

INTELLIHEART
TECHNOLOGIES



Cardiac Arrhythmia Detection

Using Machine Learning Techniques



Our Agenda for Today

LIST OF KEY CONCEPTS

- What is Cardiac Arrhythmia?
- Electrical Activity in the Heart.
- Some Examples of ECG Signals
- Our Machine Learning Model
- Datasets
- Applications
- Work to be done

*Cardiovascular diseases are
the number 1 cause of death
globally, taking an estimated
17.9 million lives annually.*

– World Health Organization

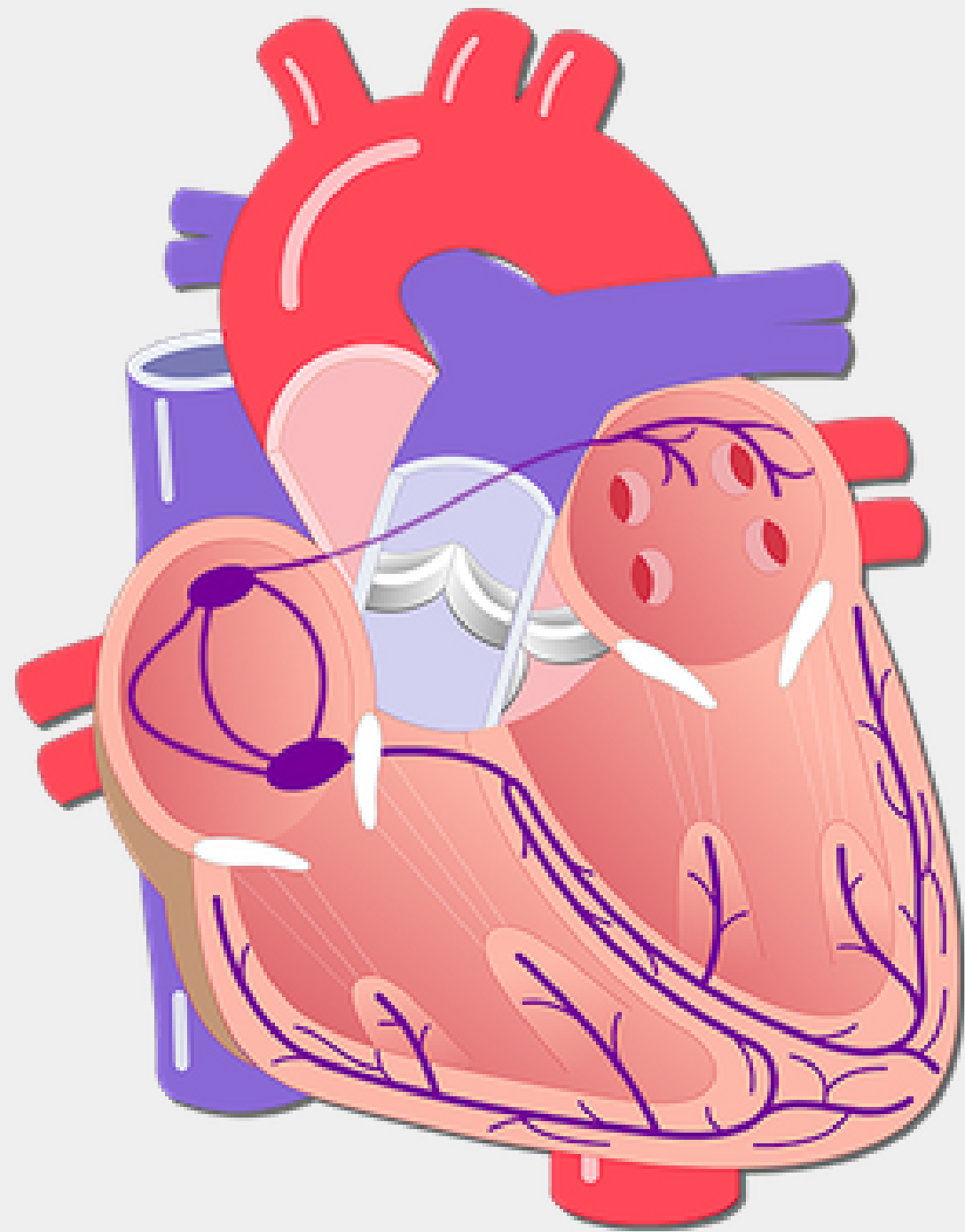


What is cardiac arrhythmia?

IN A NUTSHELL - IRREGULAR HEARTBEATS

It is a group of conditions where the heartbeat is too slow, too fast or irregular.

Electrical Activity in the Heart



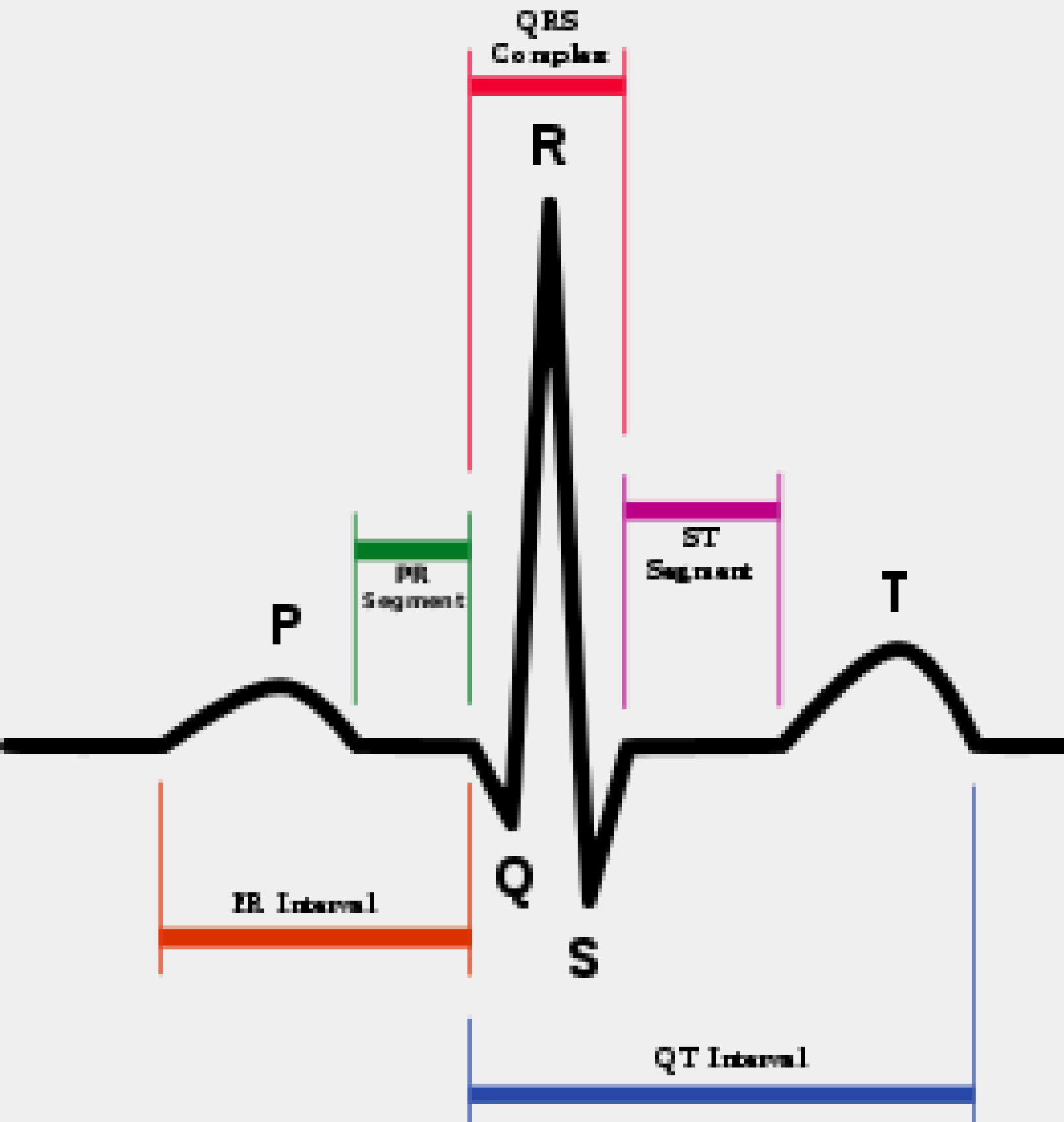
Heartbeats are triggered when electrical signals travel down the SA Node, AV Node and the Bundle of His

The ECG

detects and amplifies, the tiny electrical signals that the heart produces as when the heart muscles contract.

Extremely useful but a lot of expertise is required for effective diagnosis.

ECG Signals



P Wave - Atrial depolarization (activation)
QRS Complex - Ventricular depolarization
ST Segment - Repolarization (deactivation)

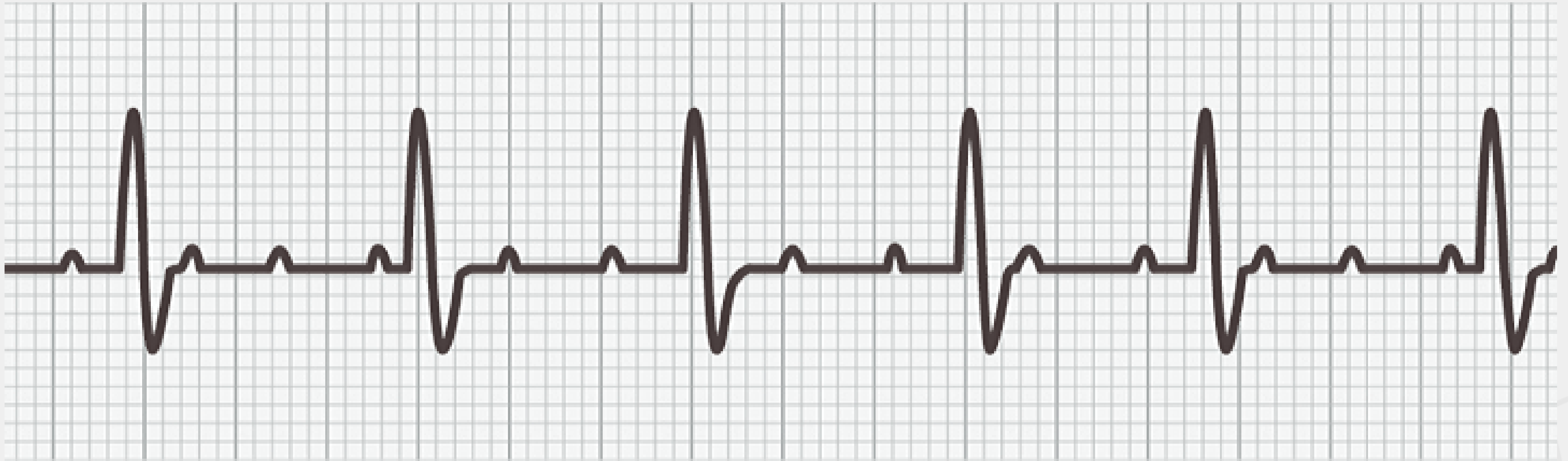
By studying the patterns that occur between these waves, we can correctly diagnose heart conditions.

ECG Signal Examples



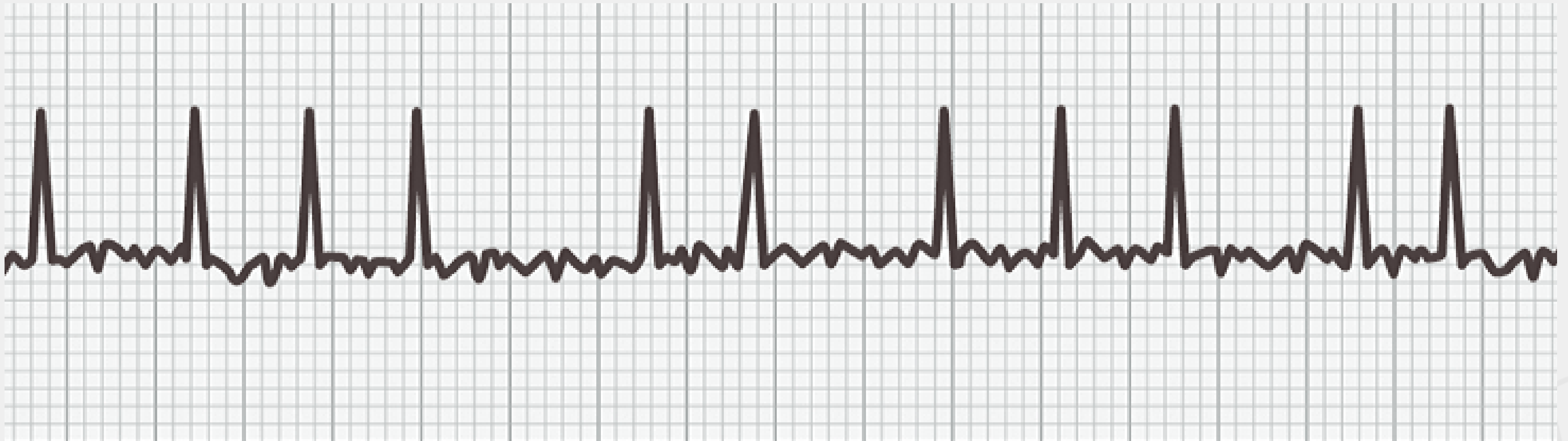
Normal Heartbeat

ECG Signal Examples



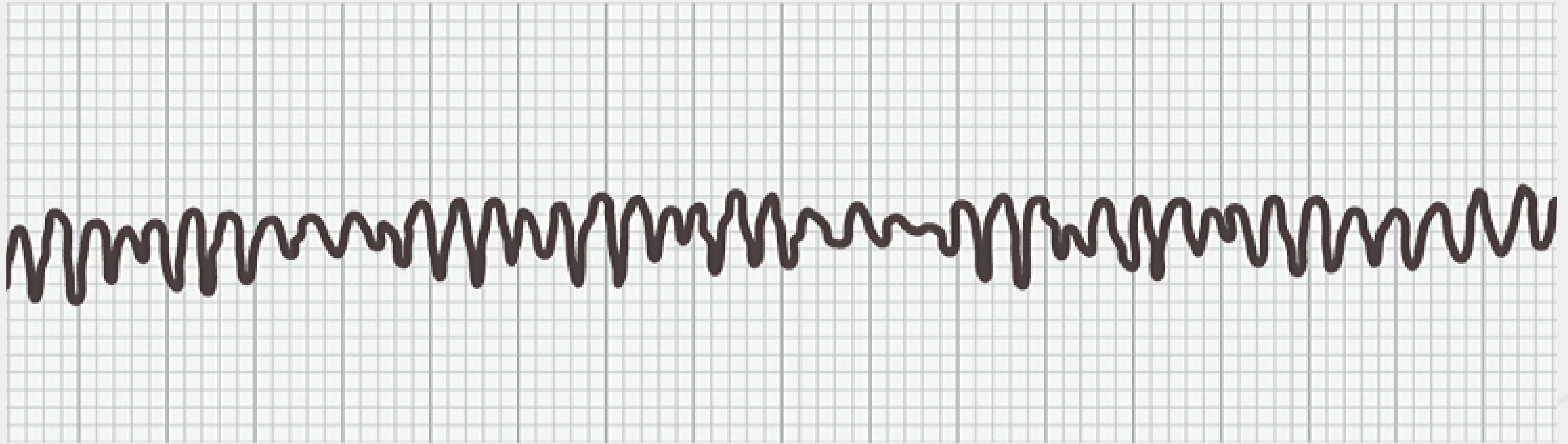
Second Degree Partial Block

ECG Signal Examples



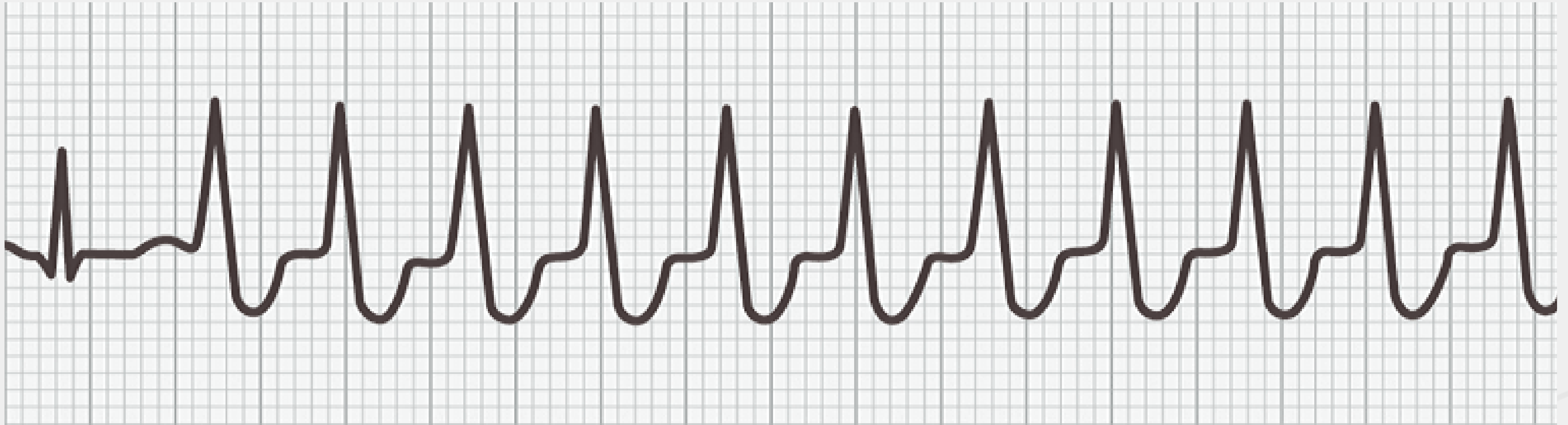
Atrial Fibrillation

ECG Signal Examples



Ventricular Fibrillation

ECG Signal Examples

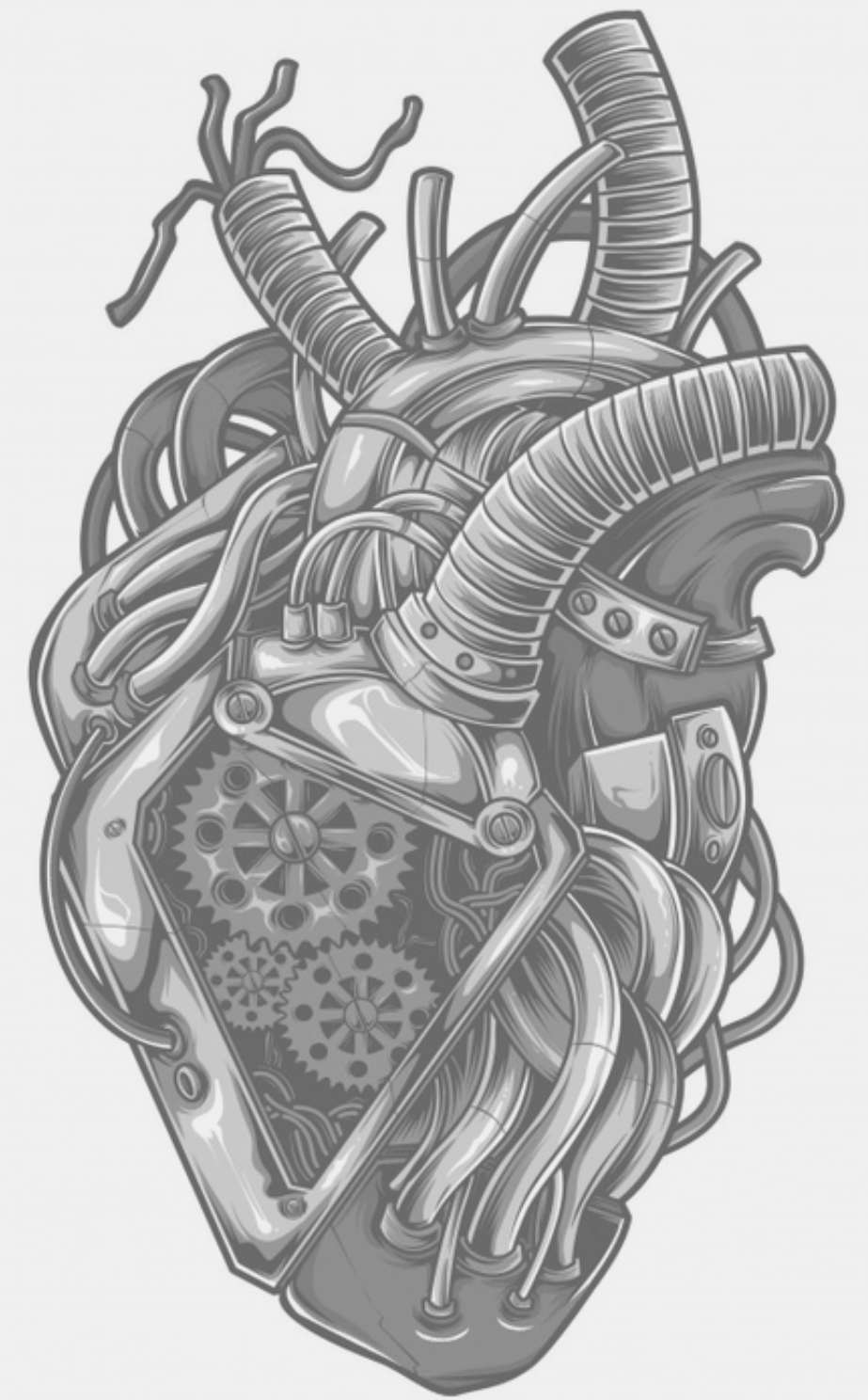


Ventricular Fibrillation

Our Machine Learning Model

TIME SERIES CLASSIFIER

Data obtained from an ECG is time series data. The objective of our model is to pick up on the subtleties of each type of wave and correctly detect and classify, the type of cardiac arrhythmia



The Datasets used

TO TRAIN AND EVALUATE

MIT-BIH Arrhythmia Dataset

Number of Samples: 109446

Sampling Frequency: 125 Hz

Number of Categories: 5

Classes: 0: Normal Heartbeat

1: Supraventricular Premature Beat

2: Premature Ventricular Contraction

3: Fusion of Ventricular and Normal Beat

4: Unclassifiable (Other)

PTB Diagnostic ECG Database

Number of Samples: 14552

Sampling Frequency: 125 Hz

Number of Categories: 2

Classes: 0: Normal Heartbeat

1: Abnormal Heartbeat

MIT-BIH

97.5% Accuracy
97.4% F1 Score
on Test Set

PTB - Diagnostic

Correctly classified 99.7
% of data labelled
Normal

However, classified a
majority of the ones
labelled abnormal as
normal... More data needed

Potential Applications



**HIGH-TECH ECG
MACHINES**



**MEDICAL DIAGNOSIS
SOFTWARE**



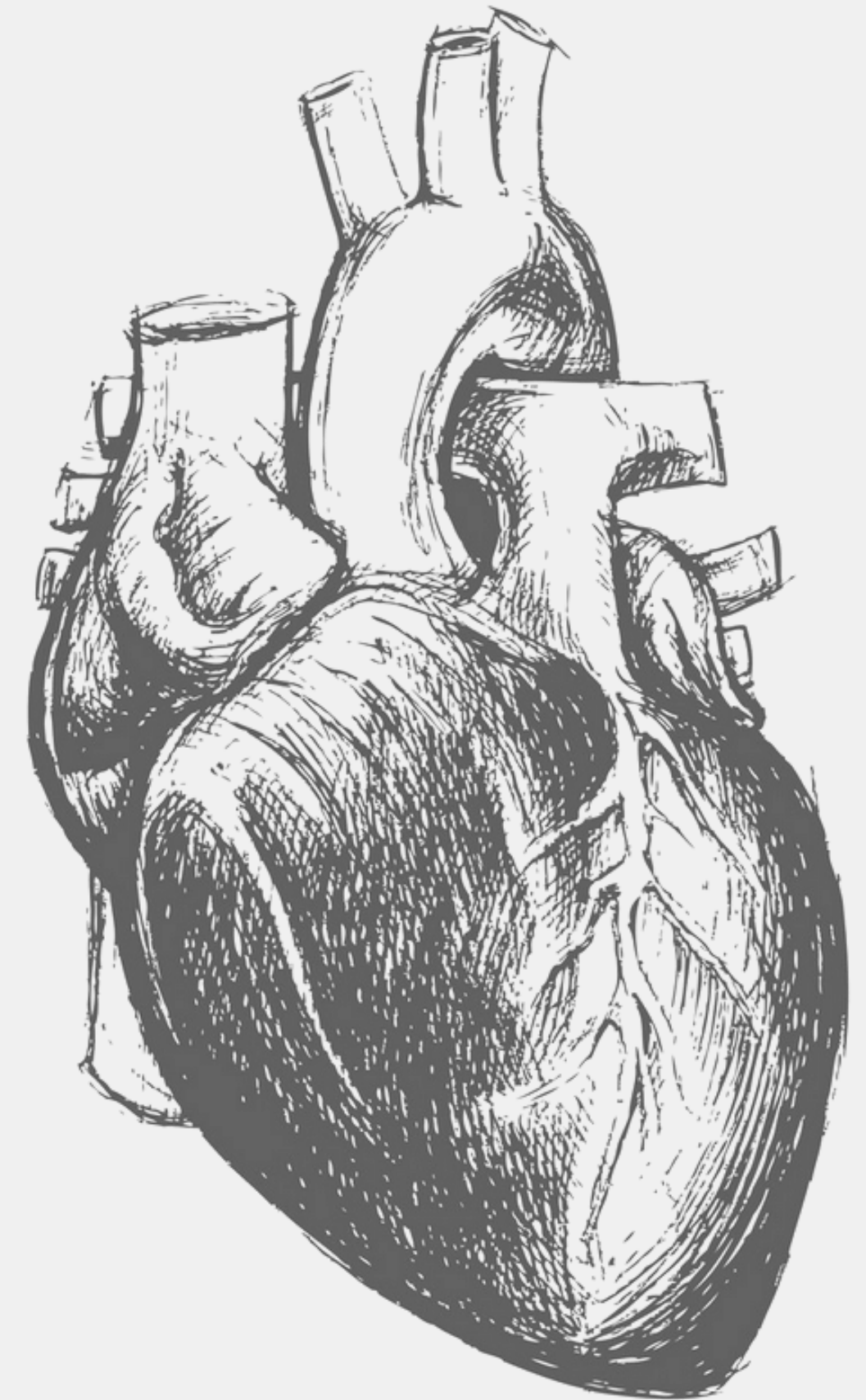
**CONSUMER HEALTH AND
FITNESS DEVICES**

Work to be done

Collect Additional Labelled Data.

Train models on multiple classes, currently just 4.

Add training data from a variety of sources.



References

1. Wikimedia Commons: Cardiac Arrhythmia -
https://commons.wikimedia.org/wiki/File:2024_Cardiac_Arrhythmias.jpg
2. Heart.org - What is Arrhythmia?
https://www.heart.org/-/media/data-import/downloadables/7/c/7/pe-abh-what-is-arrhythmia-ucm_300290.pdf



QUESTIONS?

