06 Multimodal Type-2 Diabetes Risk Prediction Using Graph Neural Networks

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과제 개요

Background

- Type 2 Diabetes (T2D) affects over 415 million people globally, with ~193 million undiagnosed cases
- Early detection and risk prediction are crucial for prevention and intervention strategies
- Traditional unimodal approaches limit comprehensive understanding of patient health conditions
- Existing multimodal datasets often lack proper patient-level linkage, leading to invalid predictions

Project Objectives

- Develop a multimodal T2D risk prediction web application for accessible clinical use
- Create user-friendly web interface for real-time risk assessment with clinical interpretability
- Address critical dataset linkage issues in multimodal healthcare prediction

시스템 개요

Data Sources

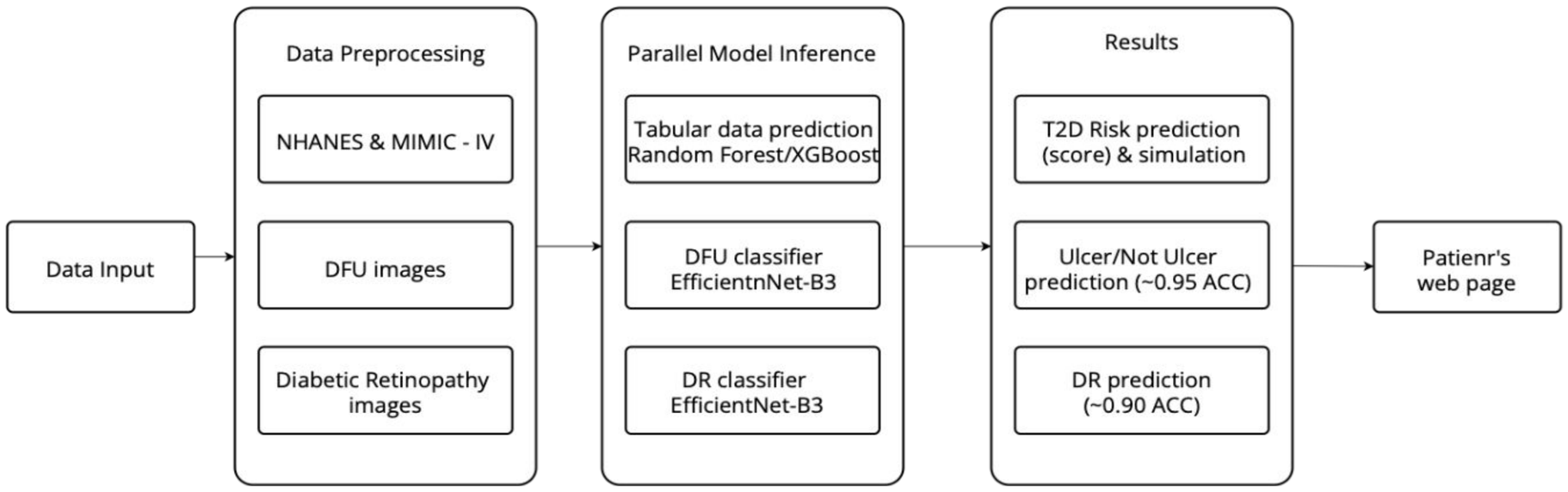
- MIMIC-IV: Clinical database with EHR, lab results, medications (proper patient linkage)
- NHANES: Population survey data with demographics and lifestyle factors
- Medical Imaging: Diabetic foot ulcer and retinopathy datasets for complication assessment

Model Framework

- RandomForest: Ensemble learning for feature importance analysis
- XGBoost: Gradient boosting optimized for clinical tabular data
- EfficientNet: CNN architecture for medical image processing
- Ensemble Methods: Model combination for optimal prediction accuracy

Web Application

- Interactive interface for healthcare providers to input patient data and upload images
- Real-time risk prediction with confidence intervals and feature explanations
- Clinical decision support with personalized intervention recommendations



기대 효과

Clinical Applications

- Early identification of high-risk T2D patients enables preventive interventions before symptom onset, potentially reducing disease progression and healthcare costs through timely medical intervention.

Technical Contributions

- First multimodal T2D prediction system using graph neural networks with scientifically valid patient-level data linkage addresses critical methodological flaws in existing approaches and provides scalable framework for other chronic diseases.