

# AI in Biomedicine Final Assignment

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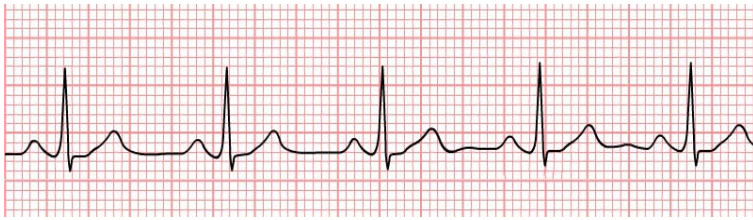
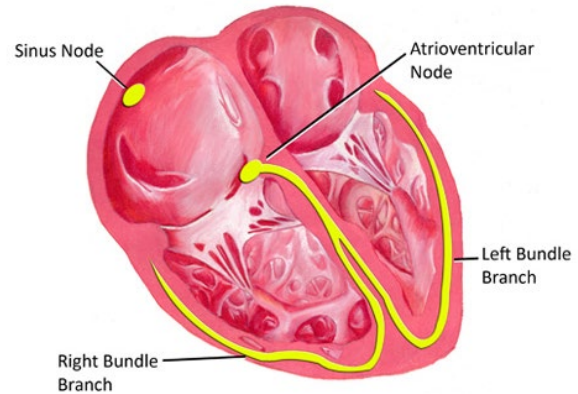


The background features a dark blue, almost black, field filled with intricate, glowing patterns. These patterns consist of numerous fine, light blue lines that curve and swirl, creating a sense of motion and depth. Interspersed among these lines are clusters of small, bright blue dots or particles, some of which appear to be trailing off, giving the impression of a dynamic, digital or scientific environment. The overall effect is one of high-tech sophistication and complexity.

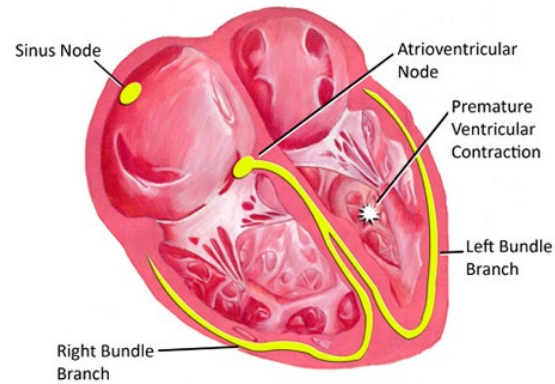
# Part 1: PAC/PVC

# PAC/PVC: Electrophysiology

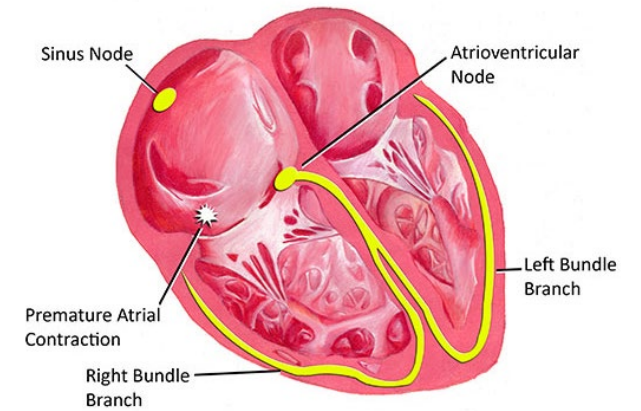
## Normal Sinus Rhythm



## Premature Ventricular Complex



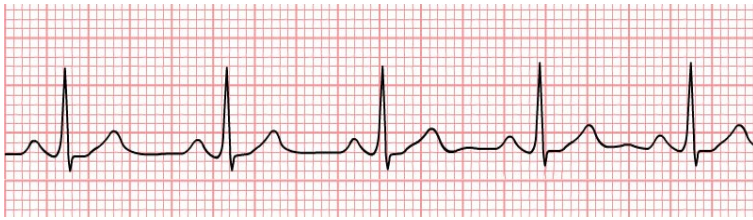
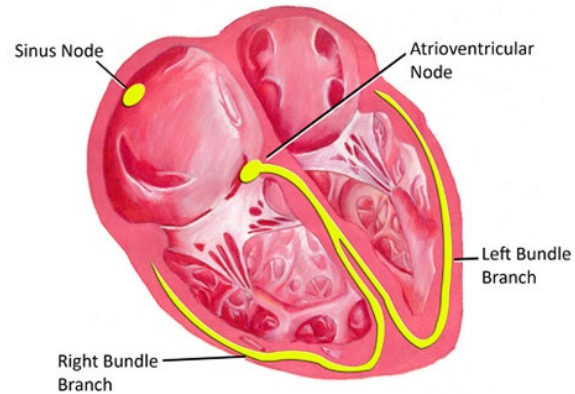
## Premature Atrial Complex





# PAC/PVC: Problematics

## Normal Sinus Rhythm



## Premature Ventricular Complex

- Benign: symptomatic/asymptomatic
- Frequent PVC, sometimes paired with left ventricular dysfunction [1].
- LV dysfunction progression (long-term) [1].



## Premature Atrial Complex

- Benign: symptomatic/asymptomatic
- Frequent PAC associated with increased stroke and death [2].
- PAC for prediction of first time appearance of AF [3].



The background of the slide features a dark blue, almost black, field filled with numerous small, glowing blue dots. These dots are arranged in a way that creates a sense of depth and movement, with some appearing as sharp points of light and others as soft, out-of-focus bokeh. Overlaid on this field are several thin, wavy, light blue lines that flow across the frame, resembling digital data streams or perhaps the paths of particles in a scientific visualization. The overall effect is one of high-tech, futuristic, and dynamic energy.

## Part 2: Assignment objective



# Part 2: Assignment objective

## Create a beat classifier for ECG signals:

Classify every beat into Normal (N), Supraventricular (S) and Ventricular (V)

Input:

- 2-lead ECG signal of length  $n$
- R peaks position

Output:

- N/V/S annotation for each R peak position

N: normal sinus rhythm beats

S: supraventricular beats (PACs)

V: ventricular beats (beats originating in the ventricles, mostly PVCs)

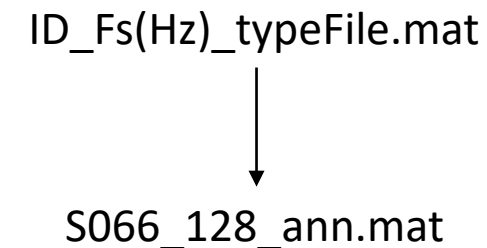
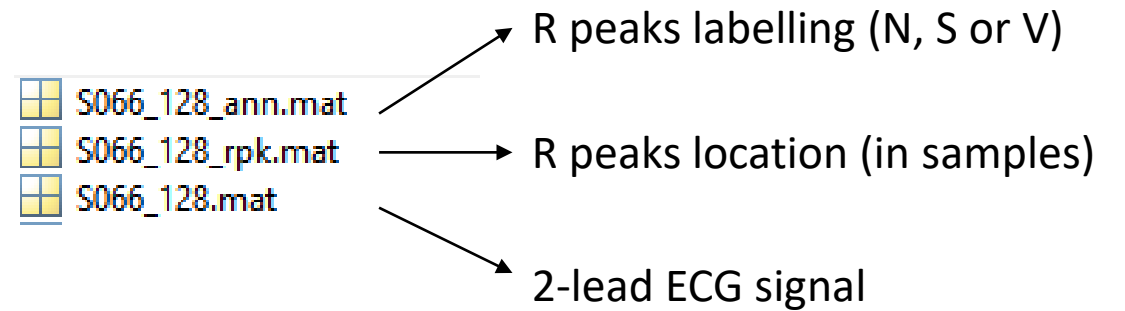
The background of the slide is a dark blue field filled with abstract, glowing patterns. These include wavy, undulating lines and clusters of small, bright blue dots, creating a sense of digital movement and data flow. A solid black rectangular box is centered horizontally and vertically, serving as a backdrop for the title text.

# Part 3: Database



# 3.1. Description

- Total number of patients: 105
- Fs: different sampling frequencies, some 128 Hz, others 250 Hz
- 2-lead ECGs
- R peak position annotations
- Labelling: N, S and V classes



## 3.2. Key elements

- Decision of network input: take into consideration how PAC and PVC affect the signal.





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# Part 4: Evaluation

## 4.1. Report

- Write a report in paper format: introduction (brief), materials and methods, results, discussion and conclusion
- Describe in detail the signal preprocessing, the model chosen and its training.
- Justify your choices in a sensitive way and provide a clear interpretation of the results obtained



## 4.2. Scoring

1. Submit report + code (training code and the final working model) one week before the exam. Provide results on validation and test performed locally (on your computer) using the training set.
2. Once the report and code have been submitted you will be provided with a test set without labels: submit the labels created by your model within the **next day of the submission** in the same format as the labels provided to you in the training set
3. In the next days, you will be provided with a test set scoring (previous to the exam) .
4. In the exam you will have to justify the choices made and to interpret the results obtained. You will also have to answer questions regarding the material seen during the lectures and practical sessions.

## 4.3. Deadlines

### Possible exam days:

- 18 January
- 19 January
- **25 January**
- 26 January
  
- 1 February
- 2 February
- 8 February
- 9 February
- 15 February
- 16 February

18	Report + code	Test set (without labels)
19	Test set predictions	
20		Scoring Test set
21		
22		
23		
24		
25	exam	





# Link to dataset

<https://drive.google.com/drive/folders/1e1g0htpfBXe-CP1woGaLWOnp2wiX8ze5?usp=sharing>

The background features a dark blue, almost black, field filled with numerous small, glowing blue dots. These dots are arranged in a way that creates a sense of depth and movement, with some appearing as sharp points of light and others as soft, out-of-focus bokeh. Overlaid on this field are several thin, wavy, translucent blue lines that flow across the frame, resembling ripples on water or the paths of particles. In the center, a solid black rectangular box serves as a backdrop for the word "END".

END