GNB: CANDIDATE PREREQUISITES

SEPTEMBER 12TH 2023

PREREQUISITE TO FACE THE HANDS-ON SESSION IN CARDIOVASCULAR SELF MONITORING IN SPORT

SKILLS	DESCRIPTION
Programming	• Basic knowledge of any programming language that allows data manipulation: ○ It is recommended to use MATLAB
MATLAB Toolbox	Signal Processing Toolbox
Data Management	• Ability to import data in MAT format • Data pre-processing and filtering • Ability to discern relevant and non-relevant information
Data Visualization	• Familiarity in the use of dedicated toolboxes for the representation of the processed data • Effective and creative visualizations
Communication	Ability to communicate results in a clear and precise manner with the aim of highlighting the produced results.

Hands-On Proposals

Preamble

The assignment consists of processing cardiac signals (heart-rate series and electrocardiogram) acquired by using wearable sensors. The aim is to characterize the cardiac status of the subjects, proving a cardiac risk assessment.
The group will provide the main indices for the assessment of cardiovascular risk.
The total score is 10.

Data

Data were acquired from two subjects, which anamnestic and training info are reported in the following table:

Subjects	Sport	Anamnestic Data				Training Info		
		Age	Sex	Smoker	Athlete	Resting Duration	Exercise Duration	Recovery Duration
#1	Basketball	22	Male	Yes	Yes	5'53''	1h28'3''	0''
#2	Tennis	56	Male	No	No	14'32''	46'58''	4'52''

Data consist of the simultaneously acquired cardiac signals by BioHarness 3.0 of Zephyr. Heart-rate series (sampling frequency of 1Hz, measured in bpm) and electrocardiogram (sampling frequency of 250Hz, measured in mV) are stored in a MATLAB structure. The file "CardiovascularSelfMonitoringInSport.m" represents a code template for analysis.
You can send the results at the following link: GOOGLE FORM

Tasks

TASKS	DESCRIPTION	TIME	SCORE
Data loading and Pre-processing	For each subject, the group has to: - load the cardiac signals (heart-rate series and electrocardiogram). - define the anamnestic data and the training info. - apply electrocardiogram. - select the pre-exercise phase of the electrocardiogram. - identify the R-peak position of the electrocardiogram acquired during the pre-exercise phase by using the Pan-Tompkins algorithm.	~5'	-
Maximal Heart-Rate Computation	For each subject, the group has to compute: - theoretic maximum heart rate (TMHR). - user-specific heart-rate threshold (thrHR). - percentage of heart-rate series that overcome the MTHR. -percentage of heart-rate series that overcome the thrHR. **Expected outcome:** The TMHRs, the thrHR, the percentages of heart-rate series that overcome the MTHR and the percentages of heart-rate series that overcome the thrHR of the subjects	~10'	4

QT-Interval Computation	For each subject, the group has to compute the corrected QT interval by using the Zhang's algorithm. **expected outcome:** Corrected QT interval of the subjects.	~10'	2
Interpretation	According to CaRiSMA, the group has to: - plot the output of CaRiSMA: heart-rate series and median electrocardiogram beat. - compute the traffic light colors of subject #1. - compute the traffic light colors of subject #2. - define which is the subject with the highest cardiac risk. **expected outcome:** Plots of the CaRiSMA outputs (possibly in a unique ".jpg" figure), the traffic lights colors of the subjects and the subject that presents the highest cardiac risk.	~20'	4
TOTAL		~45'	10