SYNOPSIS

1. TITLE OF THE PROJECT

ECG based heart abnormality detection and Myocardial Infarction Prediction

2. NAME OF THE COLLEGE AND DEPARTMENT

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Department of Computer Science & Engineering

3. NAME OF THE STUDENTS AND GUIDE

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4. KEYWORDS

Electrocardiogram (ECG), heart abnormality detection, Convolutional Neural Networks (CNNs), ECG images, deep learning, healthcare intervention

5. INTRODUCTION / BACKGROUND

Heart diseases, including myocardial infarction (heart attack), are a major global cause of mortality. Early detection and accurate prediction of heart abnormalities are crucial in preventing adverse cardiac events. Electrocardiogram (ECG) signals are commonly used for diagnosing cardiac conditions. Machine learning techniques have been extensively researched for ECG-based heart abnormality detection and myocardial infarction prediction. These methods improve diagnostic accuracy and efficiency by analyzing ECG signals and identifying patterns.

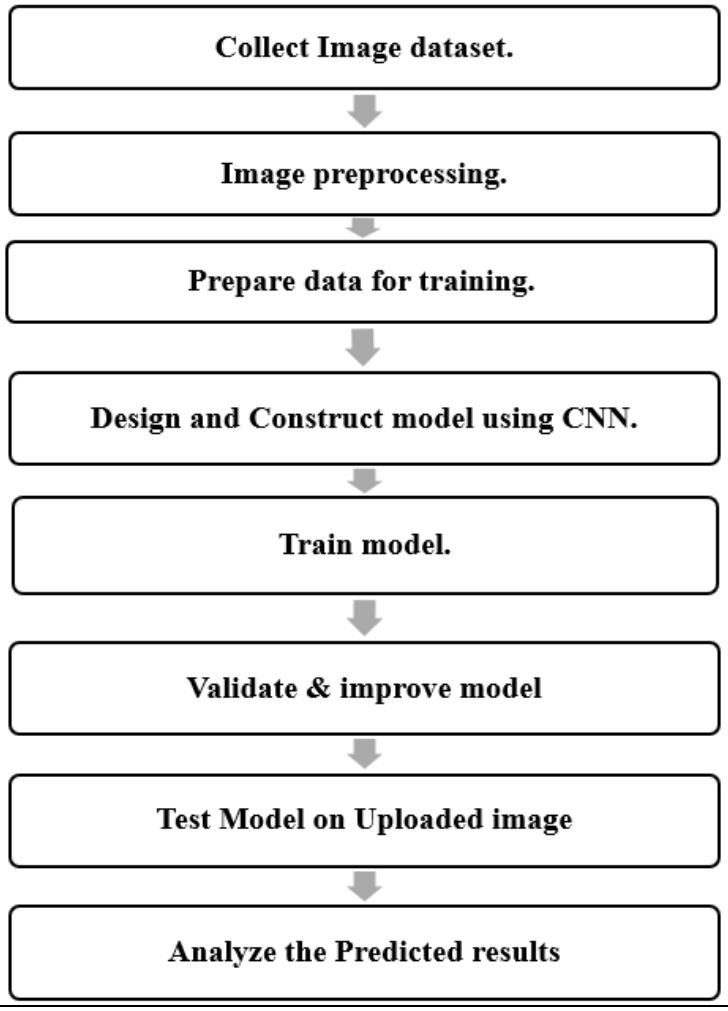
Smith et al. (2019) developed a machine learning-based approach for classifying arrhythmias and identifying indicators of myocardial infarction using ECG feature extraction and classification algorithms. Johnson et al. (2020) proposed a deep learning model for myocardial infarction prediction, achieving high accuracy in identifying at-risk patients.

This project enhances ECG-based heart abnormality detection and myocardial infarction prediction by combining existing algorithms and formulating a new approach. The system is implemented with a user-friendly webpage where doctors and patients can upload ECG images for accurate heart attack risk predictions. Insights into ECG samples, symptoms, and treatment recommendations is provided to assist decision-making. Machine learning algorithms is used to analyze cardiac images to identify anomalies or signs of myocardial infarction. Improved prediction accuracy enables early detection and timely intervention, which leads to better patient outcomes.

6. OBJECTIVES

Our project focuses on developing a Heart attack prediction system using machine learning techniques, encompassing ECG sample classification, symptom analysis, and treatment recommendation. We aim to increase accuracy and usability by comparing existing algorithms and formulating a new approach. Through image processing and CNN algorithm, our system will accurately analyze cardiac images, identify potential anomalies or signs of myocardial infarction, and provide insights to both doctors and patients. With a user-friendly webpage interface, doctors and patients can upload ECG images for processing and receive accurate predictions of heart attack risks, while also having access to heart specialists for further consultation.

7. METHODOLOGY



1. Collect Image Dataset.
    - The images are sourced from MIT-BIH Repository.
    - The dataset is then split into test and train sets.
2. Image preprocessing.
    - We need to standardize all the images and have one single format for all the images.
    - Preprocess technique includes re-sizing, scaling of pixels, adding dimensions.
3. Prepare data for training.
    - We first locate PNG image files, extract labels from file paths, and create a balanced dataset for training a machine learning model.
    - We then prepare image data by converting images to a suitable format, setting up generators for training and validation subsets, and creating data flows with shuffling for machine learning model training and testing.
4. Design and construct model using CNN.
    - We then design our model using CNN with ResNet50 DL layers and SoftMax activation function.
5. Train Model.
    - We then train our model using the training set.
    - The dataset is split into training and validation sets.
    - During training, the model learns to recognize patterns and features indicative of normal and abnormal heart rhythms.
6. Validate and improve model.
    - After training the model we then validate the model using the validate set and test it against the trained model.
    - We assess the model with metrics like accuracy, precision, recall, and F1 score.
    - If we are not satisfied with the results, we then improve the model by tweaking the algorithm.
7. Test model on uploaded image.
    - The ECG images are uploaded from the web page, they are then pre-processed.
    - Then the image is fed to the model which gives out prediction of the class which the heart beat belongs to.
8. Analyze the predicted results.
    - Predicted results are compared to ground truth annotations to assess model accuracy and performance metrics, identifying areas for improvement.
    - Analysis of false positives and false negatives provides insights into model strengths and weaknesses, guiding refinements and enhancements for increased accuracy and clinical relevance.

8. RESULTS AND CONCLUSIONS

- Web-based platform for heart abnormality detection using ECG images.
- Enable patients to upload their ECG images and receive detailed analysis reports.
- Utilizes advanced image analysis techniques to classify uploaded images into various heartbeat classes.
- Provide patients with valuable insights into their cardiac health through the web-based reporting system.
- Uses HTML, CSS, JavaScript, and Bootstrap for a visually appealing and responsive user interface.
- Employs PHP and a MySQL database for secure storage and retrieval of patient data.
- Train a Convolutional Neural Network (CNN) model on a labeled dataset of ECG images for accurate prediction.
- Use Flask, a Python web framework, to handle image retrieval and communication between front-end and back-end.
- Pass preprocessed images through the CNN model to analyze features and assign them to the appropriate heartbeat class.

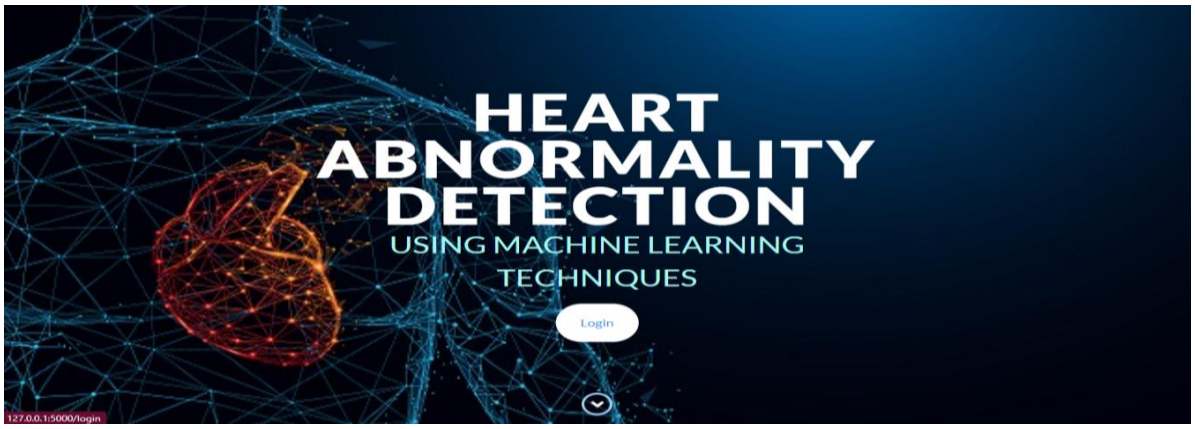


Figure: Homepage

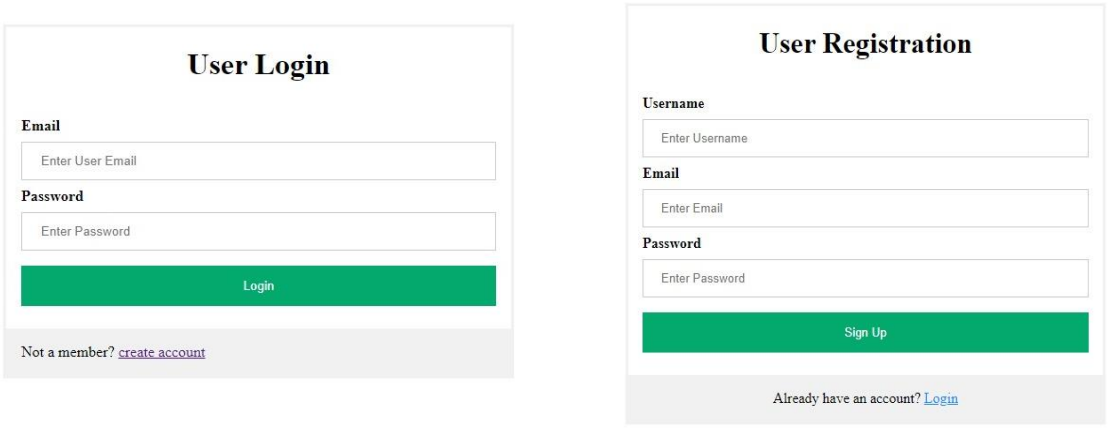


Figure: Signup/login Page

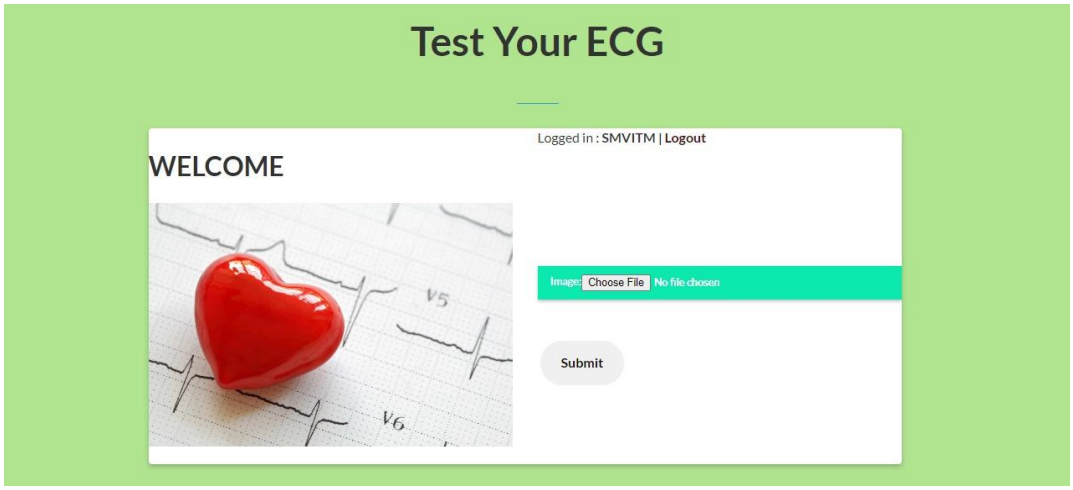


Figure: Main Page

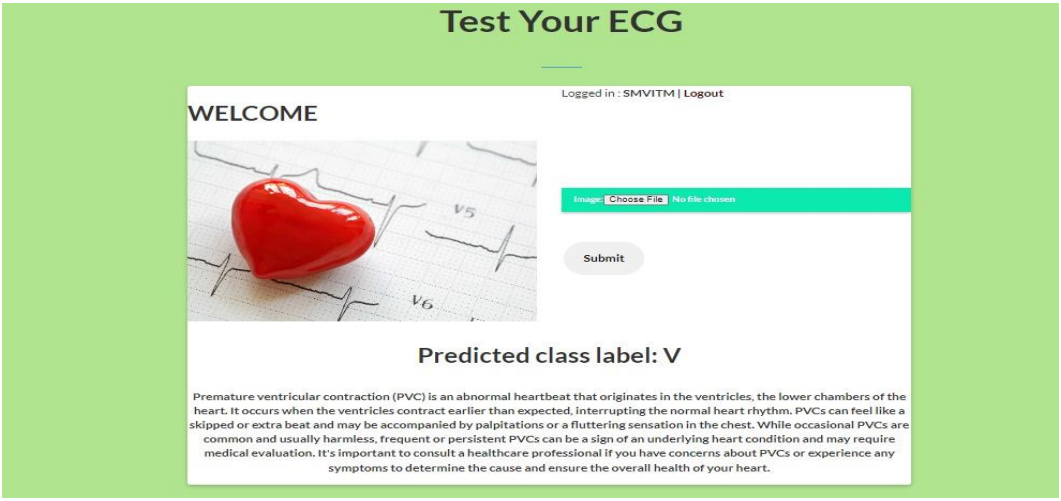


Figure: Result

CONCLUSION

The project developed a system for ECG graph-based abnormality detection and myocardial infarction prediction, leveraging advanced analysis techniques and pattern recognition algorithms. It enhances the identification of abnormal heart rhythms, aids clinical decision-making, and enables proactive measures to reduce myocardial infarction risk. However, medical expertise should always be involved in the interpretation of results. Overall, the system improves cardiac healthcare outcomes and promotes a proactive approach to cardiovascular health management.

9. SCOPE FOR FUTURE WORK

- To further enhance the project, several avenues can be explored. Firstly, expanding the dataset size and diversity can improve the model's robustness.
- Establish partnerships with research institutions and encourage data sharing to contribute to larger datasets and advance the development of ECG-based heart abnormality detection and myocardial infarction prediction models, fostering continuous improvement and innovation in the field.
- Furthermore, integrating other clinical data, such as patient demographics and medical history, could provide a more comprehensive assessment of heart abnormalities.
- By incorporating full-length ECG samples into the project, it will be possible to capture a more comprehensive representation of the cardiac activity, leading to improved accuracy and reliability in the detection and prediction of heart abnormalities.