Executive Summary / Sociotechnical Synthesis

Introduction

My technical work and STS research, while not directly linked, both address critical challenges in modern healthcare systems. The capstone project focuses on developing explainable AI techniques for enhanced chest X-ray analysis, aiming to improve diagnostic accuracy and clinician trust in AI systems. Meanwhile, my STS research explores the sociotechnical roots of inefficiency in prior authorization processes. Both projects are motivated by a common goal: to enhance healthcare delivery by addressing technological and systemic barriers that impact patient care and outcomes.

Summary of Capstone Project

This capstone project aims to develop explainable AI (XAI) methodologies for chest X-ray (CXR) analysis, addressing the challenge of AI opacity in medical imaging. This AI model is dubbed Odyssey. The project implements three main XAI techniques: saliency methods, natural language explanations, and language model-based radiology report generation. Saliency methods use gradient and perturbation-based techniques to highlight critical features in CXR images, while natural language explanations generate intuitive descriptions of AI decision processes. A large language model is utilized to automatically generate structured radiology reports. By combining these approaches, Odyssey provides unprecedented multimodal explainability in AI-driven CXR analysis. The project utilizes datasets like MIMIC-NLE and MIMIC-CXR-JPG, implements various AI models and techniques, and aims to improve diagnostic accuracy while enhancing clinician trust in AI systems. Diagnostic performance will be evaluated using metrics such as accuracy, sensitivity, and specificity, while explanation quality will be assessed through comprehensibility and relevance. The ultimate goal is to support broader implementation and

acceptance of AI in clinical settings, potentially leading to improved patient outcomes and paving the way for seamless collaboration between AI and healthcare professionals.

Summary of STS Research

This STS research examines the sociotechnical roots of inefficiency in prior authorization (PA), exploring the question: How do organizational tensions, misaligned incentives, and technological inadequacies between healthcare providers and payers contribute to an ineffective PA system, and what strategies could foster greater trust, collaboration, and efficiency? The study applies two complementary frameworks, technological determinism and actor-network theory (ANT), to analyze the complex system of human and non-human actors in the healthcare landscape. Through a mixed methods approach of documentary research and discourse analysis, the study aims to identify key insights and patterns in how PA processes are experienced by different stakeholders. The findings include insights into how outdated technologies and conflicting organizational goals create barriers to efficient PA processes, as well as the impact of these inefficiencies on patient care and healthcare costs. Additionally, the research proposes strategies for fostering greater trust and collaboration between parties as well as promoting efficiency in PA systems. These strategies include implementing automated PA systems, establishing accountability measures for insurers, and improving provider education on PA requirements. The significance of this study comes from its potential to improve policy reforms that are integral to PA, therefore improving patient outcomes while balancing cost control measures. The findings also contribute to broader talks of complete healthcare system reform and the role of technology in addressing the sociotechnical challenges in healthcare administration.

Concluding Reflection

Working on both projects simultaneously has provided me with a comprehensive understanding of the nuanced challenges in the current healthcare system. The technical project highlighted the potential of AI to aid medical diagnosis, while the STS research uncovered the complex sociotechnical factors that can delay healthcare delivery. This twofold perspective applies both technological advancements and systemic issues when addressing healthcare challenges.

The Odyssey project deepened my understanding of AI's potential in medical imaging, but also made me acutely aware of the trust issues surrounding AI in healthcare. This awareness directly informed my STS research, helping me appreciate the complexity of introducing new technologies into established healthcare processes like prior authorization.

Conversely, my STS research on prior authorization inefficiencies provided valuable insights into the organizational and human factors that can impact technology adoption in healthcare. This understanding will be crucial in the future development and implementation of AI systems like Odyssey, ensuring that they are designed with consideration for the complex sociotechnical environment of healthcare.

By engaging with both technical product development and sociotechnical system analysis, I've gained a more holistic view of healthcare improvement. I've learned that effective solutions must not only be technically sound but also considerate of the social, organizational, and human factors at play. This coupled approach has better prepared me to contribute meaningfully to healthcare advancements, armed with both technical expertise and a nuanced understanding of the healthcare ecosystem.