FAI HEALTHCARE PROJECT

Initial Project Proposal

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Topic: Developing an AI framework to detect and diagnose early risk factors, signs, and symptoms of ischemic heart disease, also known as Coronary Artery Disease (CAD).

Ischemic Heart Disease has been cited by the WHO as the leading cause of death worldwide, responsible for 13% of total deaths in 2021 (WHO, 2025). The risk factors, causes, signs, and early symptoms of the disease are well documented in medical literature, driven by robust research funding.

Due to the prevalence of ischemic heart disease worldwide, and the wealth of research that has already been conducted to identify patients at risk of developing heart disease, we have plenty of prior literature from which to draw study designs and proofs of concept. Since current research has identified specific biomarkers, lab results, and imaging results to be indicative of CAD, our group can start our exploratory analysis in these areas. This will allow our group to focus on developing a comprehensive Artificial Intelligence (AI) approach to determine which features most strongly predict the outcome of CAD, without being limited by preexisting clinical expertise.

A limitation of any healthcare project is the availability of high-quality patient medical record data. Per discussion with the professor, we have proposed our strongest idea for developing an accurate, robust, and helpful AI agent, and will require assistance obtaining a high-quality, validated medical record dataset to use as input data. We may need to rely on synthetic datasets generated for experimental AI projects, but will defer until we have confirmed our project topic.

Existing Approaches:

- Deep Learning

- Pooled network forest, funnel plots, league table (Bashar et al, 2022)

- Random forest, DL Long short-term memory (LSTM) (Yu et al, 2020)

(Bashar et al, 2022)

"Seventeen studies, with a total of 285,213 patients with CVDs, were included in the network

meta-analysis. The statistical evidence indicated that the

- DL algorithms performed well in the prediction of heart failure with AUC of 0.843 and CI [0.840–0.845], while in the
- ML algorithm, the gradient boosting machine (GBM) achieved an average accuracy of 91.10% in predicting heart failure.
- An artificial neural network (ANN) performed well in the prediction of diabetes with an OR and CI of 0.0905 [0.0489; 0.1673].
- Support vector machine (SVM) performed better for the prediction of stroke with OR and CI of 25.0801 [11.4824; 54.7803].
- Random forest (RF) results performed well in the prediction of hypertension with OR and CI of 10.8527 [4.7434; 24.8305].
- The findings of this work suggest that the DL models can effectively advance the prediction of and knowledge about heart failure, but there is a lack of literature regarding DL methods in the field of CVDs.
  - As a result, more DL models should be applied in this field. To confirm our findings, more meta-analysis (e.g., Bayesian network) and thorough research with a larger number of patients are encouraged."

Known CAD Indicators (Advocate Healthcare, 2025):

Biomarkers/Labs:

- HDL (bad cholesterol)
- apoA-I (apolipoprotein A-I)
- LDL (good cholesterol)
- A1C
- Troponins
- D-dimer

Reports:

- ECG
- Cardiac Catheterization
- TEE (Transesophageal Echocardiogram)
- CT/MRI imaging reports
- Stress test

Diagnosis Indicators (patient has CAD):
- History of MI (myocardial infarction), stroke, ischemia, aneurysm
- History of arrhythmias, flutter, bradycardia, tachycardia

References

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