Thesis Portfolio

Developing a Comprehensive Meal Detection Algorithm and Meal Content Analysis for Patients with Type I Diabetes Using Continuous Glucose Monitoring Data

(Technical Report)

Integration of Algorithms in Healthcare: How Artificial Intelligence and Machine Learning May Restructure the Patient-Physician Relationship

(STS Research Paper)

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Saurav Pandey
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Sociotechnical Synthesis

Type I diabetes (T1D) results in a state of insulin deficiency due to the autologous destruction of pancreatic β-cells. The inability to properly release insulin subsequently results in elevated glucose concentrations (GC) in the bloodstream, damaging the body and causing systemic symptoms and complications. In order for T1D-afflicted patients to maintain proper blood glucose levels, professional help in the form of clinicians and endocrinologists is often recommended. However, without an accurate meal record, these professionals cannot provide effective treatment options that T1D patients desperately need. Unfortunately, patient-provided meal records are often missing meals, indicating a need for a system capable of retrospectively reconstructing patient meal records. To this effect, we are developing a robust meal record reconstruction system that details both time of meal occurrence and analyzes meal content based solely on continuous glucose monitoring (CGM) data. Further fine tuning these algorithms and analysis on improved approaches will hopefully pave the way for development of a real-time system that seamlessly identifies a meal occurrence and type, reducing the flaws seen in current Artificial Pancreas (AP) systems.

Computational approaches such as this technical project are increasingly becoming the norm in the medical field, inevitably leading us to question the role and societal impacts of complex AI-driven technologies. Specifically, the sociotechnical component of this study is most interested in understanding the effects of technological advancements such as machine learning (ML) and artificial intelligence (AI) in reshaping patient-physician relationships. An encouraging patient-physician bond is essential in promoting healing, and careful analysis into understanding how newer technologies play a part in this complex network is of critical importance. The rapid integration of health-based technologies can be best understood in context of soft technological determinism. Despite significant advancements being achieved within the AI and ML field, I

contend that strict political regulations and lack of societal acceptance hinders the extent to which this technology will impact patient-physician relations. There are diverse positions among stakeholders regarding AI and ML technology within healthcare. Therefore, discourse analysis is the most effective methodology in analyzing the impacts of current medical technologies on the patient-physician relationships. A review of newspaper articles, books, magazines, and peer-reviewed journals, alongside interviewing healthcare-based individuals will serve as essential sources for gathering evidence, enabling me to gain perspective on how the most impacted stakeholders view the advent of AI. The various responses and positions provided across different platforms will be differentiated based on key arguments and the themes that emerge from those claims. In context of AI technology, I would anticipate both positive and negative remarks from the assorted groups. Claims that range from AI irrevocably replacing physicians to those that are highly wary of the AI technology and privacy concerns will be carefully weighed. Findings from these analyses will undoubtedly provide a profound understanding of the sociotechnical consequences that arise as a result of these technologies. Although novel methods such as meal detection tools may serve as a beacon of hope to sufferers of diabetes, the integration of more advanced techniques such as AI-powered health products may prove to be far more sinister, lodging itself directly between the patient and the physician.