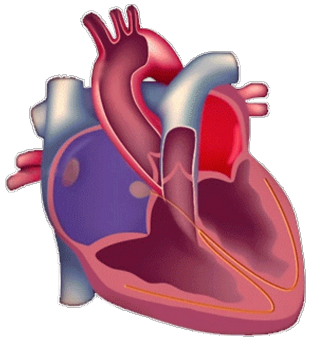
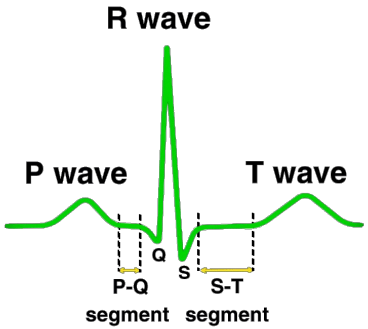
Data Science

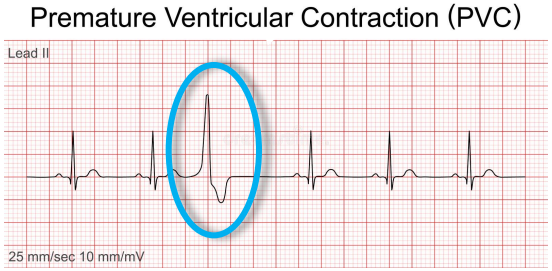
PVC Detection

Premature **V**entricular **C**ontractions detection

Projecto de Engenharia e Ciencia de Dados





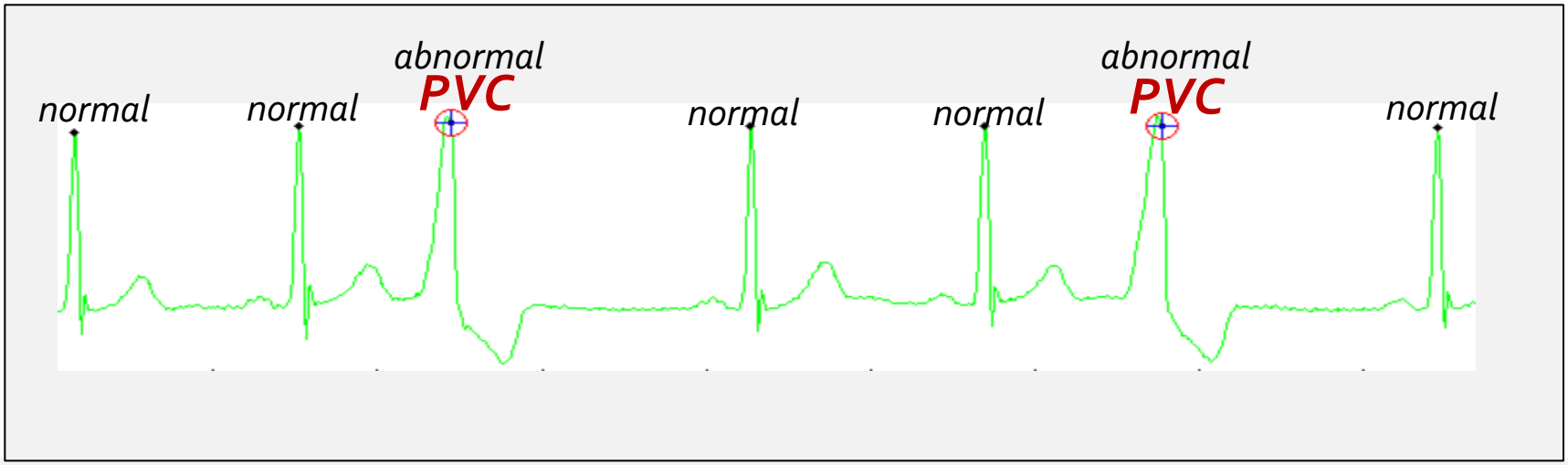


Summary

1. Objectives

Clinical problem

- Context
  - **PVC** – premature ventricular contractions
  - A specific type of arrythmia
- Main goal
  - Given an electrocardiogram, **how many PVC/ hour** ?
  - In other words, classify an **ECG beat as: normal or abnormal {0,1}**



Summary

2. Eletrocardiogram

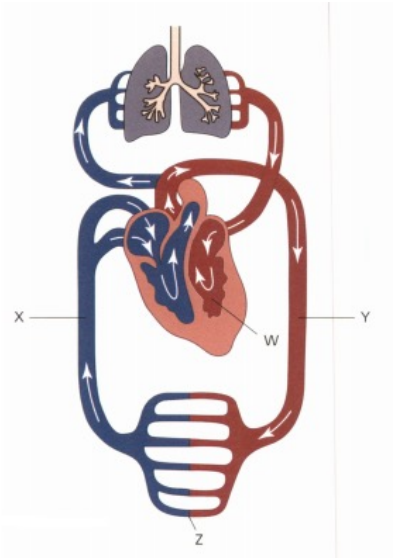
The heart's function is to provide oxygen to the human body organs .

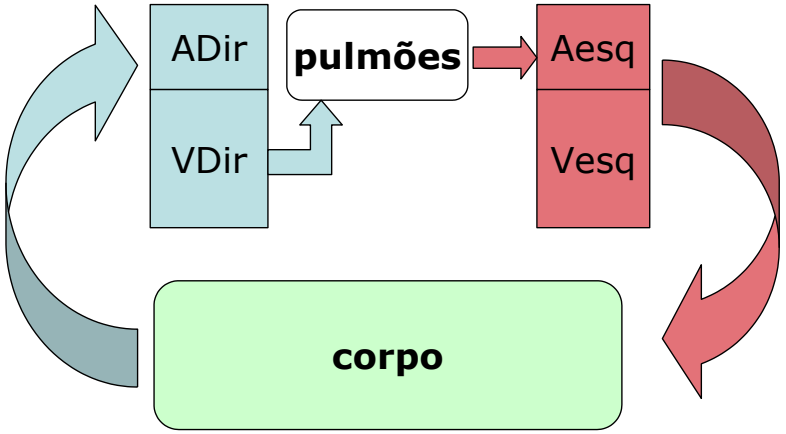
How it works ?

Myocardium, valves, atria, ventricles, …

Large circulation / small circulation

…

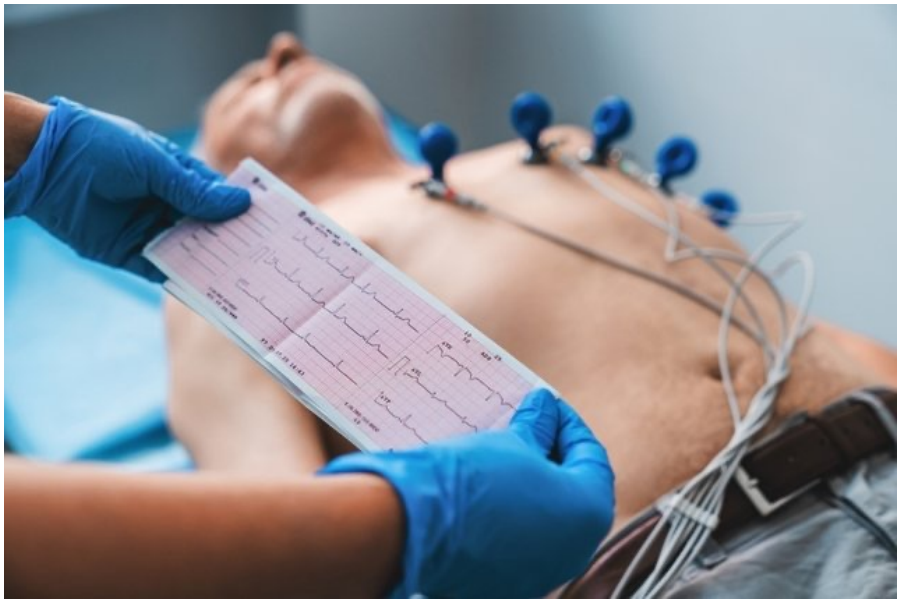




2. Eletrocardiogram

Electrocardiogram

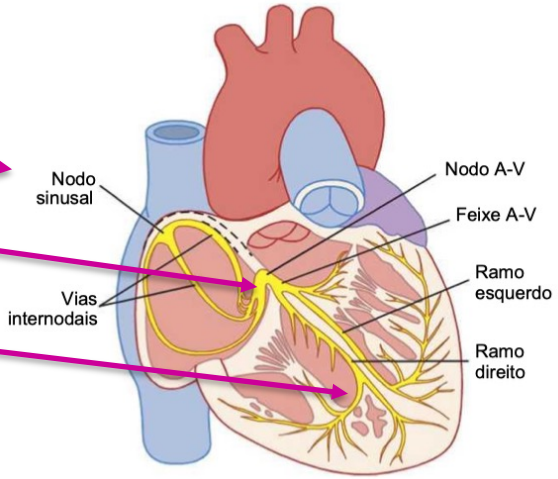
- Measure the electrical activity of the heart

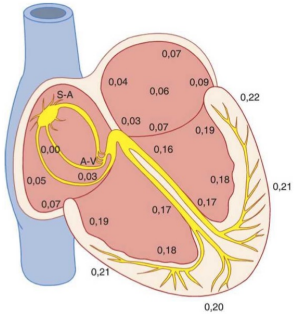


2. Eletrocardiogram

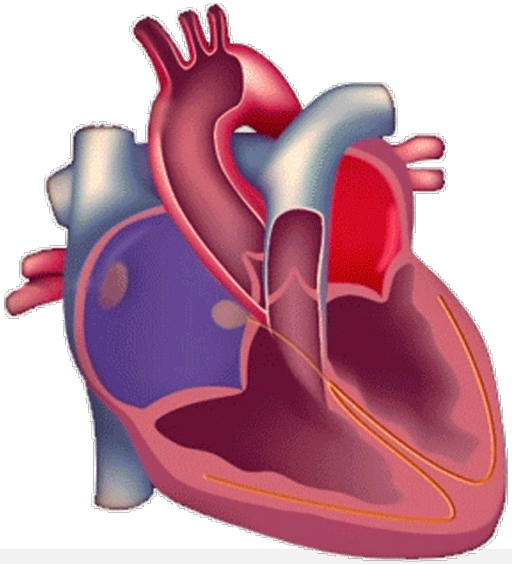
Cardiac cycle – electrical activity

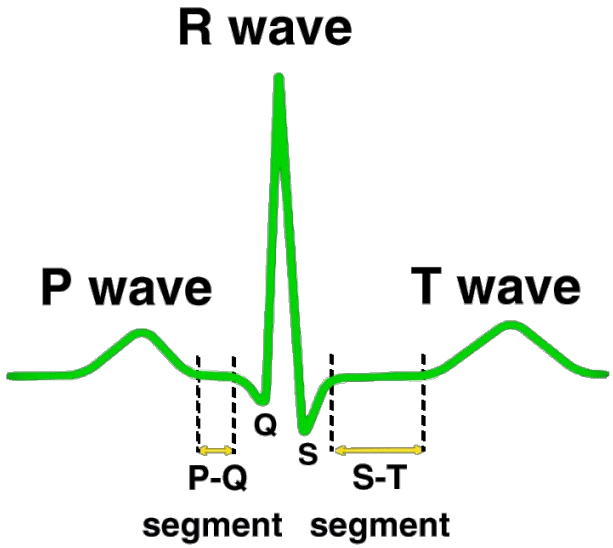
- Sinoatrial node (SA)
- Atrioventricular node (AV)
- Purkinje fibers





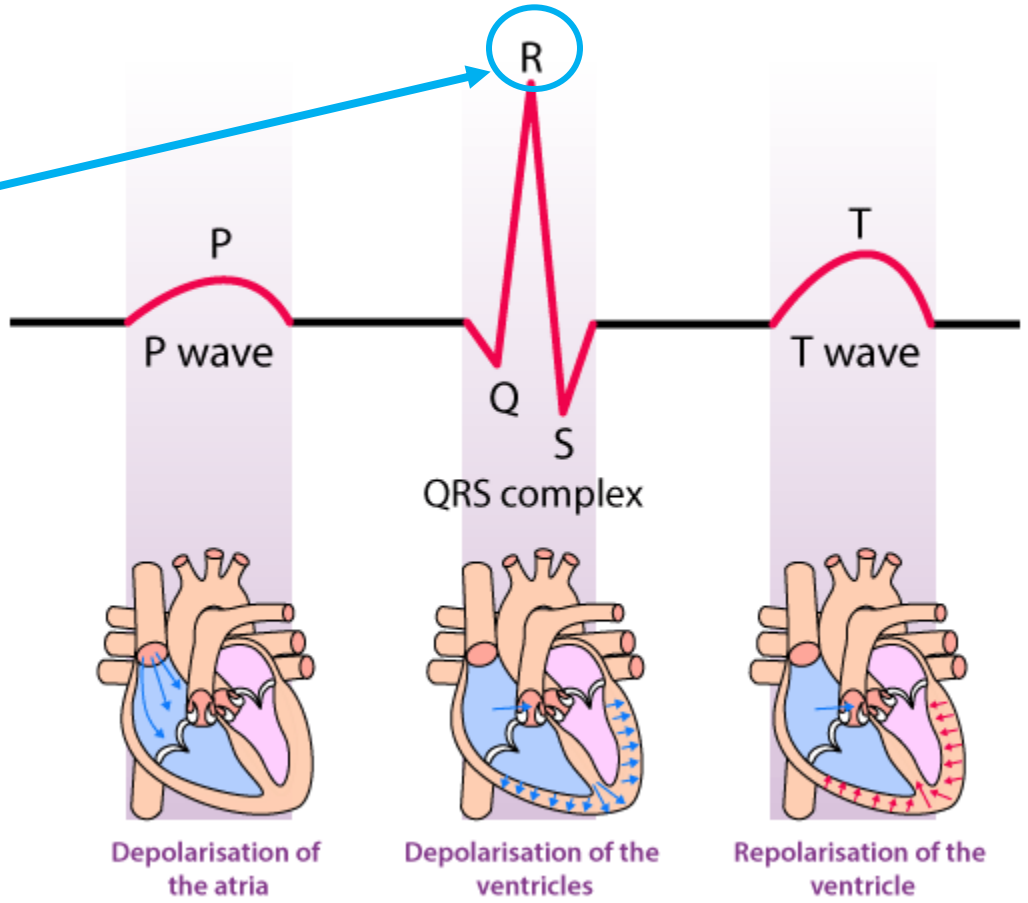
- Systolic = contraction
- Diastolic = relaxation





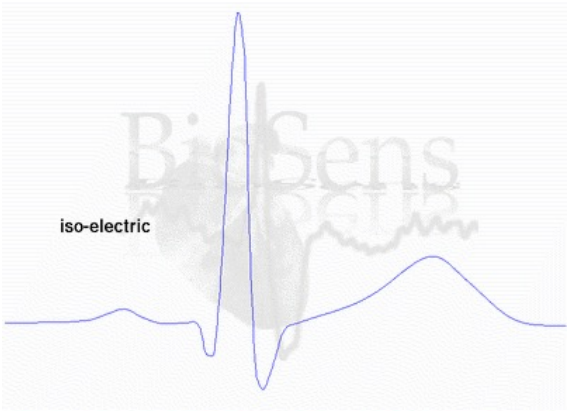
2. Eletrocardiogram

- Cardiac cycle
  - P and T waves
  - QRS complex
  - **R peak**



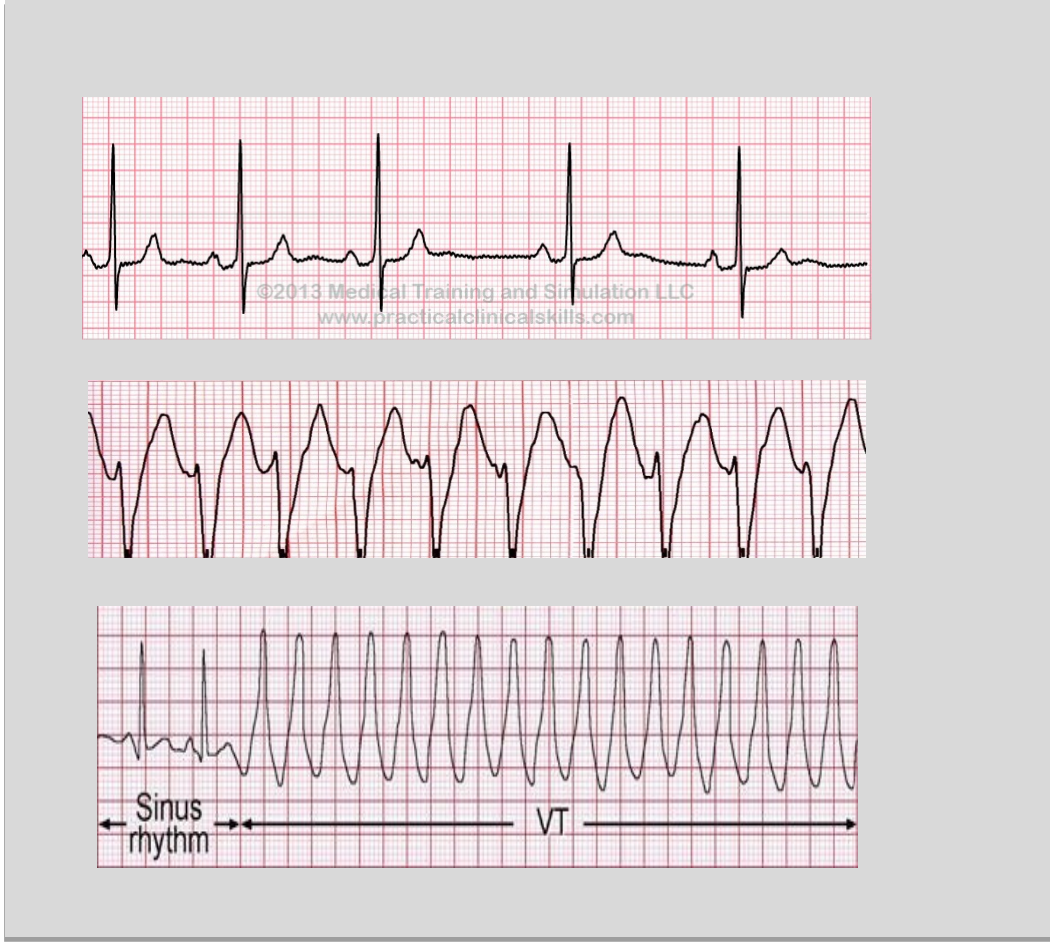
2. Eletrocardiogram

- **Normal rhythm**
  - 60-100 beats / min
  - P waves before the QRS complex
  - PR interval [0.12 - 0:20] seconds, and approximately constant
  - QRS interval [0.06 - 0.12]



2. Eletrocardiogram

- **Arrhythmias**
  - Types of arrhythmias ??
  - Several types (dozens)!
  - **Two main types**
    - Rhythm (regular ECG)
    - Morphology (irregular ECG)

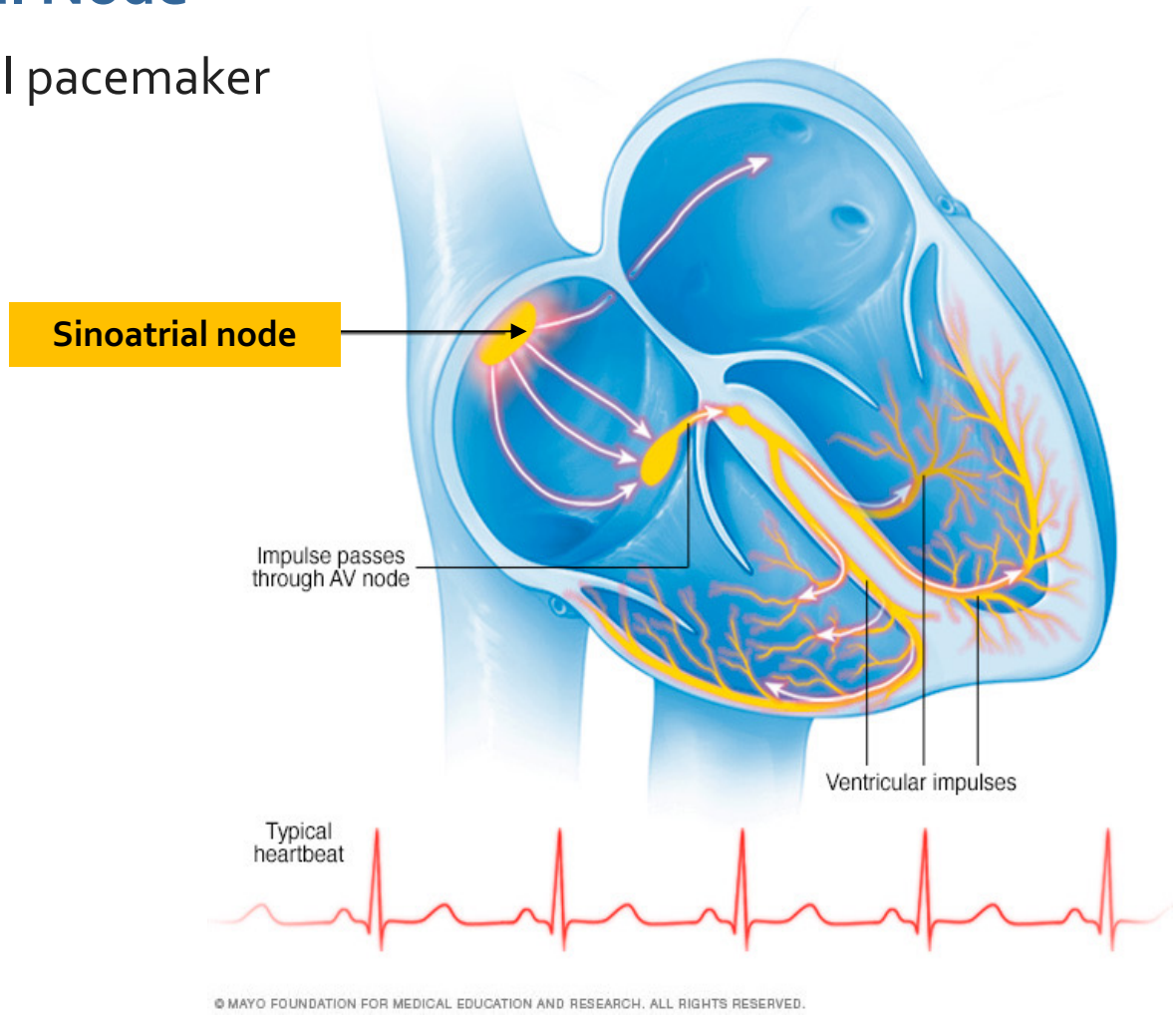


Summary

- Objectives
- R peak detection
- **3| PVC detection**
- Datasets / validation
- Requirements

3. PVC detection

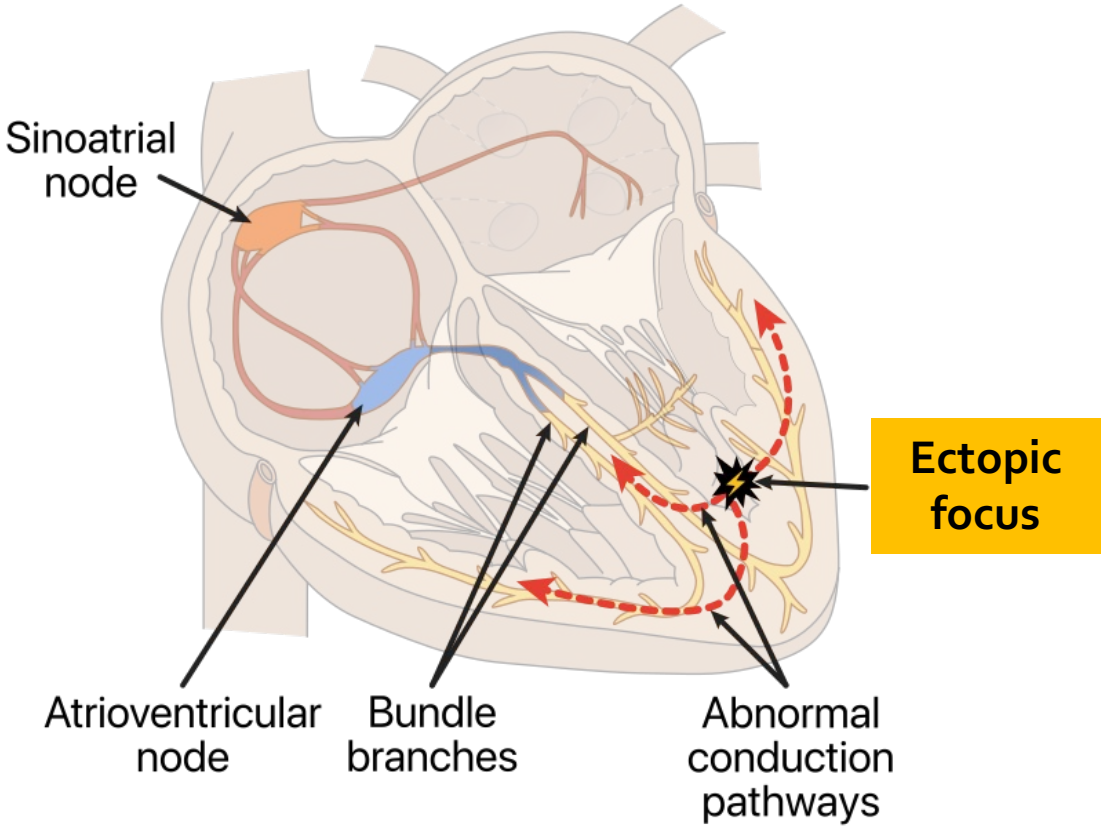
- **Sinoatrial Node**
  - A natural pacemaker



3. PVC detection

Premature ventricular contractions

- Ectopic focus !



3. PVC detection

PVC – Premature ventricular contraction

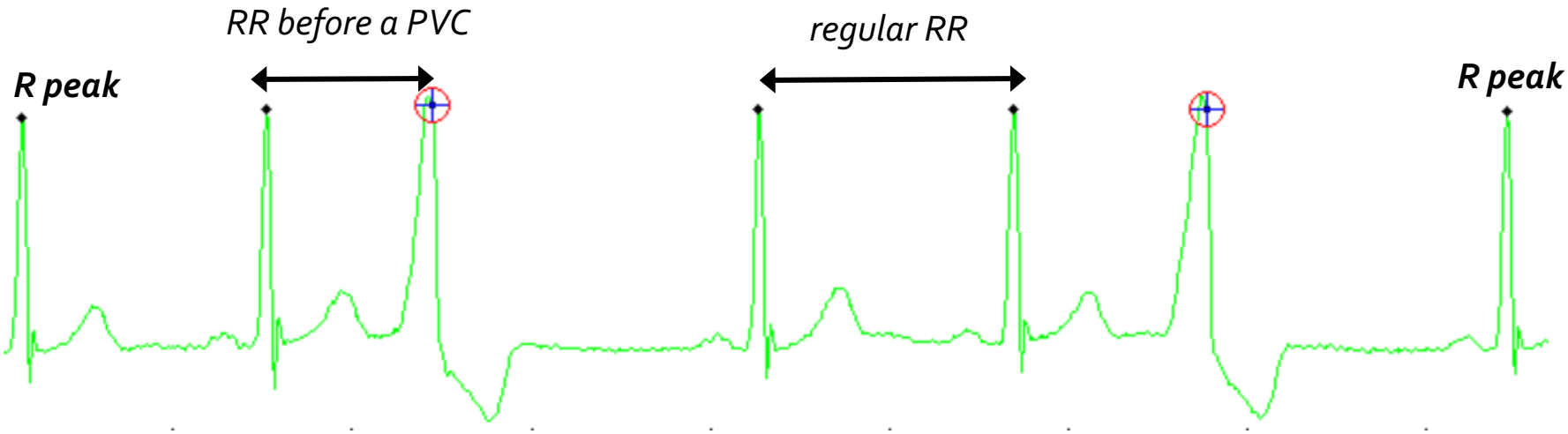
- A **focus in the ventricles** can "trigger" and originate an extra ventricular systole.

- A single PVC is not clinically significant
- However, PVC may progress to dangerous conditions (ventricular fibrillation)

3. PVC detection

How to detect a PVC

- The beat occurs before the expected
- The complex QRS presents an excessive width/duration, when compared with a normal beat



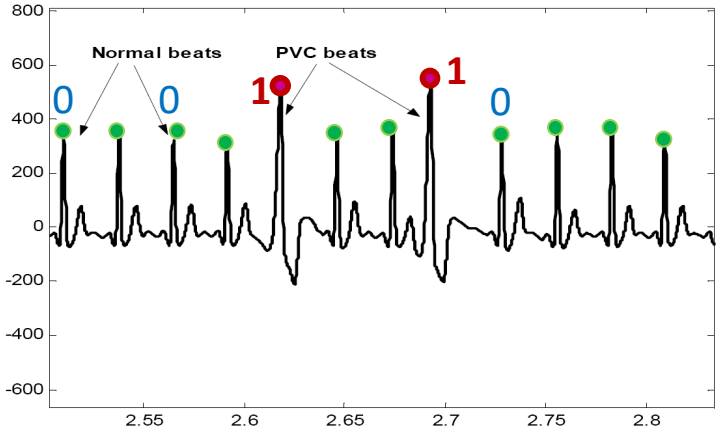
Summary

- Objectives
- R peak detection
- PVC detection
- **4| Datasets / validation**
- Requirements

4. Data sets / validation

DATPVC (360 Hz) - PVC

- DAT.ecg - signal
- DAT.ind - R peaks indexes
- DAT.pvc - 0/1 - normal / PVC



- 11 records / patients
- Approximately 30 minutes each
- Sampling rate 360 Hz

Summary

- Objectives
- R peak detection
- PVC detection
- Datasets / validation
- 5| Requirements

5. Requirements

For each patient (file)

- Given an ECG register

- **Compute / visualize**
  - The number of total beats
  - The mean heart rate
  - The number of PVCs
  - The number of PVC/hour
  - The F1 score of the PVCs classification system
  - The average ECG (**figure**) using normal cycles

Example

> 220 beats

> 65 bpm

> 39

> 14

> 0,78