Wolff Parkinson White Syndrome Detection

Submitted in the partial fulfillment of the requirements

for the degree of B.Tech in Computer Engineering

by

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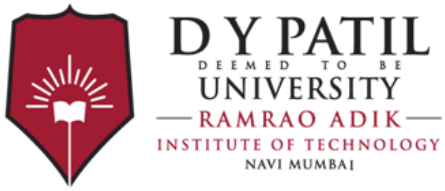

Department of Computer Engineering

Ramrao Adik Institute of Technology

Sector 7, Nerul, Navi Mumbai

(Under the ambit of D. Y. Patil Deemed to be University)

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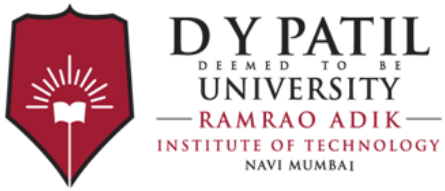

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CERTIFICATE

This is to certify that, the Mini Project-IV report entitled

Wolff Parkinson White Syndrome Detection

is a bonafide work done by

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and is submitted in the partial fulfillment of the requirement for the degree of

B.Tech in Computer Engineering

to the

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Supervisor	Project Co-ordinator
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Mini Project Report - IV Approval

This is to certify that the Mini Project - IV entitled ***"Wolff Parkinson White Syndrome Detection"*** is a bonafide work done by ***Shabbir Talib 20CE1095***, ***Atharva Hirve 20CE1086***, ***Jay Dandekar 20CE1103***, and ***Deyush Kulkarni 20CE1008*** under the supervision of ***Mrs. Tabassum Maktum***. This Mini Project is approved in the partial fulfillment of the requirement for the degree of ***B.Tech in Computer Engineering***

Internal Examiner :

1. .....

2. .....

External Examiners :

1. .....

2. .....

Date : .../.../.....

Place : .....

DECLARATION

We declare that this written submission represents our ideas and does not involve plagiarism. We have adequately cited and referenced the original sources wherever others' ideas or words have been included. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action against us by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Date: _____

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Abstract

In the present day and age, we live in a world where anything and everything related to medical condition/syndrome detection and treatment has and continues to become extremely crucial. The dependency on all such systems has grown rapidly in the last few decades due to number of external factors, of the critical factor being these system's capability and capacity of detecting diseases and syndromes or any other prevalent conditions well-in time. This offers patients the chance of exploring further options. These options depend on severity of detection if any, further course of treatment and other factors associated with the same. The team has developed a web application for analyzing ECGs of patients and detection of Wolff Parkinson White syndrome through irregular heartbeat and other pre-set parameters, in the process providing additional and useful information including symptoms, precautions and possible mode of treatments. Also, providing patients with connections to concerned health centers in the process of creating a one-stop solution for this syndrome.

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Chapter 1

Introduction

1.1 Overview

WPW syndrome (Wolff-Parkinson-White syndrome) is a cardiac arrhythmia characterized by an abnormal pathway between the atria and ventricles of the heart, which can lead to a rapid and irregular heartbeat. The condition is usually diagnosed using an electrocardiogram (ECG), which measures the electrical activity of the heart. However, WPW syndrome is often associated with low detection rates which increases the criticality of this syndrome and emphasizing the importance of early detection. The low detection rate of WPW syndrome can be attributed to several factors. One of the primary reasons is that the condition is often asymptomatic, meaning that many people with WPW syndrome may not experience any noticeable symptoms. In some cases, WPW syndrome may only be discovered incidentally during routine medical tests such as an electrocardiogram (ECG).

Another reason for the low detection rate of WPW syndrome is that it is a relatively rare condition. According to some estimates, WPW syndrome affects only around 0.1-0.3% of the general population. As a result, many healthcare providers may not be familiar with the condition or may not consider it as a possible diagnosis in patients with symptoms that can be attributed to other causes. In addition to the listed parameters, WPW syndrome can be difficult to diagnose, especially in cases where the extra pathway is intermittent or only present during certain heart rhythms. In some cases, additional testing such as a Holter monitor or electrophysiological study may be necessary to detect the condition.

Overall, the low detection rate of WPW syndrome underscores the importance of regular medical check-ups and screenings, especially for individuals with a family history of the con-

dition or other risk factors. If a patient is experiencing symptoms such as rapid or irregular heartbeats, it is important to seek medical attention promptly to rule out any underlying cardiac conditions.

This gives an overview [1] about chapter. The following Equation **??** about parameters. The following Figure 1.1 is the DYPU Logo.

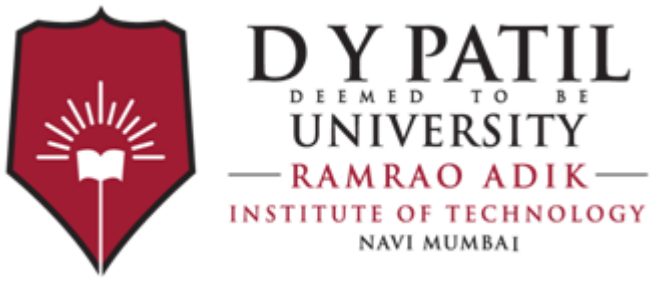

Figure 1.1: DY Patil Deemed University logo

$$\beta \leftarrow \frac{5(\pi - 1)}{\lambda^2} \tag{1.1}$$

[1]

1. Which observations strongly motivated you to take up this problem domain to work.
2. Which observations strongly motivated you to take up this problem domain to work.

AI Which observations strongly motivated you to take up this problem domain to work.

Which observations strongly motivated you to take up this problem domain to work.

The following Table 1.1 shows the Name of the Students.

Table 1.1: Name of Students

Name	**Roll No.**
Mr. Kishor Deepak Waghe	(20CE5009)
Mr. Pradyumna Sameer Mandawkar	(20CE5010)
Ms. Prabhuti Jayesh Patil	(20CE5014)
Which observations strongly motivated you to take up this problem domain to work.	(19CE1053)

1.2 Motivation

There has been a visible and drastic change towards a positive side when it comes to how the healthcare sector has adapted to the evolution of technology. The COVID-19 pandemic further accelerated the need for use of remote systems when dealing with patient of any kind. This is where the proposed system comes into the picture ensuring an easily available, cost and time sensitive solution for patients who may be suffering from the Wolff Parkinson White Syndrome. The motivation behind selection and development of this system is:

- Firstly, it could help in the early and accurate diagnosis of this very rare condition, which is important for effective treatment.
- Secondly, it could improve the speed and efficiency of diagnosis, particularly in settings where access to medical professionals or resources is limited.
- A machine learning model could potentially use a large dataset of ECG recordings to identify patterns or features that are associated with WPW syndrome.
- The model could also be designed to provide a probability score or confidence level for its classification, allowing medical professionals to make more informed decisions about treatment.
- However, it's important to note that developing a machine learning model for diagnosing WPW syndrome would require a large, diverse and representative dataset of ECG recordings, as well as appropriate regulatory approvals and ethical considerations.
- Additionally, the machine learning model should be used in conjunction with trained medical professionals, as it is intended to assist with diagnosis and improve patient outcomes.

1.3 Problem Statement and Objectives

The primary objectives of our web-application would be to provide:

1. Provides streamlined way for individuals to perform a quick check up.
2. The first part of our project is to create a separate model that will be used to convey if the patient needs to take an ECG test in the first place.

3. The mentioned model is based on symptoms that a person with a heart problem and in need of check-up might suffer from.

4. The various symptoms are as follows:

    - High heart rate
    - Dizziness
    - Fainting
    - Constant Tiredness (Fatigue)
    - Anxiousness
    - Chest Pain
    - Difficulty Breathing

5. The inputs the user will provide will be yes/no if they suffer from the above-mentioned symptoms.

6. Using the above inputs, the project will provide a prompt if they should undergo an ECG test.

7. The core element of our project is to develop a model such that by taking the ECG data input, can detect if the person is suffering from Wolff-Parkinson-White Syndrome.

8. The next part of the project is to provide a list of medical centers where the user can go for treatment if needed.

9. And another part would be to display the various available treatments they can take if they suffer from Wolff-Parkinson-White Syndrome.

1.4 Organization of the report

The report is organised as follows: The Chapter 2 reviews the literature. Chapter 3 focuses on defining the system's issue. That includes problem categorization, proposed technologies, device architecture, and hardware/software requirements. On the other hand, Chapter 5 describes the inference and future work on the technique to be utilized as a more improved model.

text

Chapter 2

Literature Survey

Survey of Existing System

The team researched for any automated software which was developed with the sole aim of detecting the Wolff Parkinson White Syndrome. The team was, however, not able to find any relevant system, which could be handling the problem statement. Through extensive research and reviewing of case studies, the team determined that no such software system had yet been developed or deployed. Henceforth, the team can confidently assert that the system undertaken for Wolff Parkinson White is indeed a fresh foray with no previous iterations or versions. The existing system or procedure in place for the detection of the Wolff Parkinson White Syndrome is of a traditional nature with little or no automation of procedures. The current process involves the evaluation of the ECGs by medical professionals after the occurrence of mild or fatal symptoms which is not a prudent measure to be followed. This syndrome is rare and may prove to be hard to be detected by medical professionals. This condition is genetic and inheritable at birth which may lead to increase in probability considering the syndrome is not detected or missed. The current procedure for detecting this syndrome goes as follows:

1. The patient may experience some symptoms, mild or serious and may deliberate whether to consult medical mediation.

2. The medical professional may be aware or unaware regarding the presence of this rare syndrome.

3. The medical professional may opt for multiple medical diagnosis which may lead to overburdening and lead to missing out on the syndrome's presence.

4. The medical professional may fail to register the results or fail to provide the medical treatments for this curable syndrome.

5. The medical professional also may fail to register the patient's genetic history for further referrals of inherited instances of the Wolff Parkinson White Syndrome.

Research papers designed in accordance with deployment of Machine Learning techniques as well as from a medical science approach have been studied, observed and analyzed. Following are the inferences made:

- A method for automated generation of isochrone maps using electromechanical wave imaging (EWI) and machine learning techniques. EWI is a medical imaging modality that uses high-frequency ultrasound to measure the electromechanical wave propagation in biological tissues. By analyzing the time-delay between electrical activation and mechanical deformation, EWI can generate isochrone maps that provide information on the electrical activation patterns in the heart. The proposed method involves using a convolutional neural network (CNN) to automatically detect and segment the heart in EWI images, followed by computing the time-delay between electrical and mechanical signals to generate isochrone maps. The CNN is trained on a large dataset of EWI images with corresponding ground truth segmentation and isochrone maps. Overall, the paper presents a novel approach for automated generation of isochrone maps using EWI and machine learning techniques, which could potentially improve the diagnosis and treatment of cardiac arrhythmias. They also compare the results with traditional methods and show that the proposed method outperforms them in terms of accuracy and efficiency.

- Using speckle tracking imaging to gain insights into the cardiac dysfunction that occurs in children and young adults with Wolff-Parkinson-White (WPW) syndrome. The authors found that patients with WPW syndrome had significantly lower global longitudinal strain (GLS) and global circumferential strain (GCS) compared to healthy controls. GLS and GCS are measures of myocardial deformation, which are used to assess myocardial function. The paper describes the specific patterns of cardiac dysfunction observed in patients with WPW syndrome, including impaired left ventricular systolic function and abnormal left ventricular filling. The authors also found that the severity of cardiac dysfunction was related to the presence of ventricular pre-excitation, a key feature of WPW

syndrome. The study further explores the potential of STI as a diagnostic tool for WPW syndrome, particularly in detecting subtle changes in cardiac function that may not be evident with conventional imaging techniques. The authors suggest that STI could be a valuable addition to the diagnostic and monitoring tools for WPW syndrome. Overall, the paper provides a deep insight into the cardiac dysfunction in children and young adults with WPW syndrome using STI. The study highlights the importance of assessing cardiac function in patients with WPW syndrome and emphasizes the potential of STI as a diagnostic and monitoring tool for this population.

- A case report of a then 15-year-old patient with intermittent Wolff-Parkinson-White (WPW) syndrome diagnosed by a single beat on a 12-lead electrocardiogram (ECG). WPW syndrome is a type of cardiac arrhythmia caused by an extra electrical pathway in the heart, which can lead to rapid heart rate and potentially life-threatening arrhythmias. Diagnosis of WPW syndrome typically requires observation of a characteristic ECG pattern called a delta wave, which is present during sinus rhythm. The authors of this case report describe a patient who presented with symptoms of palpitations and light-headedness but did not have a delta wave on initial ECG. However, a repeat ECG performed during an episode of palpitations revealed a delta wave, confirming the diagnosis of WPW syndrome. The authors emphasize the importance of performing repeat ECGs in patients with suspected WPW syndrome, as the characteristic delta wave pattern may be intermittent and not present during sinus rhythm. They also note that single-beat diagnosis of WPW syndrome is rare but possible, and clinicians should have a high index of suspicion for the condition in patients with symptoms suggestive of arrhythmia. Overall, the case report highlights the importance of careful ECG interpretation and the potential for intermittent WPW syndrome to be missed on initial evaluation.

- Investigating the accuracy of algorithms in predicting the location of accessory pathways in pediatric patients with Wolff-Parkinson-White (WPW) syndrome. WPW syndrome is a type of cardiac arrhythmia caused by an abnormal electrical pathway in the heart, which can lead to rapid heart rate and potentially life-threatening arrhythmias. Accessory pathways can be located in different regions of the heart and identifying their location is important for planning treatment. The authors of this study developed and tested algorithms to predict the location of accessory pathways in pediatric patients with WPW syndrome.

The aim of this study was to assess the predictive accuracy of 12 published algorithms for accessory pathway localization in pediatric WPW patients by comparing 12 lead resting ECG tracings with ECG tracings showing full ventricular preexcitation. The algorithms were based on demographic and electrocardiographic parameters and were compared to the actual location of the accessory pathway as determined by electrophysiological study (EPS).

- The study included 64 pediatric patients with WPW syndrome who underwent EPS to determine the location of the accessory pathway. The accuracy of the algorithms varied depending on the location of the accessory pathway, with better accuracy for pathways located in the left side of the heart. For 12 lead resting ECG tracings, the algorithms published by D'Avila, Boersma, and Xie were found most accurate to determine exact AP location (58%, 54%, and 54%, respectively). For laterality, the highest accuracy was found for the prediction of right-sided APs (from 42 to 78%; median 74%). For left-sided APs the median accuracy was 73% (from 53 to 80%), and for septal APs, the median accuracy was 68% (from 48 to 78%). From ECG tracings with full preexcitation during EPS the algorithm published by Boersma [11] yielded highest accuracy rates for exact AP localization (55%). For laterality, highest accuracy was found for prediction of right-sided APs (from 52 to 78%; median73%). For left sided APs median accuracy was 73% (from 58 to 83%), and for septal Aps median accuracy was 65% (from 50 to 75%) The authors suggest that the algorithms could potentially be used as a non-invasive method for predicting the location of accessory pathways in pediatric patients with WPW syndrome, reducing the need for invasive EPS in some cases. However, they note that further studies are needed to confirm the accuracy of the algorithms and validate their use in clinical practice.

- The paper presents a case report of a patient with congenital absence of left atrial appendage (LAA) and type A Wolff-Parkinson-White (WPW) syndrome, diagnosed using multimodal imaging techniques. The LAA is a small pouch-like structure in the left atrium of the heart, which can be a source of blood clots and increase the risk of stroke in patients with certain cardiac conditions. Congenital absence of LAA is a rare condition that may be associated with other cardiac abnormalities. Type A WPW syndrome is characterized by an extra pathway that is located in the anterior septal region of the

heart. The authors of this case report describe a patient who presented with palpitations and was found to have type A WPW syndrome on electrocardiogram (ECG). Multimodal imaging techniques, including transthoracic echocardiography, cardiac magnetic resonance imaging (MRI), and computed tomography (CT) angiography, were used to further evaluate the patient's cardiac anatomy and function. The multimodal imaging studies revealed that the patient had congenital absence of LAA, which was associated with a smaller left atrium and increased blood flow velocities in the pulmonary veins. The authors thus emphasize the importance of using multimodal imaging techniques for the diagnosis and management of complex cardiac conditions, such as congenital absence of LAA and WPW syndrome. They note that further research is needed to better understand the pathophysiology and clinical implications of congenital absence of LAA and its association with other cardiac abnormalities.

- The paper proposes a novel signal-adaptive multi-feature extraction algorithm for arrhythmia detection in electrocardiogram (ECG) signals. The algorithm aims to improve the accuracy of arrhythmia detection by utilizing multiple features of ECG signals and adapting to the signal characteristics. The proposed algorithm consists of four main steps: pre-processing, feature extraction, feature selection, and classification. In the pre-processing step, the ECG signal is filtered and segmented into individual heartbeats. Then, a set of features is extracted from each heartbeat using different signal processing techniques, including time-domain, frequency-domain, and wavelet-based methods. Next, a feature selection algorithm is employed to select the most relevant features for arrhythmia detection. The feature selection is performed based on a combination of statistical and correlation analysis to identify the most discriminative features. Finally, a machine learning classifier is trained using the selected features to classify each heartbeat as either a normal beat or an arrhythmic beat. The proposed algorithm is evaluated using the MIT-BIH Arrhythmia database and achieves high accuracy, sensitivity, and specificity compared to existing algorithms. Overall, the proposed algorithm offers a promising approach for arrhythmia detection using ECG signals, by combining multiple features and adapting to the signal characteristics.

- The paper presents a study on the use of 3D-rendered electromechanical wave imaging (EMWI) for the localization of accessory pathways in paediatric patients with Wolff-

Parkinson-White (WPW) syndrome. The study aims to evaluate the accuracy and feasibility of EMWI for guiding catheter ablation procedures in paediatric patients with WPW syndrome. The study included paediatric patients with WPW syndrome who underwent catheter ablation procedures guided by EMWI. EMWI involves the integration of 3D electroanatomic mapping with real-time ultrasound imaging to create a 3D-rendered image of the heart's electromechanical activation patterns. The use of EMWI also resulted in shorter procedure times and fewer catheter ablations compared to traditional fluoroscopic guidance. The study concludes that EMWI is a promising imaging modality for the localization of accessory pathways in paediatric patients with WPW syndrome. The use of EMWI may improve the accuracy and safety of catheter ablation procedures in paediatric patients, reducing the risk of complications and radiation exposure. Overall, the study suggests that 3D-rendered EMWI is a promising technique for localizing APs in paediatric patients with WPW syndrome. It offers a non-invasive, radiation-free, and accurate approach for identifying the location of APs, which can improve the success rate and safety of the catheter ablation procedure.

- The paper proposes a novel approach for analyzing accessory pathways (APs) in patients with Wolff-Parkinson-White (WPW) syndrome using a multimodal deep learning model. WPW syndrome is a cardiac condition characterized by the presence of an additional electrical pathway between the atria and ventricles, leading to arrhythmias. The proposed deep learning model combines multimodal data, including electrocardiogram (ECG), intracardiac electrogram (IEGM), and imaging data, to improve the accuracy of AP analysis. The model consists of three main components: a feature extraction module, a multimodal fusion module, and a classification module. The proposed approach offers a promising alternative for AP analysis in patients with WPW syndrome. By integrating data from multiple modalities, the model improves the accuracy of AP localization and can potentially reduce the need for invasive procedures such as catheter ablation. However, further studies are needed to validate the performance of the model in larger patient populations and across different healthcare settings. In the feature extraction module, each modality of data is processed separately to extract relevant features. The multimodal fusion module then combines the features from each modality to create a single representation of the AP. Overall, the study suggests that the proposed multimodal deep learning model offers a promising approach for analyzing APs in patients with arrhyth-

mias. The model's ability to combine information from multiple sources of data improves the accuracy of AP analysis and has the potential to improve the diagnosis and treatment of patients with arrhythmias.

- The paper provides an overview of Wolff-Parkinson-White (WPW) syndrome, a cardiac condition characterized by the presence of an accessory pathway in the heart that can cause rapid heartbeats or arrhythmias. The article discusses the pathophysiology of the condition, the clinical features, and the diagnostic and treatment options. The authors describe the pathophysiology of WPW syndrome, which involves the presence of an accessory pathway that connects the atria and ventricles of the heart, bypassing the normal electrical conduction system. The presence of this accessory pathway can cause electrical impulses to travel abnormally through the heart, leading to tachycardia or other arrhythmias. The article also discusses the clinical features of WPW syndrome, which can include palpitations, chest discomfort, shortness of breath, and syncope. The authors emphasize the importance of early diagnosis and treatment, as WPW syndrome can lead to serious complications, such as ventricular fibrillation and sudden cardiac death. The authors discuss the use of ECG in detecting the characteristic delta wave pattern, which is indicative of WPW syndrome. They also describe electrophysiology studies, which can be used to identify the location of the accessory pathway and guide catheter ablation therapy. The article concludes with a discussion of the treatment options for WPW syndrome, which include medications, catheter ablation, and surgical interventions. The authors emphasize that catheter ablation has become the preferred treatment option for WPW syndrome, as it offers a high success rate and low risk of complications. The table below provides the user with a quick, yet insightful glance of the characteristics of research papers utilized.

Limitations of Existing System

Gist of survey analysis:

In brief, there has been a comprehensive analysis of existing methodologies that have been deployed to increase the accuracy and frequency of prediction of the WPW syndrome. The literature survey consists of proposed methodologies such as automated generation of isochrone maps

using electromechanical wave imaging (EWI), using speckle tracking imaging to gain insights into the cardiac dysfunction that occurs in children and young adults with Wolff-Parkinson-White (WPW) syndrome, diagnosis by a single beat on a 12-lead electrocardiogram (ECG) highlighting the importance of careful ECG interpretation and the potential for intermittent WPW syndrome to be missed on initial evaluation. These papers have also deployed use of 3D-rendered electromechanical wave imaging (EMWI) for the localization of accessory pathways in paediatric patients and early detection using a multimodal deep learning model. All observed systems have successfully achieved respective objectives.

How far is the problem from being made into a solved complete problem:

As of today, not many systems exist for the sole purpose of detecting Wolff Parkinson White syndrome detection and mostly consist of research-based solutions for the detection problem. The research done for this syndrome is, most probabilistically suggesting the inclination towards medical basis for the subject matter at hand. Moreover, the research undertaken by the team also indicates that considering the very rare instances of any such systems in existence, many do not even come close to solving the accuracy issue of the detection problem with accuracy ranging over 70-80% suggesting the instances of misdiagnosis or missing detections for the remaining 30% of the overall cases. Another problem for such rare systems is the presence of issues such as false positives and false negatives which plague the system and lead to decrease in the evaluation parameters thus diminishing the system's optimality and performance standards.

Additionally, WPW detection is not officially standardised, with no calculated measures with for properly detection parameters. All these issues have been researched by the team and have tried to define the improvement possibilities for designing and developing a model addressing all these issues as well as improving the standard for the detection of Wolff Parkinson White detection.

Observations of the analysis of all above points and improvement possibilities:

As stated, the Wolff Parkinson White is a rare syndrome, mentioned less frequently even in the medical contexts and discourses leading to less prevalence and information regarding the

syndrome regardless of its severity or fatality probabilistic chances. Also, the issues associated with the detection subject of the Wolff Parkinson White syndrome such as, the detection's accuracy and precision as well as dealing with the cases of false positives and false negatives associated with detection. All of these issues as listed can be used to demonstrate the improvement probabilities for the current limitations and drawbacks. The improvement possibility of increasing the accuracy along with other evaluation parameters such as precision and recall for the rare systems currently in place as well as solving the major issues of false positives and false negatives demonstrate the capability of this project's undertaking to be a worthwhile endeavour.

Observations on the technologies and methodologies that you feel are performing better:

In the current time frame of developing this report, rare instances of technologies or different methodologies-based models were discovered. Based on the research undertaken, it can be stated that methodologies such as multimodal imaging and speckle track imaging can be stated to be performing better among rare instances of detection implementations with accuracy parameters averaging around 75%. Also, the use of machine learning classification models such as Random Forest Method, Support Vector Machine, etc. are developed for the textual data derived from ECG readings. Altogether, based on the research and evaluation performed by our time, some methodologies can be stated to be performing better, however with no public releases of web based or application user interfaces for utilizing the detection features of any such methodology in real time.

Chapter 3

Proposed System

3.1 Problem Statement

The team has developed a web application for analysing ECGs of patients and detection of Wolff Parkinson White syndrome through irregular heartbeat and other pre-set parameters, in the process providing additional and useful information including symptoms, precautions and possible mode of treatments. Also, providing patients with connections to concerned health centres in the process of creating a one stop solution for this syndrome. The main task of our study is to create a detection-mechanism that can successfully and reliably detect even minute changes or irregularities in the ECG readings of a patient. A method that combines Convolutional Neural Network (CNN) and Naïve Bayes Classifier which makes use of Supervised Learning. Further, we pass these images to deep learning CNN model for feature extraction.

Through this, the developed stem aims to develop a web-application that can be accessed and operated by all involved set of users i.e. the patient side and medical professional/ diagnostic center and can provide highly accurate and useful insights that are fairly easy to interpret even for a user having very less or zero knowledge about how the detection systems in general work.

3.1.1 Features of Wolff Parkinson White Detection System

1. Home Page:

   (a) Provides specific information on WPW Syndrome.

   (b) Allows user to explore other features provided in system.

2. Pre-ECG testing:

   (a) Pre-set and widely known symptoms are listed

   (b) User input evaluated.

   (c) Analysis of input on a probability-based approach.

   (d) Decision communicated to user.

3. ECG Analysis:

   (a) User advised for ECG will reach here.

   (b) Makes use of ECG data in (.hea) and (.mat) format.

   (c) Analysis on provided set of ECG data.

   (d) Decision communicated based on detection outcome.

4. Medical Centre:

   (a) A list of medical centres for seeking further treatment if required.

5. Treatment Page:

   (a) Provides user with set of treatments that are routinely followed if detected.

   (b) Informs about the prescribed medicines, however, does not recommend usage.

3.2 Proposed Methodology/Techniques

A project based on using Convolutional Neural Networks (CNNs) to detect WPW syndrome from ECG signals could involve the following steps:

- Data collection: Collect a dataset of ECG signals from patients with and without WPW syndrome. The dataset should be diverse, and representative of the population being studied.

- Data pre-processing: Pre-process the ECG signals to remove noise and artifacts that can interfere with the analysis. This could involve filtering, baseline correction, and normalization.

- Model selection: Choose a suitable CNN architecture for the task of detecting WPW syndrome from ECG signals.
- Model training: Train the CNN model using the pre-processed dataset. This involves optimizing the model parameters to minimize the loss function.
- Model evaluation: Evaluate the performance of the trained CNN model using various metrics such as accuracy, loss. Using a separate validation set for this purpose.
- Model deployment: Deploy the trained CNN model in a real-world setting for detecting WPW syndrome from ECG signals.

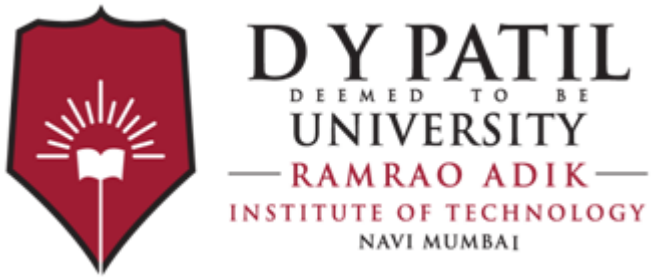

Figure 3.1: System Architecture

The above System Architecture consists of the following web pages:

- Home Page
- Symptoms Page
- Detection Page
- Treatment Page
- Medical Centers Page

In addition to the above depicted System architecture, our team has also successfully developed an independent system that use a probability-based approach to determine whether or not an ECG is recommendable/ advisable for the patient in the first place. Based on the research of existing papers and open-source medical journal content available for access, the team has narrowed down on the most common symptoms that an individual suffering from WPW syndrome may encounter. These symptoms are listed on the interface following which a form is presented

to the user. This form is designed for user to give input depending on the symptoms faced currently in a 'yes' or 'no' manner. Based on the user input provided in this form, the model is able to accurately predict if ECG is recommended or vice-versa. This feature has been added to avoid unwarranted process of ECG testing in the process helping system to focus only on cases where probability of positive WPW syndrome detection is higher in comparison.

The Different models used in the project are:

- Model to check if user should go for an ECG test
- Model to Detect WPW Syndrome using ECG Data (In the file format of .mat and .hea files

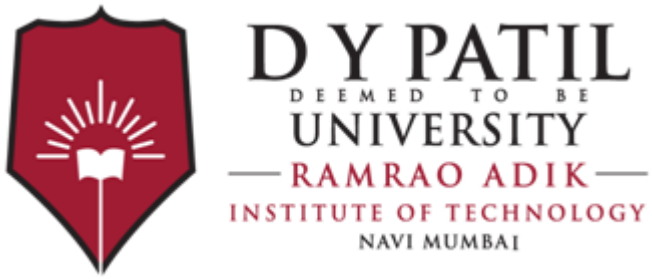

Figure 3.2: Accuracy Comparison

3.3 System Design

In our system, database connectivity and backend development will be playing an important role in the primary design. Some amount of frontend development with good GUI interfacing will be required for the interactive webpages. Our system design will thus involve mostly dynamic pages along with some interactive widgets. All of these features will provide for the system design to be unique and give the system an altogether varied interface for the end user.

3.3.1 Description of Algorithm

1. STEP 1: Open website homepage.
2. STEP 2: Hover and find enlisted features.
3. STEP 3: Choose the functionality you want to access and utilise.

4. STEP 4: Go for pre-ECG testing to determine if ECG is needed.
5. STEP 5: If advised, upload ECG file in desired format for detection purposes.
6. STEP 6: Explore Trusted Medical Centers around offering particular treatment.
7. STEP 7: Allows to observe generic course of treatment and medicines offered.

3.4 Details of Hardware/Software Requirement

The technologies which will be used by us during the course of the development of this application will be:

1. HTML
2. CSS
3. JavaScript
4. PHP
5. XAMPP
6. MySQL
7. Bootstrap
8. Python
9. Flask

Hardware used in the procedure of creating the application:

1. Microsoft Windows 7/8/10 (32 or 64 bit
2. 2 GB RAM minimum, 8 GB recommended
3. 2 GB of available disk space minimum, 4 GB recommended
4. 1280 x 800 minimum screen resolution

Chapter 4

Results and Discussion

This chapter presents the results generated. Compare them w.r.t. the existing solutions discussed in the literature survey. Add your project outcomes (screenshots of implementation). This is the brainstorming part. Understand, analyse, visualise why the results are the way they are.

4.1 Implementation Details

4.2 Result Analysis

The result of this web application detection system primarily focuses on the precise detection of whether or not the patient has WPW syndrome. The accuracy for the same is 96.06% and thus the model can be considered a reliable source of detection. In addition, the system does not just accurately depict the ECG analysis outcome but also allows users to check if an ECG is recommended or not through the pre-listed common WPW symptoms page which makes use of a probability-based approach. This has been done in order to make the system advise ECG only to those patients who have an urgent need to do so. Apart from this, the web application has the ability to connect patients with the nearest medical centers/ hospitals offering treatment for WPW syndrome and a list of the treatment methodology and medicines advised in general. It is important to note that we do not recommend any of the treatment processes or medicine consumption. In the process, the system is effective in terms of acting as a one-stop solution for the patients.

Chapter 5

Conclusion and Future Scope

In conclusion, our team feels that this is a project worth doing as it will help address the detection problem of the Wolff Parkinson White syndrome which even though is rare may prove to be fatal and thus address a worthwhile endeavour of reducing the probabilities of cardiac issues in the general demographic and assist the progress in the medical field. The different features provided by our application will help to create a system that provides for multiple assistance options such as detection, treatments, medical opinions and information dispersion. This project aims to eliminate problems faced by the current traditional process employed to detect the syndrome which is not automated and thus may lead to issues in detection and treatment of this syndrome. The functionalities in this application are to create a system that enforces simple and interactive options for symptoms detection, syndrome detection and treatments as well as other parameters.

This project implements various machine learning models for detection of probability of symptoms which provide near accurate results for prediction of probability of presence of the Wolff Parkinson White syndrome. The project then implements neural networks for detection of the presence of Wolff Parkinson White syndrome detection as well as prediction the comprehensive after detection medications, treatments and referrals for medical centers for treatment.

Future Scope:

- Genetic testing: WPW syndrome is a genetic condition that is often inherited. Genetic testing can identify individuals who carry the gene for WPW syndrome and may develop the condition later in life.

- Wearable technology: Advances in wearable technology, such as smartwatches and fit-

ness trackers, may make it easier to detect abnormal heart rhythms associated with WPW syndrome in real-time.

- Telemedicine: Telemedicine has become increasingly popular in recent years, and it may be particularly useful for diagnosing and managing rare conditions like WPW syndrome. Remote consultations with specialists can help patients receive timely and accurate diagnosis and treatment. New imaging techniques: Advances in imaging technology, such as 3D echocardiography and cardiac CT/MRI, may provide more detailed images of the heart and improve the diagnosis and management of WPW syndrome.
- New imaging techniques: Advances in imaging technology, such as 3D echocardiography and cardiac CT/MRI, may provide more detailed images of the heart and improve the diagnosis and management of WPW syndrome.

References

[1] A. Kunjir, H. Sawant, and N. F. Shaikh, “Data mining and visualization for prediction of multiple diseases in healthcare,” in *2017 International Conference on Big Data Analytics and Computational Intelligence (ICBDAC)*, p. 329–334, IEEE, Mar 2017.

[2] N. Chuka-Maduji and V. Anu, “Cloud computing security challenges and related defensive measures: A survey and taxonomy,” *SN Computer Science*, vol. 2, p. 331, Jul 2021.

Appendices

Appendix A

Weekly Progress Report

Figure A.1: Weekly Progress Report

Appendix B

Plagiarism Report

Appendix C

Publication Details / Copyright / Project Competitions

1. S. Gaud, S. Kale, R. Sarambale, P. Gunjgur, “A Recommendation System for Integrated Agriculture Using Convolutional Neural Networks with Random Forest Algorithm,” Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), July 2022. [Published]

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Date: _____