Understanding ECG Signal

Agenda

- Aim
- About ECG Signal
- Data required for the AI ML Model

Aim

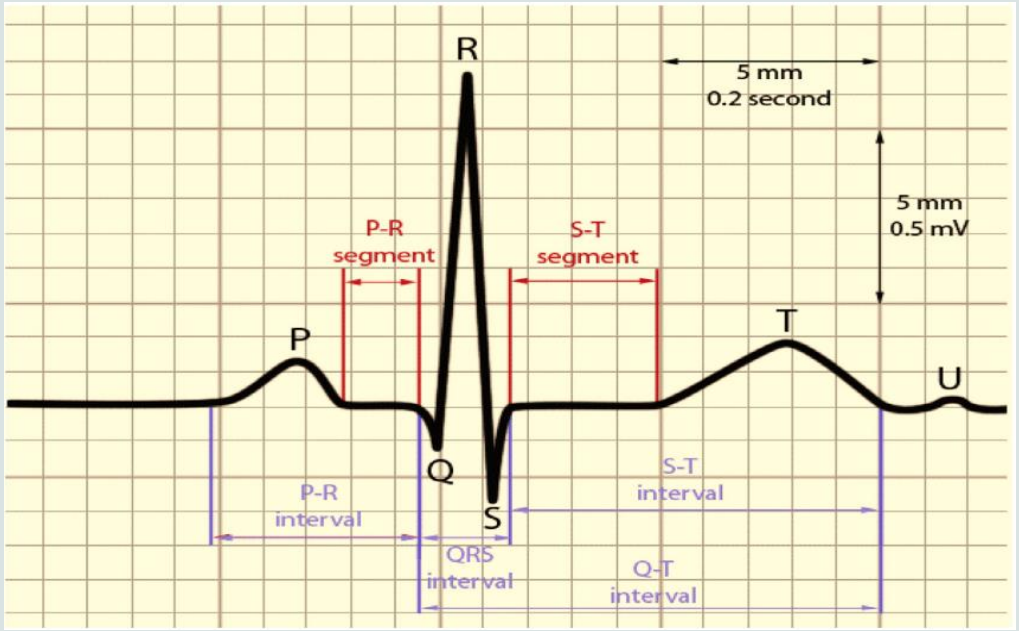
The aim of the presentation is to understand the functioning of the heart and the ECG signal generated and to figure out the data the needs to be extracted from the ECG Signal to detect Atrial fibrillation.

About ECG Signal

An ECG signal, also known as an electrocardiogram represents the electrical activity of the heart measured over time. It is a graphical representation of the voltage changes that occur during each heartbeat which are detected using electrodes.

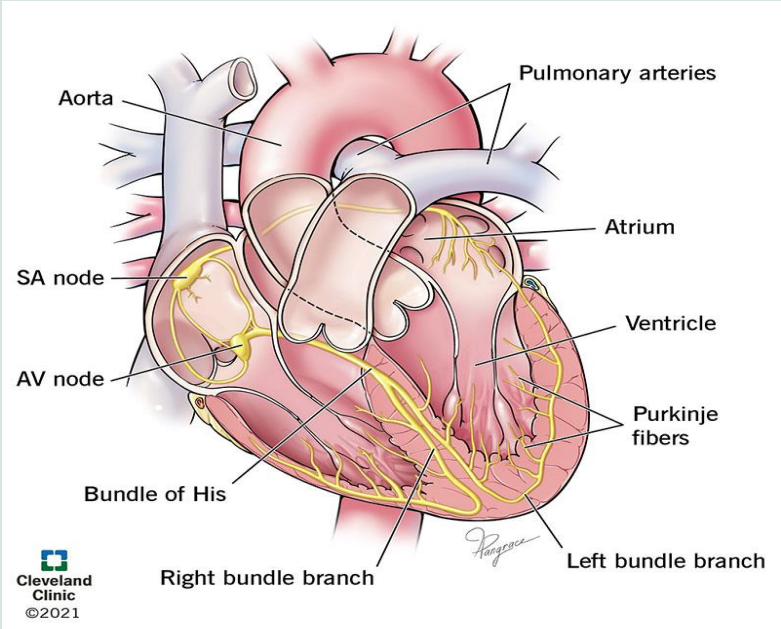
By analyzing the shape, amplitude, and timing of the different waves in the ECG Signal, we can assess the heart rate, and detect different signs of heart damage.

An ECG signal mainly constitutes of the PQRST complex which looks like,



The question that arises before actually understanding the ECG signal is 'What happens in a complete Sinus rhythm?'.

When the deoxygenated blood from the organs enter the right atria, then the SA node present there triggers an electrical impulse along the walls of the atria which marks the beginning of the Sinus rhythm. Now, this electrical impulse depolarizes the walls of the atria and the causes it to contract. The blood is the pushed into the ventricles. When this electrical signal reaches the AV node present in between the atria and ventricle, then the signal travels through the AV bundle (or His bundle) and reaches the apex of the ventricles, causing it to depolarize and contract.



Understanding the PQRST complex is a very crucial step before designing the AI/ML model. Here each wave (P, Q, R, S, T) represents the different electrical signals generated during various processes involved in a Sinus rhythm.

- P wave : This signifies the electrical impulse spreading through the waves of the atria and causing them to contract or depolarize eventually.
- Q wave : This is little negative deflection before the R wave. It represents the depolarization of the small portion of ventricle called the interventricular septum. This may be very faint or sometimes even absent in a normal ECg signal.
- R wave : This is a huge upward spike which represents the depolarization of the ventricles. As the contraction of the ventricle is stronger because it needs to transport the blood to the whole body for its functioning, which explains the large spike.
- S wave : This is a downward deflection indication the completion of ventricular depolarization.
- T wave : This indicates the repolarization or expansion of the ventricles.

Data required for the AI ML Model

Our goal is to detect Arrhythmias or atrial fibrillation from the ECG signal. Atrial fibrillation arises when the P wave is not present which indicates the abnormal functioning of the SA node. Atrial fibrillation is also diagnosed from an abnormal RR interval.

Thus, we can conclude that we need to detect the R peaks and then calculate the RR peak difference. This difference will then be used to train and use the AL ML model.

Thank you

Subhleen Singh

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Yogesh Tiwari