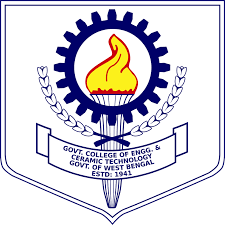
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***Government College of Engineering and Ceramic Technology***

**Statistical Analysis of ECG Signal for Myocardial Ischemia**

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*Registration No.:*

*Department:*

*Year:*

**ABSTRACT**

Electrocardiogram (ECG), a noninvasive technique is use as a primary diagnostic tool for cardiovascular diseases. A cleaned ECG signal provides necessary information about the electrophysiology of the heart diseases and ischemic changes that may occur. It provides valuable information about the functional aspects of the heart and cardiovascular system. The objective of the project is to automatic detection of cardiac diseases from ECG signal. The aim of this work is to detect automatically the R peaks, the T and P wave maxima, separately. After having represented the ECG equivalent in time frequency domain, we detect the slope of the QRS complex and ST elevation. Then we construct an one dimensional convolutional neural network to detect any abnormality in the ECG waveforms. After training and testing our model, it will be able to detect Myocardial Ischemia. The method is tested on inputs taken from European ST-T database from Physiobank database.

**MAIN REPORT**

**Introduction:** Myocardial ischemia occurs because of insufficient oxygen supply to the heart, leading to ischemic heart disease (IHD). It is the leading cause of death worldwide, responsible for more than 8 million deaths globally every year (World Health Organization, 2016). If untreated, ischemia can lead to a myocardial infarction (MI), commonly known as a heart attack. MI causes cell death and can lead to permanent damage to the heart muscle if not treated immediately. In many cases early signs of ischemia are overlooked or ignored by the patient. Timely detection and treatment of IHD can stop progression towards MI and save many lives and prevent permanent damage to heart muscle. Thus the aim is to develop an algorithm to detect ischemic events in ambulatory ECG signals. This can be used for continuous monitoring of a suspected ischemic patient and provide early detection of myocardial ischemia.

**Objective:** The Objective of this project is to automate the detection of cardiac disease- Myocardial Ischemia from ECG Signal. The aim of this project is to detect R peak, the slope of QRS Complex and T wave. After obtaining the following values we have created a Convolutional Neural Network (CNN) based Deep Learning (DL) model that detects whether a patient, whose ECG signal is fed into the model is suffering from myocardial disease or not.

**Scope:** The accuracy can be improved when the threshold is selected from a larger dataset. However one thing is observed that this method can provide a patient specific monitoring system for ischemia. If medical experts’ opinion is included in the phase of manually training the model, then detection accuracy can be improved also with their suggestions. Using this method, many other heart diseases like Hyperkalemia,Cardiac Hypertrophy, Cardiac infraction (from QRS complex abnormality) and Ventricular Hypertrophy, pre excitation syndrome , Digitalis effect (from T wave abnormalities ) etc can also be detected. This project model can be considered as a demo for such personal healthcare and disease detecting algorithm which can be equipped with better techniques in future.

**Limitation:** This model needs extensive dataset for training and experts’ suggestion for improvement. As a personal healthcare device, this can be difficult for a common person. It uses enough system resources.

**Features:** The main aim of our project is to develop a code to detect specifically whether a person

is having myocardial ischemia or not with the help of required no. of ECG signal dataset without

having to go to the clinic.

Any person anywhere in the world can use this whenever needed with a code executable machine

in hand (Laptop,desktop,ph..etc).So, anyone can use it easily without much knowledge.

A small or a minor change in the dataset won’t largely affect the code performance as it is deeply

trained by the use of convolutional neural network.

It is platform independent that it can run on any system and with that we need python 3.6.5

software only.

**Platform:** As we know Python is almost platform independent, so any platform or system able to run Python can run the software.

**Software and Hardware requirement**

Any Operating system except linux with upgraded version of python 3.6.5 software.

Tensorflow -gpu -: 1.2.3-It is an open source artificial intelligence library, using data flow graphs to build models. It allows developers to create large-scale neural networks with many layers. TensorFlow is mainly used for: Classification, Perception, Understanding, Discovering, Prediction and Creation.

Keras 2.3.1-: Keras is the python Deep learning library. It is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library.

Wfdb 3.0.1-: The native Python waveform-database (WFDB) package. A library of tools for reading, writing, and processing WFDB signals and annotations.

Data requirements: We used the European-st-t database which was intended to be used for evaluation of algorithms for analysis of ST and T- wave changes. This database consists of 90 annotated excerpts of ambulatory ECG recordings from 79 subjects.

And we as a group of 4 have used 4 databases (e0103,10104,e0105 and e0108) respectively i.e. the ECG record of Four patient as our training and test dataset for the execution of the code.

In each data set we run a code where the dataset is divided into segments having 240 data point each(a typical heart rate has 70 to 75 beats per minute, i.e. each cardiac cycle takes about 0.8 seconds to complete the cycle).

**SOURCE CODE OF THE PROJECT**

We have created the script gen\_manual\_verdict.py to process european st-t dataset to generate training data for our CNN model. Next we train our model using train\_model.ipynb. The script also generates .hdf5 file so that our model can be used everywhere. Next check\_individual\_inputs.ipynb is used for checking individual records.

**Future application**

* The current model only predicts whether a patient is suffering from myocardial ischemia or not. By feeding more data records of patients suffering from different cardiac disease like myocardial infarction, bradycardia, tachycardia. This model will also be able to predict whether a patient is suffering from the mentioned disease or not.
* A portable device can be made which will take the ECG signals as input and will predict whether a person is suffering from cardiac disease or not.