ADAPTIVE MOBILE SENSING: LEVERAGING MACHINE LEARNING FOR EFFICIENT HUMAN BEHAVIOR MODELING

EXAMINING DATA PRIVACY REGULATION TO PROTECT PERSONAL HEALTH RECORDS

An Undergraduate Thesis Portfolio
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SOCIOTECHNICAL SYNTHESIS

Advancement in the mobile health market presents patients new opportunities to leverage technology to monitor their own health. In the technical research, the Capstone team studied methods of sampling mobile sensing data from smartphones in conjunction with ongoing research to develop a mobile health application that can passively monitor and predict user health status. The STS research paper investigated the implementation of additional data privacy policy in response to increasing concerns about the protection of health information in electronic Personal Health Record systems not covered by the current data privacy regulations in the United States. The technical and STS research papers both investigate the use of advanced technology in the health industry. The two topics are loosely coupled because the technical research focuses on the collection of mobile sensing data to predict user health, while the STS research focuses on the security of patient data in electronic Personal Health Record systems.

The technical team investigated multiple data sampling methods to determine which one most efficiently collected mobile sensing data capable of identifying user context. To do this, the team used a mobile crowdsensing application to collect data from smartphone sensors in three sensing strategies that differed in their sampling frequencies. The strategies also administered surveys to serve as ground truth data for context information such as user activity, user location, physical state, and phone position. The team created context models from the data collected in each strategy to understand the utility of the data.

The Capstone team found that the dynamic adaptive sensing strategy was the most efficient method of data collection. The dynamic adaptive sensing strategy had the best balance of reducing battery consumption while maintaining data quality by smartly turning the smartphone sensors on and off based on the phone's use. Additionally, the data collected in the dynamic

adaptive sensing strategy generated better performing context models than the data collected in the other sensing strategies. The dynamic adaptive sensing strategy will be implemented for future development of the mobile health application.

Electronic Personal Health Record systems provide patients the ability to manage their own health on personal computers or smartphones. However, some private companies creating these platforms are not under the Health Insurance Portability and Accountability Act, leaving sensitive information unprotected from being shared or misused. The gap in regulation led to researching how the United States can protect sensitive health information in these platforms. The STS research identified gaps in regulation using government articles outlining the current health data privacy regulation, news articles exposing misuse of health information in these platforms, and employing Actor Network Theory to determine the relevant actors and actants involved in the development of the platforms. Additionally, a global review of data privacy regulations served to compare current regulations in countries around the world.

The research concluded that the European Union's General Data Protection Regulation is the most comprehensive data privacy policy upholding the necessary standards to protect personal health information. These standards include important features such as a minimum standard, informed consent, documentation, and rules for sharing data. Implementation of a data privacy regulation the United States modeled after the European Union's General Data Protection Regulation would establish appropriate protection of personal health data not protected under the Health Insurance Portability and Accountability Act, allowing patients to reap the benefits of an electronic Personal Health Record system without compromising their privacy.

Implementation of technology in the health industry has the potential to significantly improve patient health outcomes. However, there are still developments that need to be made in the

technical and privacy aspects for this technology to be widely accepted. Once these advancements are made, patients will be able to safely and efficiently monitor their health from their personal devices.

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