Computer Science Department

Final Project: Multi Modal Heart Disease Predictor

Introduction/Background

Problem: Multi Modal Heart Disease Predictor

A.I in healthcare is extremely beneficial. With a defined problem statement and availability of data, we can fairly create an accurate level classifier for a specific task. For the term project, we will build a heart disease predictor model. The biggest difference between normal predictors and this is the availability of and the scale at which we will build the predictor. We aim to combine data from as many sources we can find and ultimately will deploy a usable predictor model that could be used at scale. While there is a lot of literature around the topic, we aim to create the most accurate heart disease predictor model. This would be a classification problem with around 10+ dimensions. We aim to create the predictor model as diverse as possible.

Is this another Heart Disease Predictor?

Ans: No, this model is a multi modal neural network.
We incorporate data from different sources such as:

1. Structured data
2. Sound data (Healthy and Defective Heart)

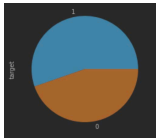
Dataset description

Dataset Info: Given the nature of the project, we first compile csvs of different heart disease datasets. Due to the nature of different column names, we apply:

1. **Preprocessing to change column names**
2. **Label Encoding**

(True) 0.553377
(False) 0.446623

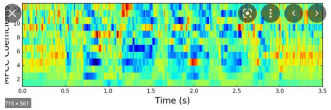
The dependent variable is target and it is a numeric variable. This is the label for the classification problem.



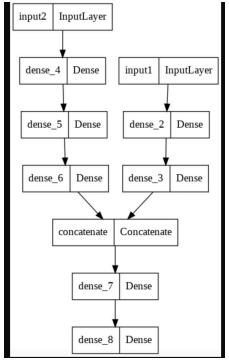
Methodology

Incorporation of heart sounds in our dataset

While we do not have specific sounds for each row or person, we can correlate them with a healthy heart and defective heart Heart sounds we are taking into account:
Normal: 31 files (1)
Murmur: 34 files (0)
Each sound is converted using **mel frequency cepstral coefficients to extract features**



Following is the model architecture.



An snapshot of the model

Analysis and Results

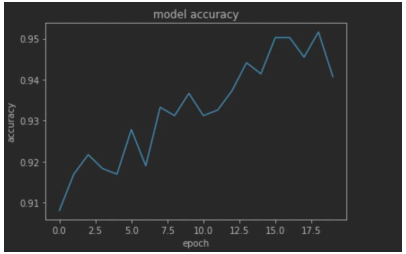
Training Analysis

For the training of the network, data preprocessing was done to convert sounds to a preprocessed vector of 40 dimension. A neural network was developed with two modalities (Structured data and sound data)

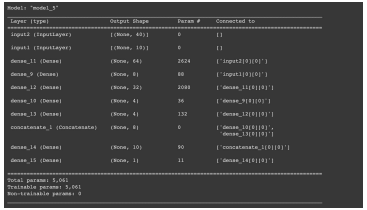
The final dataset was split into a 80/20 split and testing accuracy was calculated. The model was trained for 20 epochs

To measure the results, accuracy was chosen as a metric (As there was no class imbalance). Training and testing accuracy was reported.

A training accuracy of 94% and testing accuracy of 92% was reported.



Model accruacy plot



Architecture

A method was developed that is capable of predicting if a person heart is healthy or not based on several factors such age, sex, bp etc, additionally, we included different modalities such as sounds. To conlude, we reported a testing accuracy of 94 and 92 as training showing that the model is indeed feasible.

Rugulies, R. (2002). Depression as a predictor for coronary heart disease: a review and meta-analysis. American journal of preventive medicine, 23(1), 51-61.
Mohan, S., Thirumalai, C., & Srivastava, G. (2019). Effective heart disease prediction using hybrid machine learning techniques. IEEE access, 7, 81542-81554.

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