Title: Dual Intelligent System for Predictive Heart Failure Using Clinical Parameters and MRI Imaging

Authors: Aryan Dhanuka (E23CSEU1707), Aryan Upadhayay (E23CSEU1685)

Early and effective interventions are important to reduce the morbidity associated with cardiac error and mortality. This project will lead a dual modal, diagnostic AI-based diagnostic framework that constructs MRI imaging and clinical data to improve predictive accuracy of heart failure outcomes. The system uses a random forest classifier and a folding network (CNN) for tabular data, particularly focusing on the DICOM format. User-friendly web applications are integrated into the system, allowing real-time, accessible predictions for clinicians and researchers.

Introduction

Cardiovascular disease (CVD) remains the most common cause of death worldwide, and heart failure remains a major problem in this group. Although diagnostic instruments such as MRI and EHRS (electronic health records) have improved, early and accurate detection of heart failure remains a critical clinical challenge due to the complexity of symptoms and the variability of individual health data.

However, the challenge is to combine structured tabular data with unstructured image data to create an effective prediction system. This study addresses this gap by designing a diagnostic diagnostic framework using dual modality to ensure interpretability and practical applicability.

---

2. Methodology

2.1 Data Source

- Clinical Data: Comes from the Sunnybrook Heart Data Record, consisting of 299 anonymized patient files. Each data record contains parameters such as age, blood pressure, and cholesterol. Death_event (binary classification).
- The 80/20 exercise test was used.
- `pydicom.`

Interface

A minimal and intuitive web-based interface has been created using flasks and flow. This creates a minimal, intuitive web-based interface through the risk of both data streams:

- DICOM-MRI-Scans
- Live Forecast
- Systematic targets, risk categories, risk categories, risk categories, risk categories, risk categories, risk categories, risk categories, risk categories, risk categories. interpretation.
- Hospital or research environment.

---

3. MRI Image Analysis

Medical imaging plays an important role in the recognition of cardiac abnormalities. The model architecture was specifically tailored for classification of MRI-DICOM scans, and CNNs were used to learn related visual functions. These properties include:

- Abnormal Helzuk movements
- Ventricular size
- Modifications

Models were used using 10 epoch cycles as follows:
It provides a more complete diagnostic profile than using one of the two isolated modalities.

---

4. Model Performance and Evaluation

4.1 Random Forest Classifier (Surface Data)

Metric Values:

- Accuracy: 87%
- F1-score: 0.63

Key Features:

- Serum Creatinine
- Emission Fraction
- BP

> Random Forest Classifier showed high levels of risk factors. Model analysis of the models confirmed the relevance of clinical attributes. In the future, the model output will propose further improvements through transfer learning or vision transformers (VITs).

5. Conclusions and Future Research

This study demonstrates the effectiveness of dual AI systems in diagnosing heart failure both with clinical data and with MRI scans. The most important articles include:

- Integration of two different data streams
- Real-time prediction via web border area

Future instructions:

- Shap or lime for Lime for lime for chemicals
- Public Cardiovascular Repository
- Border Use for Real-Time Health Care Support in Ambulances and Rural Clinics

6. References

1. Bernabas, A. et al. (2025). Expert system with the "Automatic detection of cardiac pathology in echocardiographic imaging using VIT." application.
2. Guppa, A. Etal. (2025). "Predicting the risk of stroke by neural networks." *Journal of Neurorestoratology*.
3. Liu, T. et al. (2025). "ML Models of Cardiovascular Disease with Honor: A Meta-Analysis." *European Heart Journal - Digital Health*.

Keywords: heart failure, random forest, CNN, DICOM, MRI, machine learning, dual modal KI, heart image, visual transformer, honesty

MRI-SCAN

To explain the CNN input format, representative MRI-DICOM images are shown below:

Normal

Infected