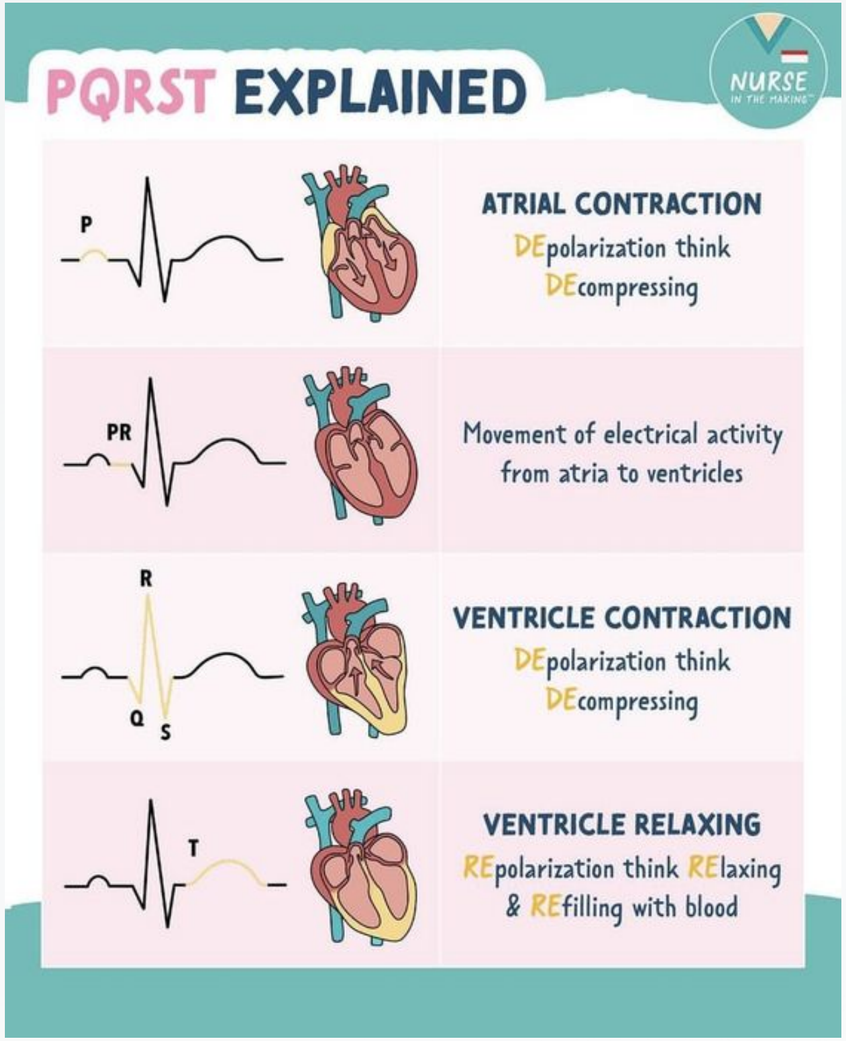
A SURVEY ON ECG ANALYSIS

Aim: To extract raw signal and process it so that it is ready for medical use and application purpose.

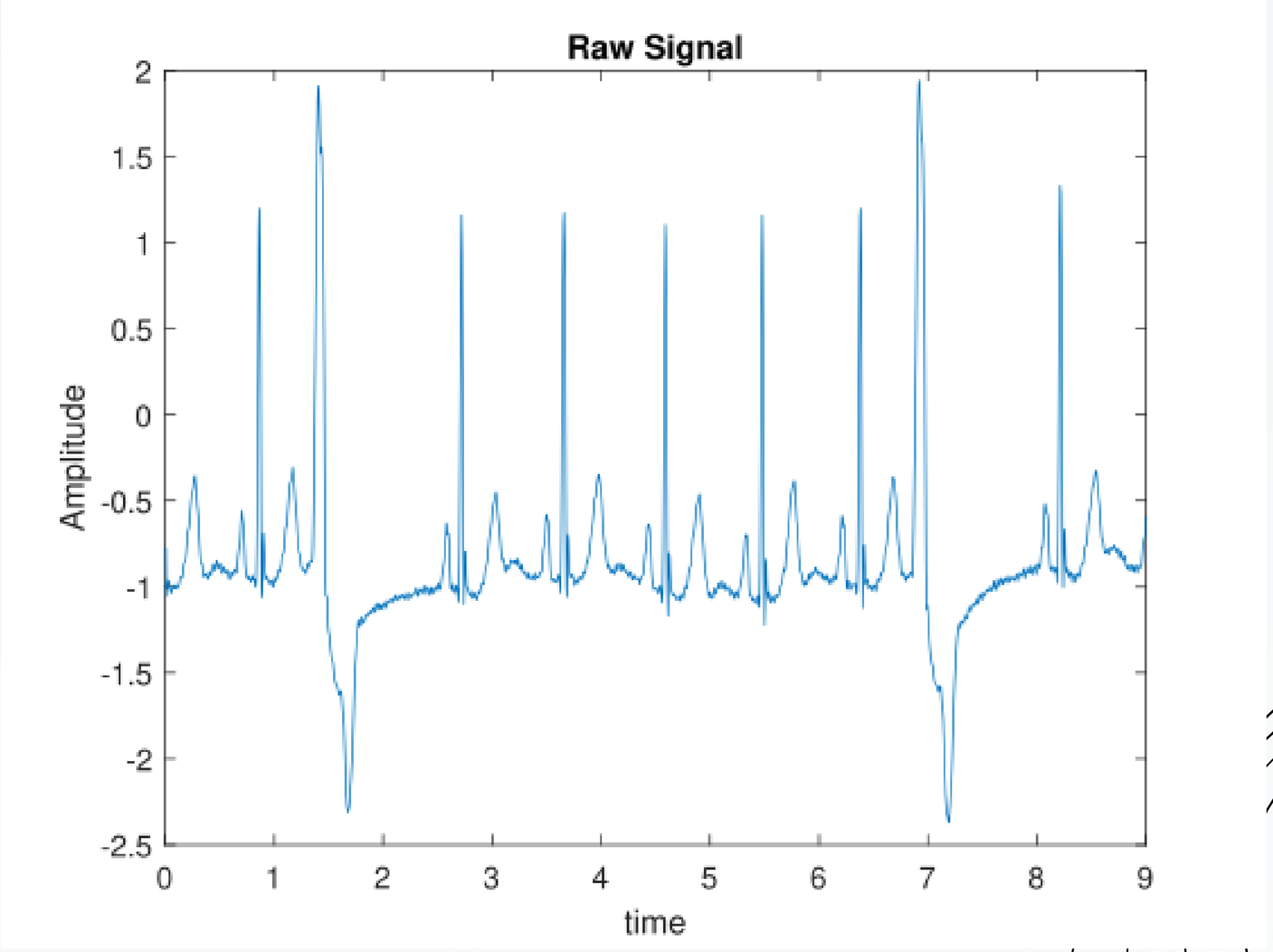
INTRODUCTION

Electrocardiogram is a recording of the heart’s electrical activity through repeated cardiac cycle.



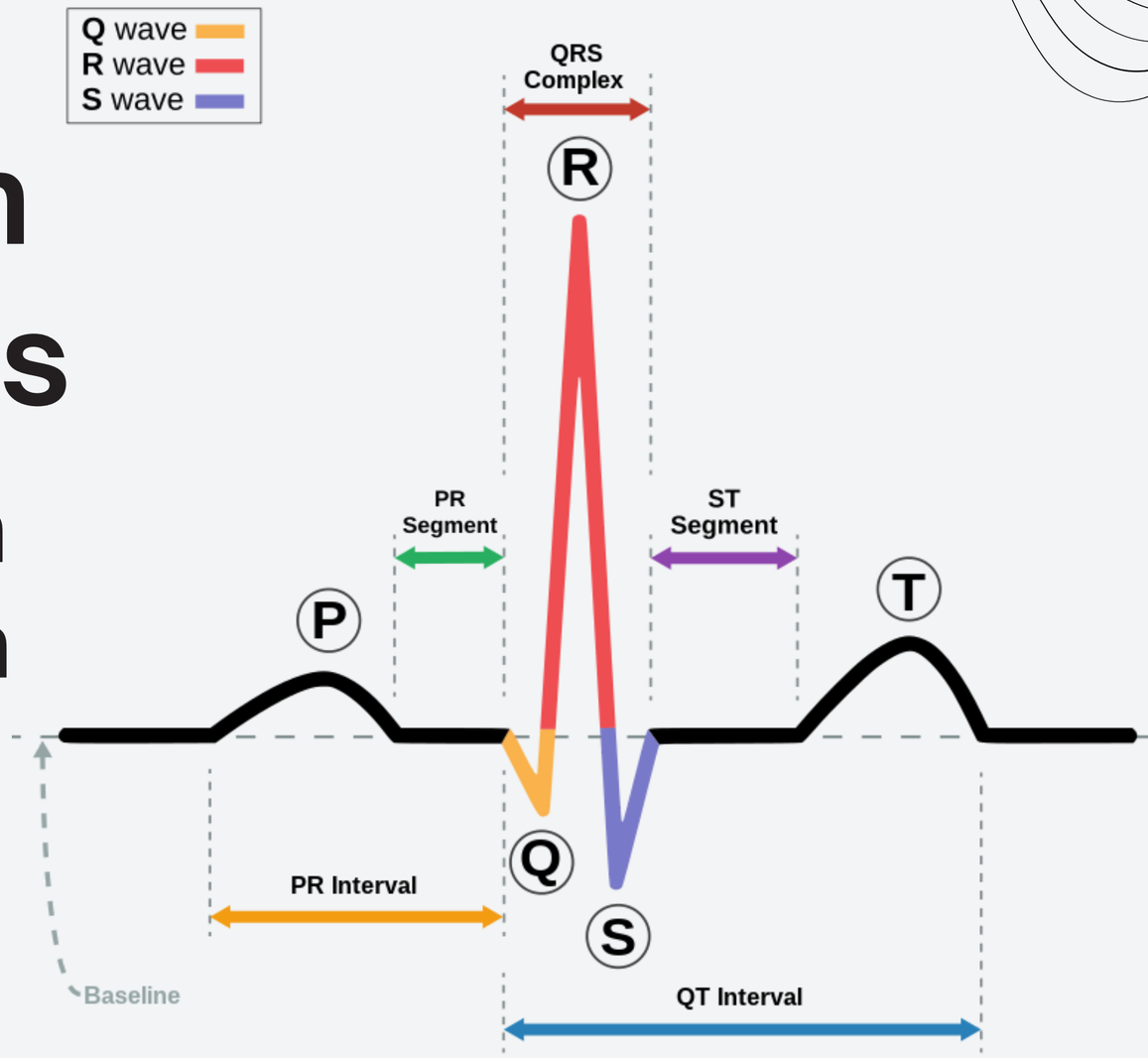
Noises

- Baseline Wander - Patient’s breathing (0.15 to 0.3 Hz)
- Power Line Interference - 50 Hz or 60 Hz
- Electrosurgical Noise - Medical Apparatus (100 kHz to 1 MHz)
- Electromyrography Noise - Due to Muscle Contractions
- Electrode contact noise - Contact between the electrode and the skin



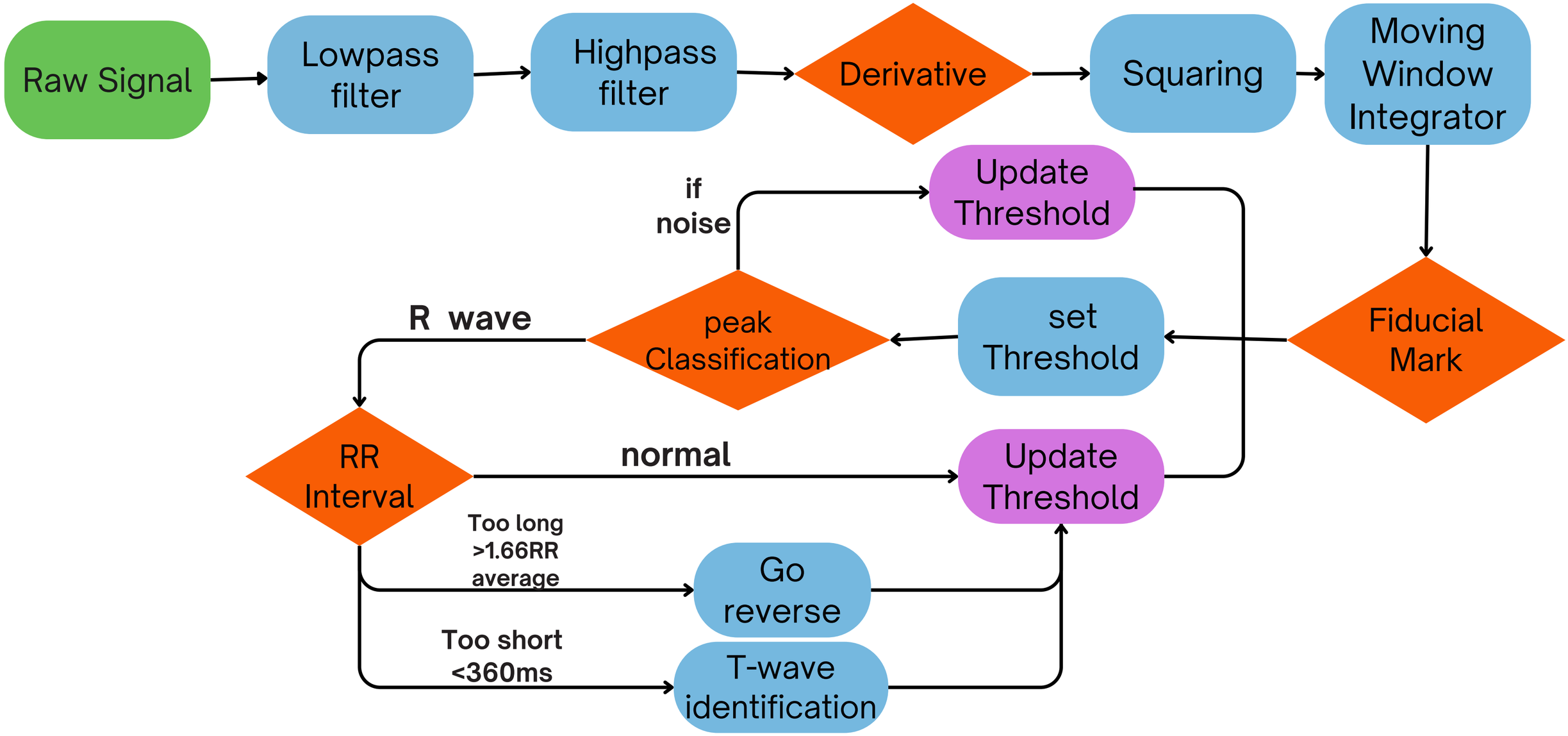
STEPS INVOLVED IN ANALYSIS

- Preprocessing
- Feature Extraction
- Applications Fields
  - Disease Classification
  - Heart Rate calculation



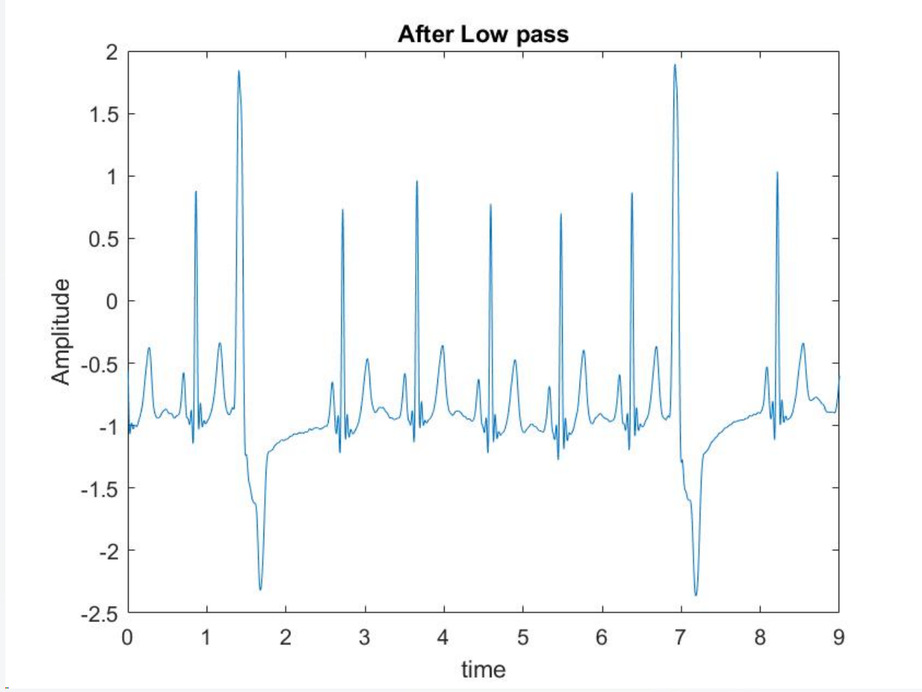
STAGES

Pan Tompkin's Algorithm



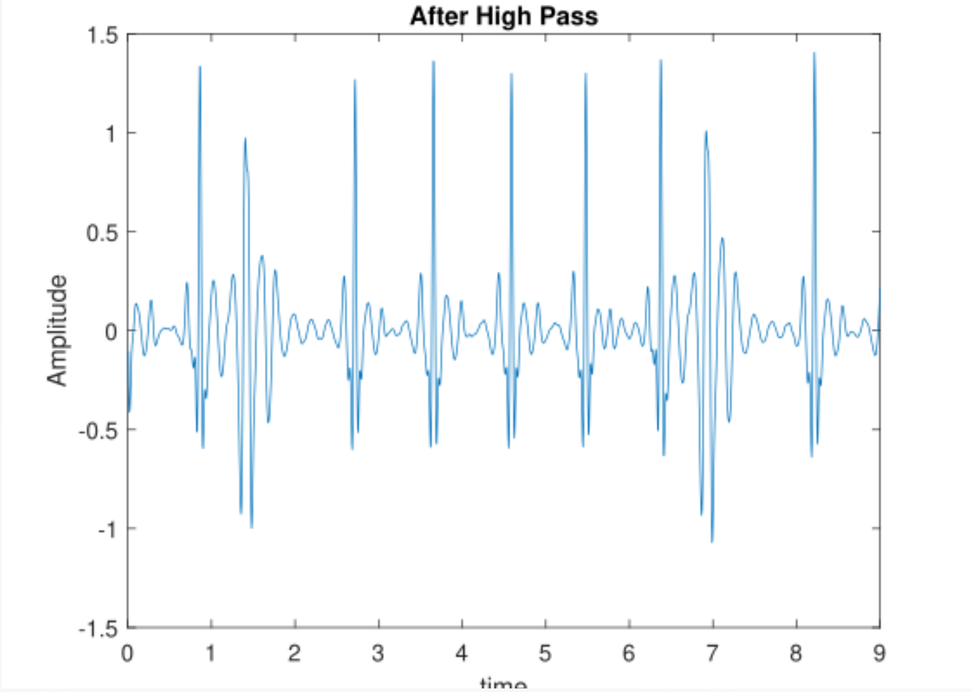
BANDPASS FILTER

1. Low pass filter



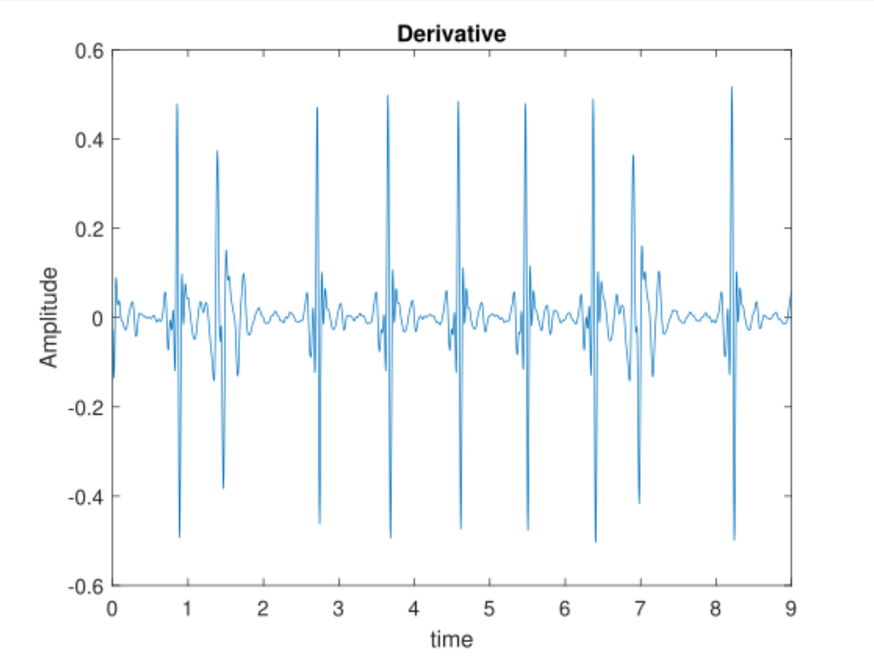
- Remove frequency above 11 Hz

2. High pass filter



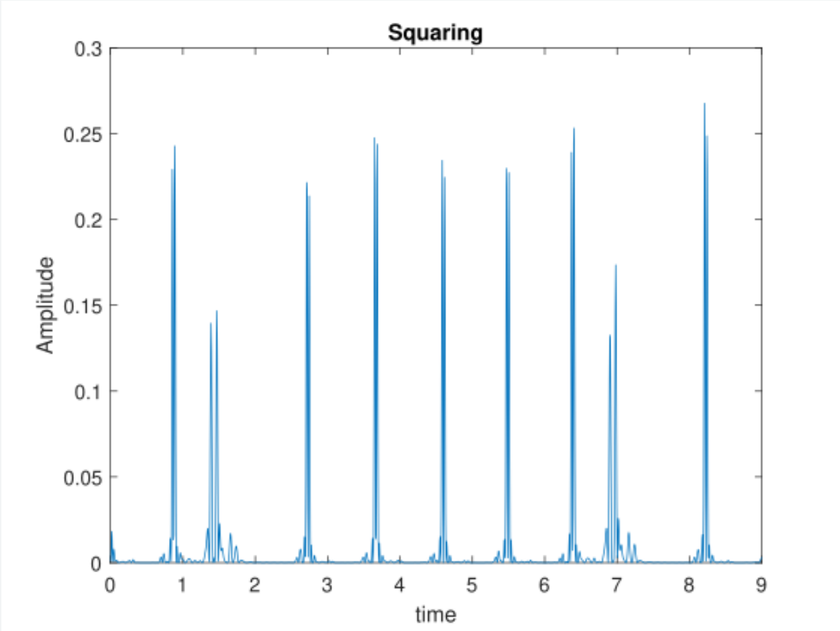
- Remove frequency below 5Hz

Derivative



- Provides the QRS complex slope information.
- Enhances the QRS energy.

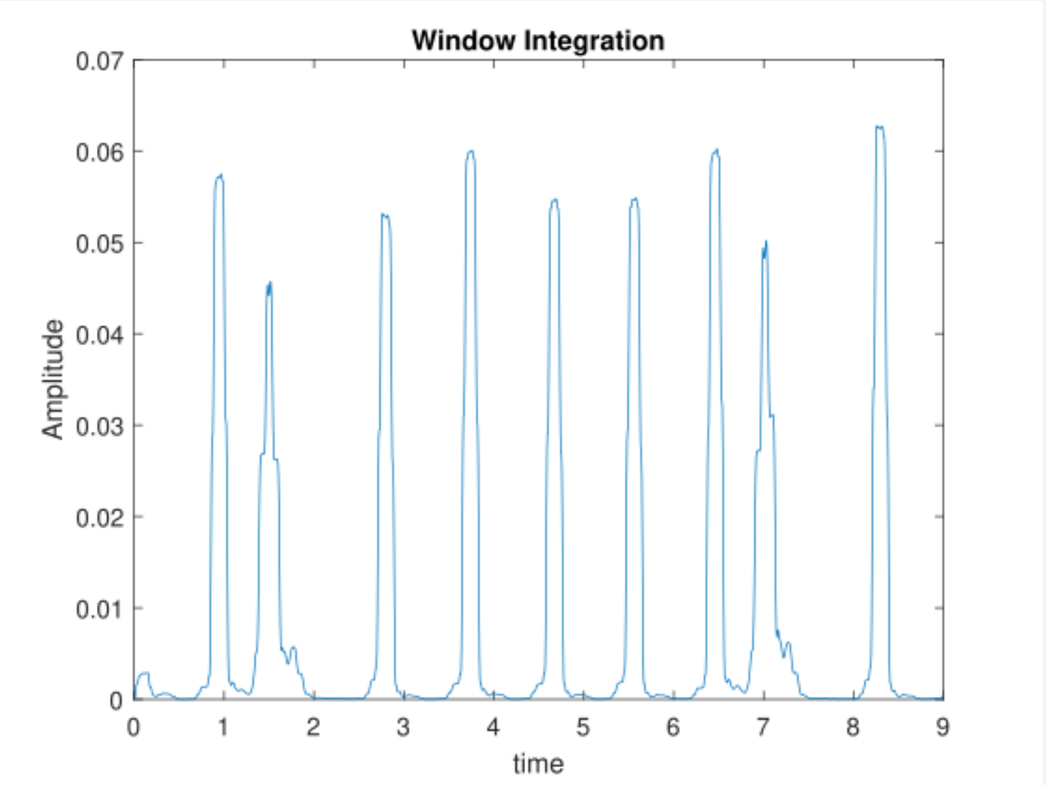
SQUARING



- Amplifies and makes the R wave of QRS complex positive.
- Suppresses P and T waves.

Moving window integration

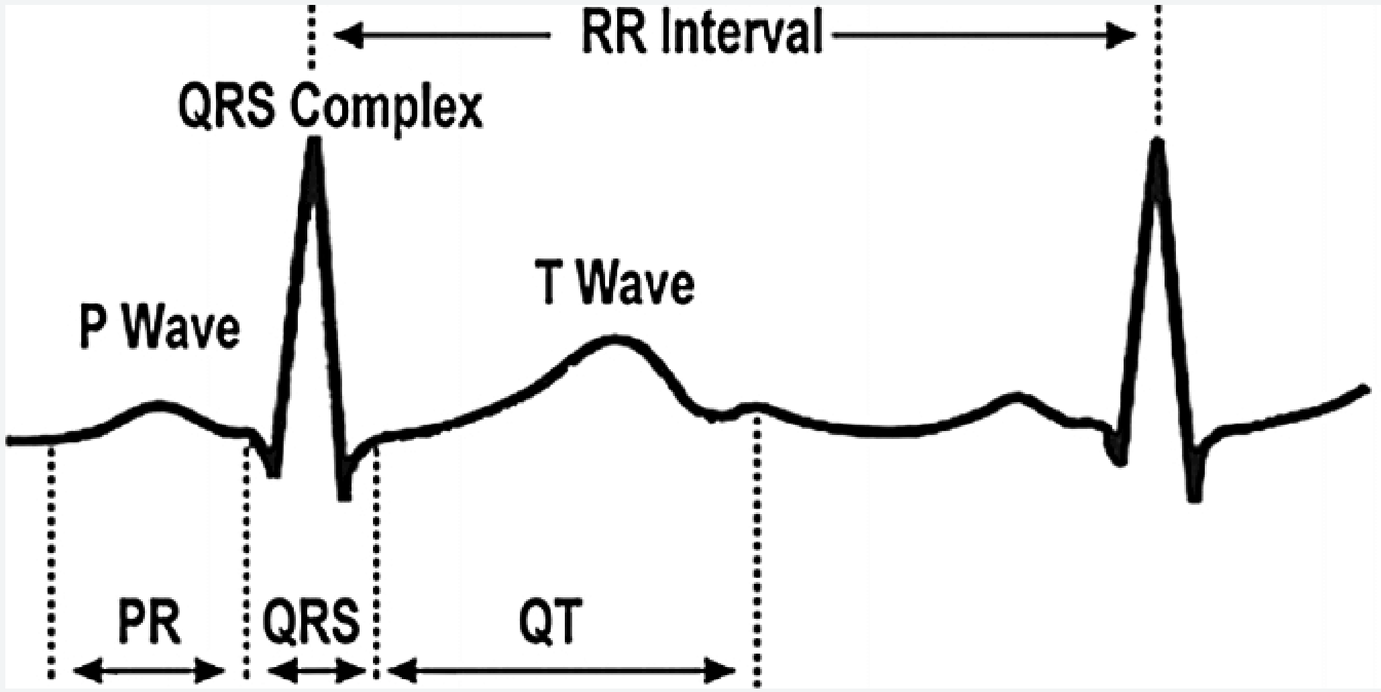
- Reduce noise and high-frequency components in the signal.
- It smoothens the QRS complex .
- This step is crucial for accurate peak detection.



After applying these filters signal, preprocessing is done and signal is ready for peak detection

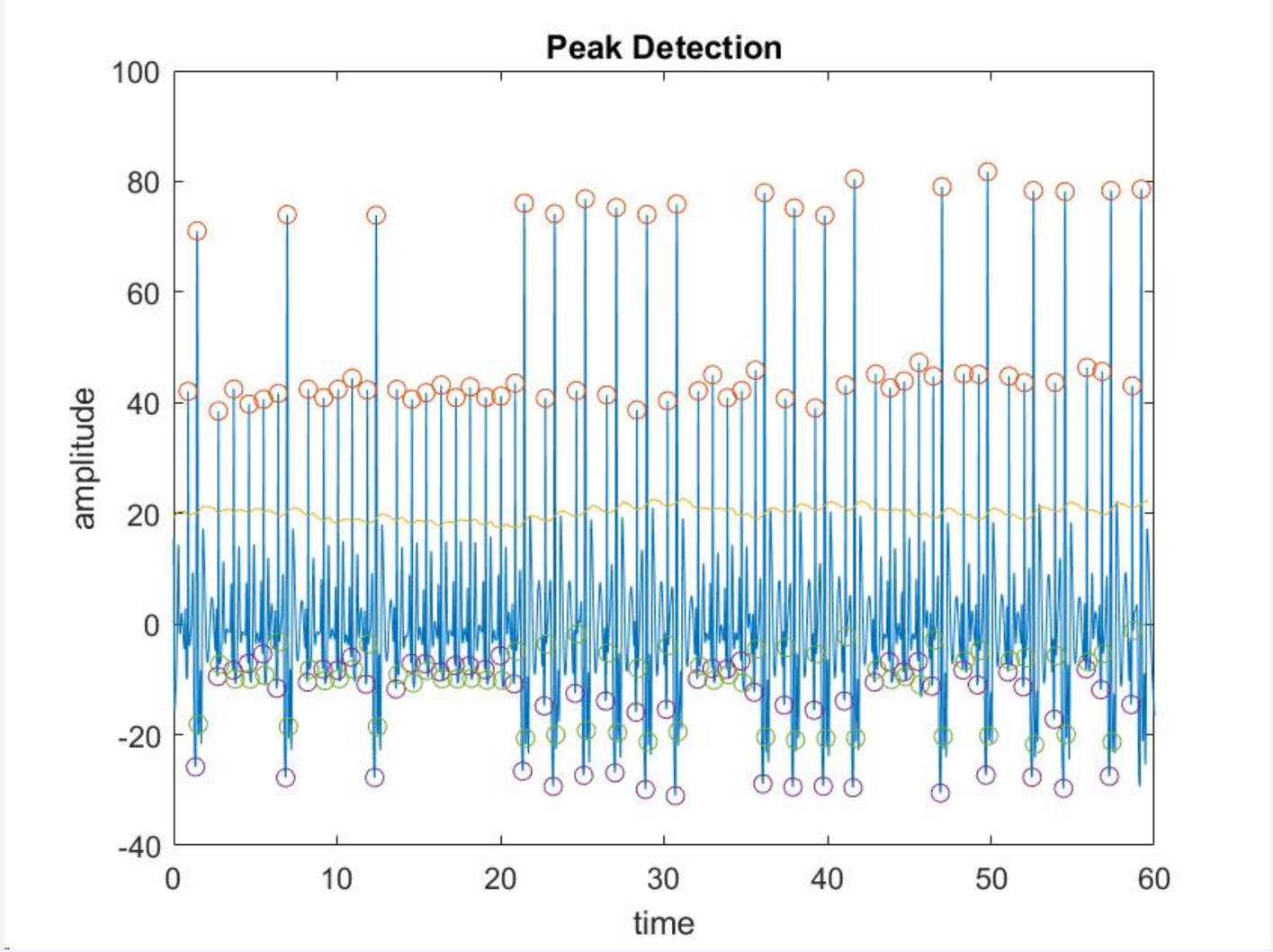
FEATURE EXTRACTION

- Thresholding - Two distinct Thresholding.
- Threshold1 - To be a signal peak.
- Threshold2 - For search back (RR MISSED LIMIT = 166% RR AVERAGE2)
- Refractory period (200 ms)- eliminates the possiblity of a false detection.



PEAK DETECTION

- Q,R,S peaks are detected as follows.
- These can be used to obtain the QRS width and the RR interval.



Disease Classification

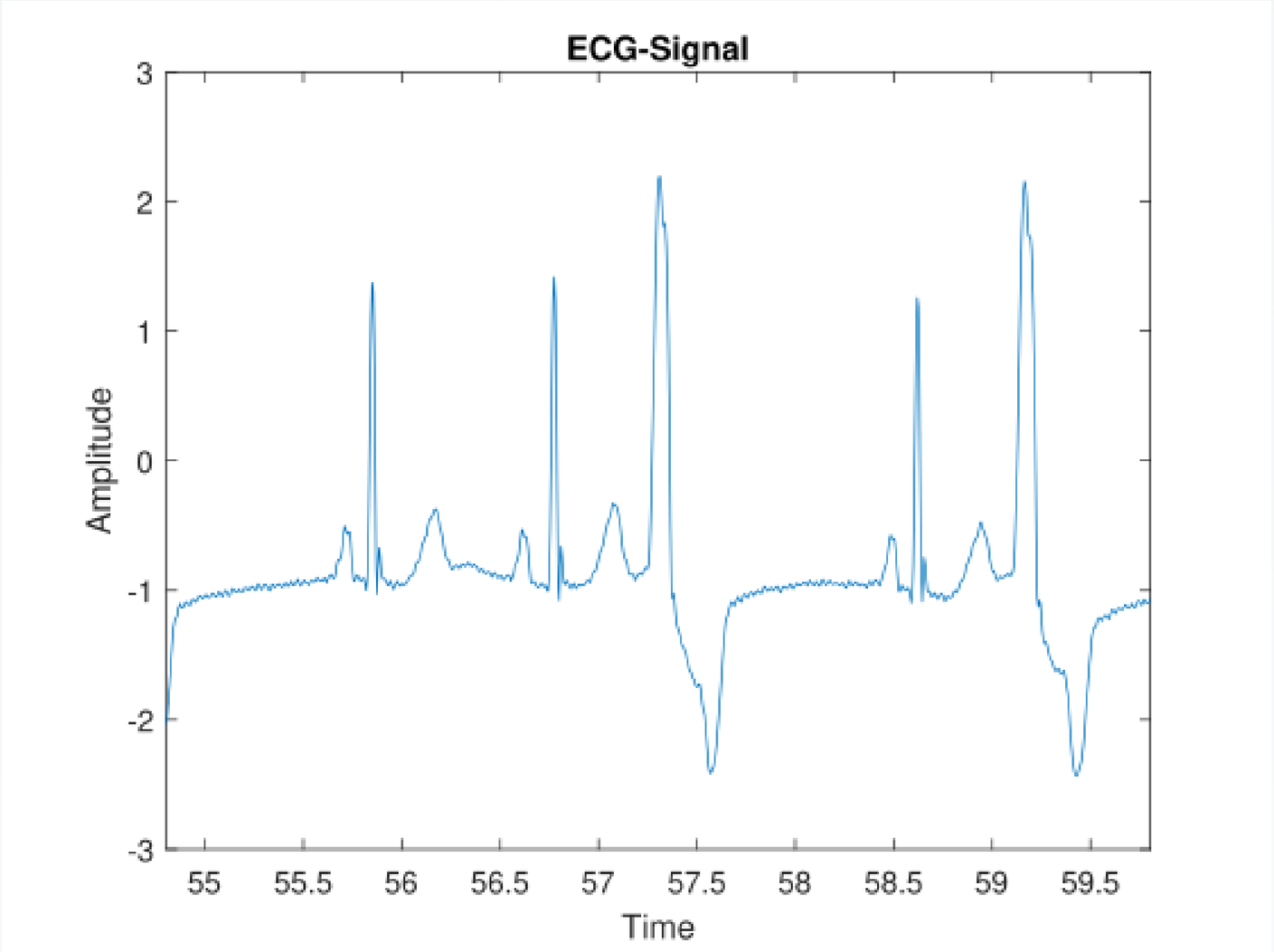
Category	Criteria
Bradycardia	RR_t > 1.5s or AR_t > 1.2s
Tachycadia	AR_t < 0.6s
Premature Ventricular Contractions	RR_t < 0.875ARt-2 QRS width > 0.12s $RR_t + RR_t$ = 2ARt-2
Atrial Premature Beat	RRt-1 < 0.875ARt-2 QRS width normal RRt-1 + RR_t < 2ARt-2

RR_t : RR interval

Average RR_t : Average RR interval, $AR_t = (RR_t + RR\ t\text{-}1 + \ldots + RR\ t\text{-}7)/8$

RESULTS

- The average heart rate and the disease is obtained.
- Average Heart rate is 65.9/min (60/RR)
- Disease - Premature ventricular contraction.

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Average heart rate: 65.9/min
There seems to be Premature ventricular contractions, 2 records in all have been found
 at time=12.5s 29.0s >>
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INDIVIDUAL CONTRIBUTION

Rohit and Manish

Understanding and Implementation of filters, differentiators, integrators etc.

Bharat and Sujal

Implementation of thresholding and feature extraction part.

Amar and Shreyas

Disease classification and Heart beat calculation.

THANK YOU