Clinical Decision support system for diagnosis of Heart Diseases

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Introduction

- The rapid economic transformation leading to environmental changes and unhealthy lifestyles are increasing the risk factors and incidence of cardiovascular disease, leading to death.
- The limited access to health facilities, lack of expert cardiologists, and lack of regular health check-up trends make CVD major causes of mortality in low-resource settings.

Purpose

- AI-based computer-aided heart disease diagnosis decision support system has been proposed using clinical data, patient information, and electrocardiogram (ECG) data.

Methods

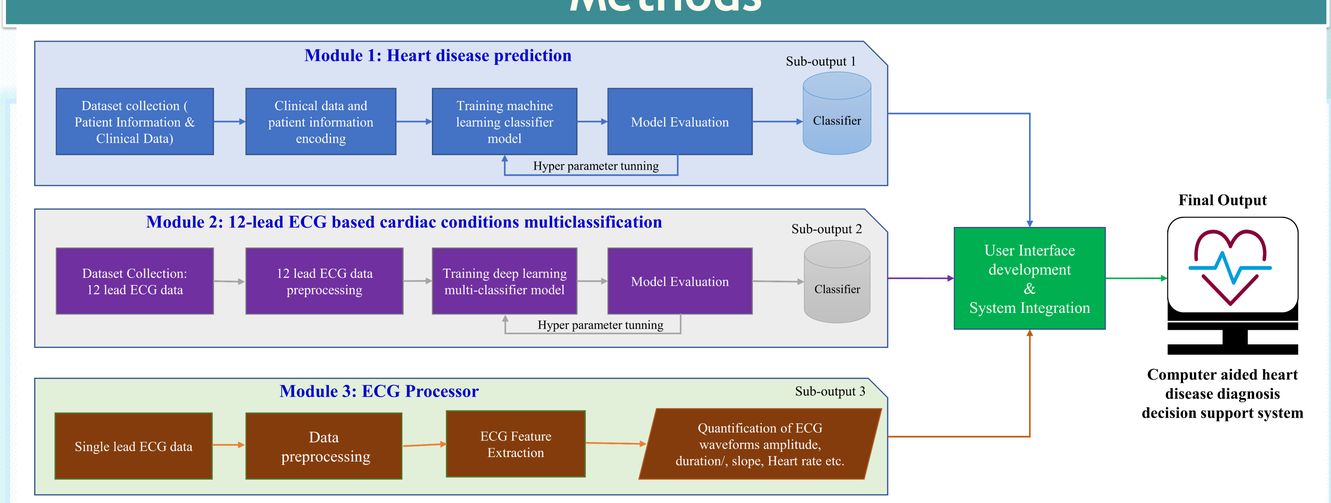

Figure 1: Summary of the proposed computer aided heart disease diagnosis tool

Heart disease prediction based on clinical data

- a total of 1190 observations containing different attribute information including age, sex, chest pain type, blood pressure, cholesterol in mg/dl, blood sugar, maximum heart rate etc. were used
- Two machine learning models (XGBoost and Random Forest), and an artificial neural network (ANN) deep learning model were trained and tested with the same attribute information for heart disease prediction.

Heart diseases multiclassification based on 12-lead ECG Data

- For the classification of the 18-cardiac conditions/abnormalities from 12-lead ECG data, a conventional neural network (CNN) was trained and validated

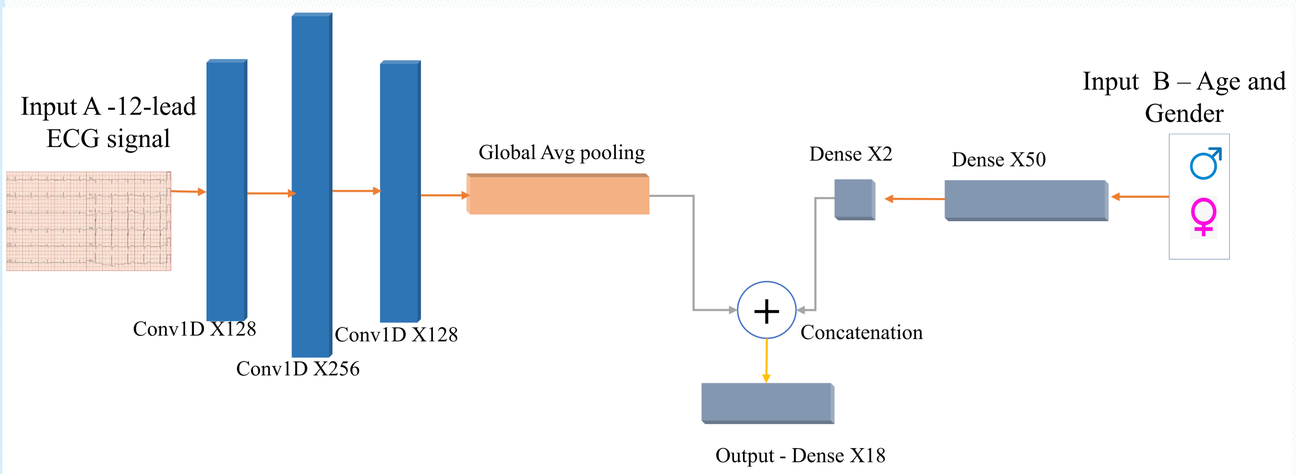

Figure 2: Simplified architecture of the heart disease classification model. Conv1Dx128: 1 dimensional CNN with 128 outputs, GlobAvPooling: 1 dimensional Global Average Pooling, DenseX18: dense layer with 18 outputs

Results

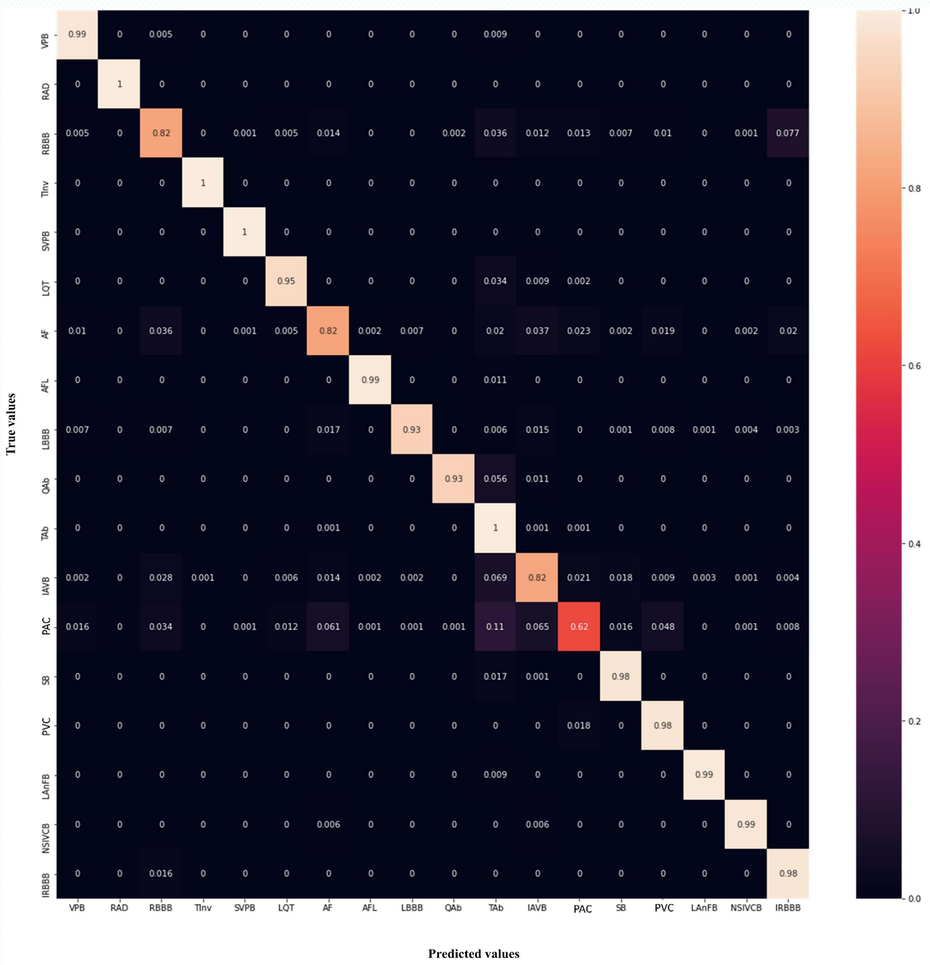

Figure 3: Normalized confusion matrix of the 12 lead ECG signal based multi-class classifier

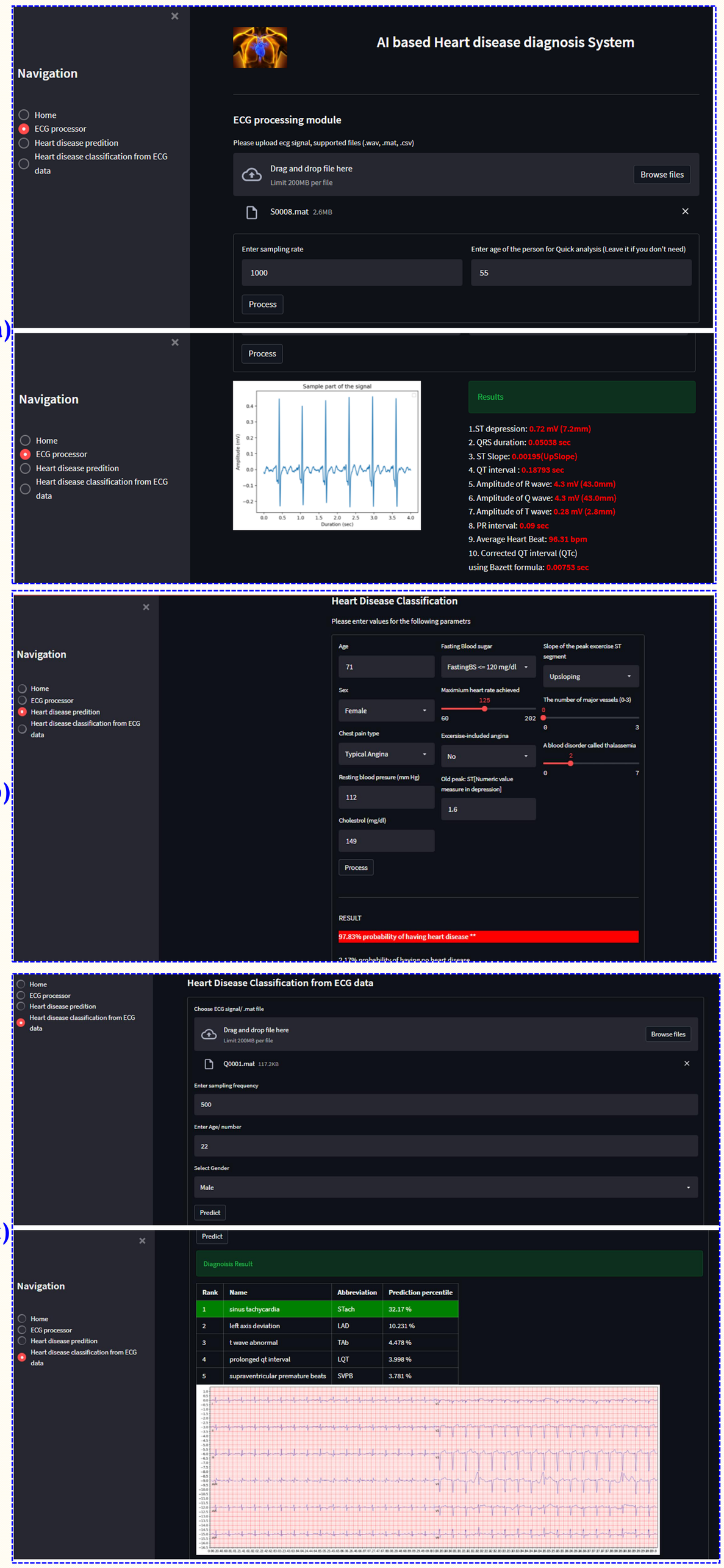

Figure 4: User interfaces (a) ECG processor (b) Heart disease prediction (C) Heart-disease classification using 12-lead ECG signal

Conclusion

- This paper presents an integrated AI-based decision support tool for diagnosis and assessment of cardiac conditions.
- Different machine learning and deep learning models were trained, evaluated and deployed in a custom designed web-based user interface for prediction of heart disease and multiclass classification of cardiac conditions.
- The developed system can provide a reference for clinical diagnosis, remove the opportunities for human error, saves time and money, and improve the diagnosis ability of clinicians for heart disease enabling timely decision making and treatment planning.