# Identification of Arrhythmia using Electrocardiogram Data

## Introduction

Arrhythmia is a group of conditions where the heartbeat is irregular, too slow, or too fast. It occurs when the electrical signals to the heart that coordinate heartbeats are not working properly. For instance, some people experience irregular heartbeats, which may feel like a racing heart or fluttering. A heart rate that is too fast – above 100 beats per minute in adults – is called tachycardia and a heart rate that is too slow – below 60 beats per minute – is called bradycardia. Any interruption to the electrical impulses that cause the heart to contract can result in arrhythmia. A number of factors can cause the heart to work incorrectly, they include alcohol abuse, drug abuse, diabetes, mental stress, smoking [2].

## Abstract

Arrhythmia analysis of ECG signal plays a significant role in diagnosing most of the cardiac diseases. One cardiac cycle in an ECG signal consists of the P-QRS-T waves. A beat can be decomposed into waves known as P, Q, R, S, and T, which correspond to polarization and depolarization of different parts of the heart. The initial task for efficient analysis is the removal of noise and detection of QRS peaks. It actually involves the extraction of the QRS component by rejecting the background noise. In this project, we first use Pon Tomkins algorithm and then compare it with different machine learning algorithms to obtain the results and compare their accuracy.

## Motivation

Some of the main points that motivated us in pursuing this project are:

- Arrhythmia is one of the most common heart problems with over 10 million reported cases reported per year in India. The state of cardiac heart is generally reflected in the shape of Electrocardiogram (ECG) waveform and heart rate. ECG, if properly analysed, can provide information regarding various arrhythmia diseases related to heart.
- Clinical observation of ECG can take long hours and can be very tedious. Moreover, visual analysis cannot be relied upon and the possibility of the analyst missing the vital information is high. Hence, computer-based analysis and classification of Arrhythmia diseases can be very helpful in diagnosis.

## Dataset

The MIT-BIH Arrhythmia Database was developed by MIT in collaboration with Boston's Beth Israel Hospital (BIH) in 1980 for arrhythmia detection [3]. This is the first standard database used by researchers to validate the performance of their proposed technique and compare their result with pre-existing algorithms. The database contains 48 records, each containing two-channel ECG signals for 30 min duration selected from 24-hr recordings of 47 individuals (record 200 and 201 are from same patient). Each ECG record consists of two channel recordings. The first channel recording uses modified lead limb II (MLII) while the second channel recording commonly uses lead V5. The first 23 (100-124) recordings

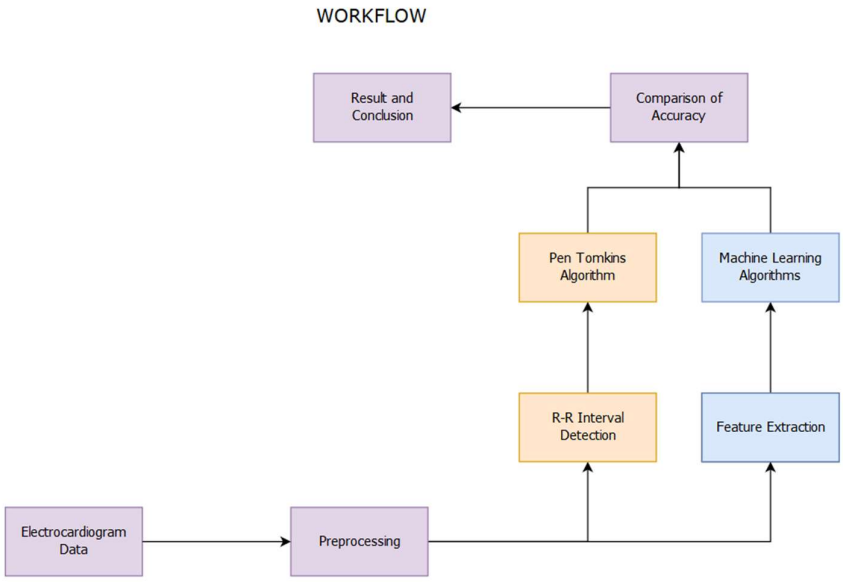
correspond to the routine clinical recordings while the remaining recordings (200-234) contain the complex arrhythmias.

## Methodology

Electrocardiogram consists of repetitive series of P, Q, R, S, T waves, which conform to established standards for size and shape and occur 60-100 times each minute. There are four major ECG intervals RR, QRS, QT, ST, T segments. The heart rate (beats per minute) can be readily computed from the inter beat (R-R) interval. The PR interval measures the time (normally 120 to 200 ms) between atrial and ventricular depolarization. The QRS interval normally 100ms or less) reflects the duration of ventricular depolarization. The QT interval includes both ventricular depolarization and repolarization times [1]. Our main aim is to identify these features in the ECG and detect abnormalities using different algorithms to obtain a higher accuracy.

## Workflow

The following block diagram shows the workflow of the project




## References

[1] J. Pan and W. J. Tompkins, “A real-time QRS detection algorithm.” IEEE Trans on bio-medical engineering, vol. 32, no. 3, pp. 230–6, Mar. 1985.

[2] Arrhythmia: Causes, symptoms, types and treatment written by Christian Nordqvist (https://www.medicalnewstoday.com/articles/8887.php)

[3] Moody GB, Mark RG. The impact of the MIT-BIH Arrhythmia Database. IEEE Eng in Med and Biol 20(3):45-50 (May-June 2001). (PMID: 11446209)