

Project Title:

Deep Learning in Digital Medicine: An Automatic Assessment System for Identifying and Managing Challenging Patients

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Project Abstract/Proposal Summary:

The rise of digital medicine heralds a paradigm shift in healthcare, powered by machine learning, offering transformative capabilities for enhancing patient care and optimizing clinical workflows. Specifically, machine learning can offer promising solutions by informing and improving clinical pathways, better utilizing resources, and reducing costs. Leveraging advancements in technology and data analytics, machine learning can enable the early identification of troublesome patients, supports tailored care strategies, and optimizes resource allocation. However, the complexity of doctor-patient interactions, inconsistent data collection, and the limitations of current assessment tools pose significant challenges.

To address these issues, we propose a comprehensive framework to develop a robust automated patient assessment system by leveraging structured data collection mechanisms, linguistically informed preprocessing, and cutting-edge multimodal large language models. Therefore, the project includes three parts.

First, by leveraging a dataset of over 1.1 million doctor-patient dialogues and 4 million utterances across 172 diseases and 29 specialties from Shanghai Ninth People's Hospital, we aim to create comprehensive data collection mechanisms for patient assessment in structured and standardized physician-patient labs.

Second, our data preprocessing approach leverages linguistic expertise alongside advanced techniques like Convolutional Neural Networks (CNN, Mel Frequency Cepstrum Coefficients (MFCC), and Word2Vec to accurately extract and integrate complex multimodal interaction data.

Third, the core of the assessment system is driven by a Transformer-based multimodal large language model that integrates diverse data streams, automates quantification using advanced classifiers with Dynamic Time Warping and Wasserstein Distance algorithms, and ultimately delivers precise patient assessments and actionable insights for clinical decision-making.

Through interdisciplinary collaboration across computational research, linguistics, and frontline medicine, this project establishes a benchmark for AI-driven patient care, offering a scalable solution to enhance healthcare delivery, optimize resource allocation, and improve patient outcomes.