The background of the slide features a dark blue background with a subtle, glowing blue digital wave pattern composed of small dots.

AI in Biomedicine Final Assignment

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Outline

1. PAC/PVC

1.1. Electrophysiology

1.2. Problematics

2. Assignment objectives

3. Database

3.1. Description

3.2 Key elements

4. Evaluation

4.1. Report

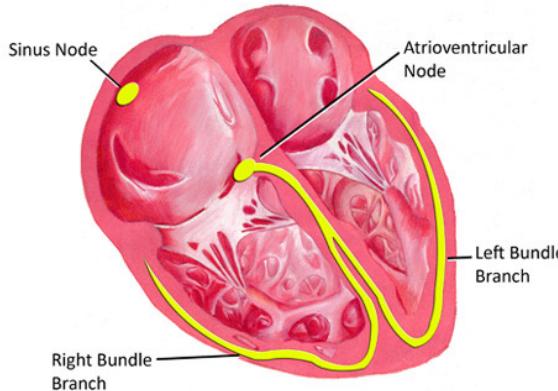
4.2. Scoring

4.3. Deadlines

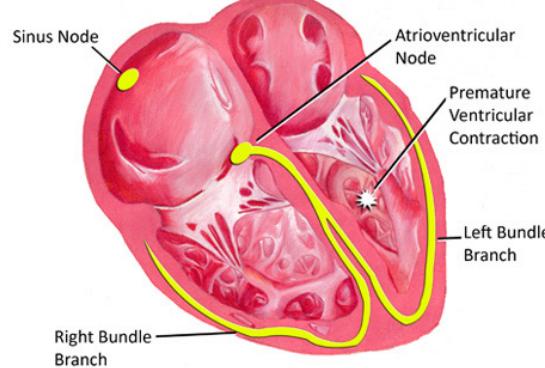
Part 1: PAC/PVC

PAC/PVC: Electrophysiology

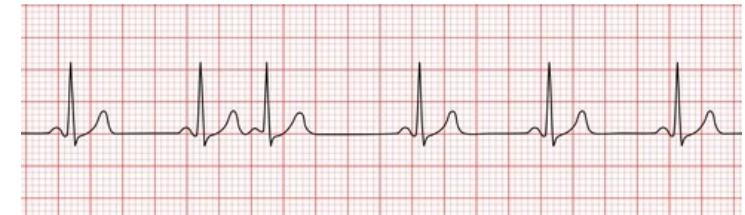
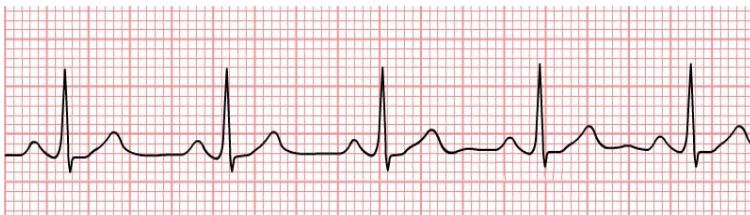
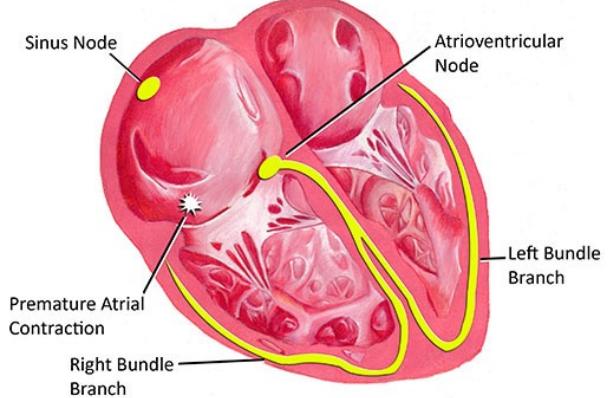
Normal Sinus Rhythm



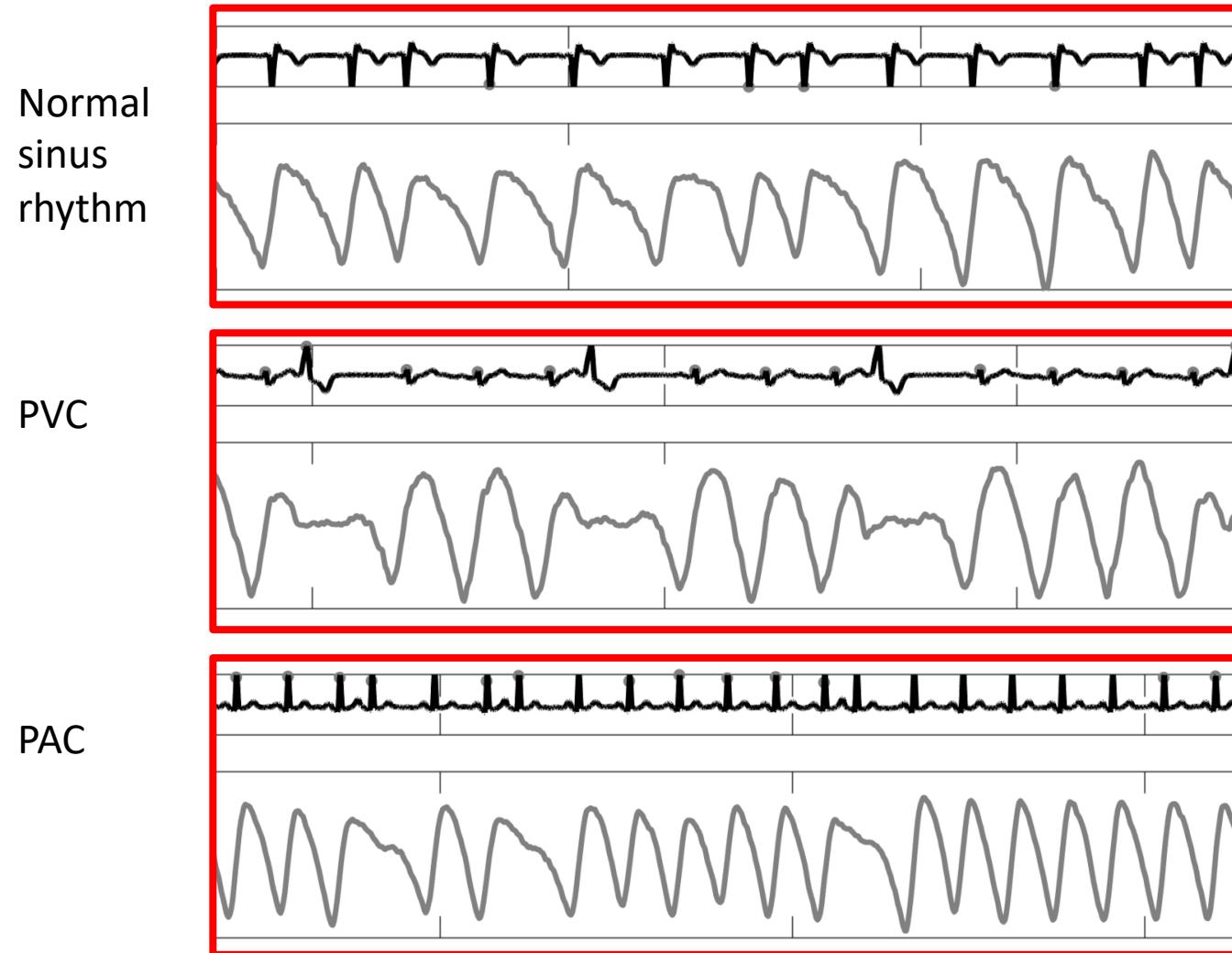
Premature Ventricular Complex



Premature Atrial Complex



PAC/PVC: Electrophysiology



PAC/PVC: Problematics

PAC:

Benign: symptomatic/ asymptomatic

Frequent PVC, sometimes paired with left ventricular dysfunction [1].

LV dysfunction progression (long-term) [1].

PVC:

Benign: symptomatic/ asymptomatic

Frequent PAC associated with increased stroke and death [2].

PAC for prediction of first time appearance of AF [3].

Part 2: Assignment objective

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Create a beat classifier for PPG signals:

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

Input

- PPG signal
- Systolic peak position

AIM

Output

Two classifications:

1. N vs. nonN
2. N/V/S annotation for each systolic peak position

One estimate confidence per classification: how robust is the estimate that the i-th beat is a V?

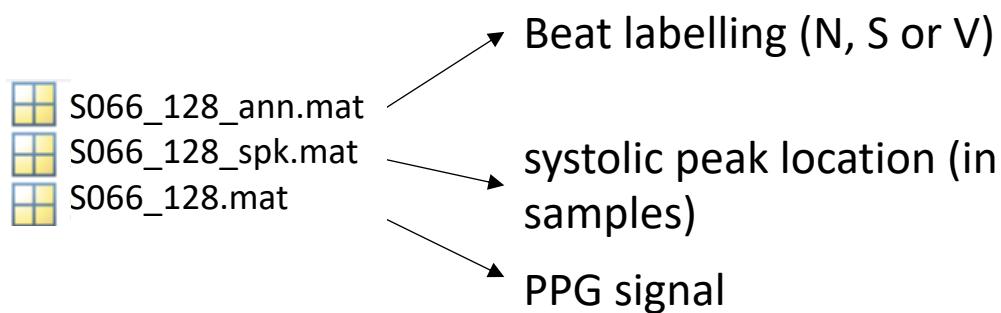
+ design your own metric to better detect S and V

Part 3: Database

3.1. Description

- Total number of patients: 105
- Fs: sampling frequency (some 128 Hz, others 250 Hz)
- PPG signal
- systolic peak position
- Labelling: N, S and V classes

3.1. Description



ID_Fs(Hz)_typeFile.mat

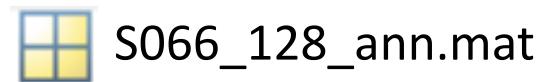
typeFile:

ann → annotations

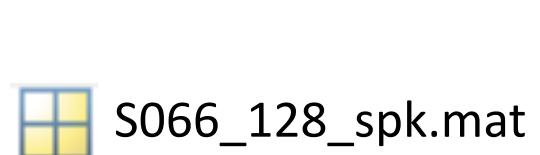
spk → peak location

Nothing → ppg

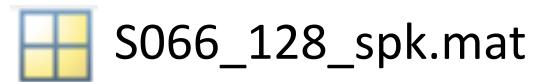
Example: annotations for subject 066, with sample frequency 128 Hz S066_128_ann.mat



S066_128_ann.mat



S066_128_spk.mat



S066_128_spk.mat

Variable:

ppg → it contains the ppg signal in samples

S066_128_ann.mat

Variable:

labels → it can assume 3 values N, V, S

S066_128_spk.mat

Variable:

speaks → it contains peak positions in samples

3.2. Key elements

Decision of network input:

→ take into consideration how PAC and PVC affect the signal

Part 4: Evaluation

4.1. Report

- Write a report in paper format: introduction (brief), materials and methods, results, discussion and conclusion (4-6 pages double column format)
- Describe in detail the signal pre-processing, the models chosen and their training
- Justify your choices in a sensitive way and provide a clear interpretation of the results obtained
- You should describe and explain
 - your own metric
 - The classifier for N vs. nonN beats + estimate confidence
 - The classifier for N/V/S beats + estimate confidence

PS: write in the report all you want to be evaluated
What is not in the report will not be considered (even if in the code)

4.2. Scoring

1. Submit report + code (training code and the final working model) one week before the exam.
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. You will be provided with a test set scoring (before or during the oral 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:

- January 8
- January 9
- January 15
- January 16
- January 22
- January 23

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8	Report + code
9	Test set predictions
10	
11	
12	
13	
14	
15	exam

Test set (without labels)

Scoring Test set

PS: assignment to be done in groups (3 students)
Oral exam together, book one slot per group

Link to dataset

[https://drive.google.com/drive/folders/144csMW7W4RS
KWcG6ePGP-kXjJojkG45L?usp=sharing](https://drive.google.com/drive/folders/144csMW7W4RSKWcG6ePGP-kXjJojkG45L?usp=sharing)