct methodologies and pursues unique objectives, they collectively aim to revolutionize the delivery and usability of flood-related data across diverse global populations. This synthesis not only outlines the specific features and aims of each project but also delves into the profound insights gained from managing these complementary studies concurrently. By doing so, it highlights the synergistic potential of integrating technological advancements with sociotechnical theories to address critical issues in disaster management effectively.

Capstone Project

The Capstone project, Floodwatch, is a technical feature that integrates Natural Language Processing (NLP),Machine Learning (ML), and the novel concept of Artificial Intelligence agency to improve interactions with flood prediction systems. By leveraging a multilingual Large Language Model (LLM), such as GPT-4, the project enables dynamic, user-friendly interactions across multiple languages. This NLP integration facilitates access to real-time environmental data and predictive modeling, making flood forecasts, and other relevant weather information accessible and comprehensible to a broad audience. The core innovation of this feature on Floodwatch lies in its ability to process data in real-time and interact seamlessly in the user's native language, enhancing the system's responsiveness and utility. The Floodwatch project is a

National Science Foundation sponsored global project and has collaborators in Vietnam, Germany, and France, which has prompted the need for cross-language capabilities on this platform. Key features include an AI-driven interface that supports multilingual communication, allowing for effective data display and interaction with predictive models, which significantly enhances the accessibility and user experience of flood-related data.

STS Research Paper

The STS research paper explores the sociotechnical implications of applying NLP and ML in disaster management, particularly focusing on the challenges and opportunities of making emergency communication systems accessible across linguistic and cultural boundaries. It examines how traditional emergency management systems often exclude non-English speakers and individuals who require simplified data presentations, emphasizing the necessity for inclusive technologies that cater to diverse global needs. With one of the biggest barriers in advancement being access to information, the push to make data and user interfaces by default multi-lingual highlights the potential created by AI. The paper advocates for a paradigm shift towards integrating multilingual capabilities within disaster management technologies. By doing so, it aims to democratize access to vital information, ensuring that all members of the global community, regardless of language proficiency or cultural background, can make informed decisions during crises.

Reflection

Engaging concurrently in the Capstone project and the STS research paper offered insights into the intersection of technology and social needs, especially within the realm of disaster response. This experience highlighted the critical role of sociotechnical perspectives in technology development, where the societal impacts of technological innovations are as

significant as their technical achievements. The work on these projects showed the benefits of a holistic approach that considers both the potential and the limitations of technology in societal applications. It emphasized the importance of designing technologies that are not only effective but also equitable and accessible to all segments of society.

While the thought of an AI agent was initially inspiring from a technical standpoint, the in-depth research into the sociotechnical studies side of the project revealed far-reaching implications beyond mere technological achievement. Exploring this perspective highlighted how the integration of an AI agent in disaster management could serve as a crucial tool for breaking down barriers to information access. By seamlessly translating and contextualizing flood-related data across languages and cultures, the AI technology promotes a more inclusive approach. This not only democratizes access to critical information during emergencies but also ensures that such data is understandable and actionable for people with diverse linguistic and cultural backgrounds. This exploration also shed light on the social responsibilities of technological innovators to design and deploy AI systems that uphold ethical standards and contribute positively to societal equity. Through this dual lens of technological innovation and social impact, the project underscores the transformative potential of AI in creating systems that are not just efficient but also accessible to all.

Working on both projects highlighted the transformative potential of NLP and ML to not only advance technical capabilities in flood prediction and management but also to enhance the effectiveness of these systems on a global scale. The integration of sociotechnical insights with technical innovations in Floodwatch provides a compelling example of how engineering can serve broader social purposes, promoting a more informed, prepared, and resilient global community in the face of natural disasters.