Dissertação de Mestrado em Engenharia Informática (2018/2019)

Title: Higher Order Markov Chain Forecasting of Physiological Time Series

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Summary

Physicians are faced daily with the analysis of physiological time-series data such as Electrocardiogram (ECG) and Electroencephalogram (EEG) signals. Their attention is focused on understanding the patterns of the data across time so that they can provide meaningful interpretation for clinical purposes. The complexity of the clinical context requires systems with the capability to make decisions based on reduced data. Moreover, the adoption of mobile and ubiquitous devices could provide personal health related information. Due to the stringent service quality requirements in medical activities, eHealth applications face nowadays several challenges as to how to provide accurate and reliable data to both health care professionals and patients. The present topic focuses on dealing with modelling, real-time estimation and forecasting of physiological time series based on higher order Markov chain concepts; thus, providing an accurate clinical decision-making tool for immediate response to forecasted abnormal situations.

Tasks

- T1 – Technological background study;
- T2 – Review the State-of-the-art;
- T3 – Requirements Analysis;
- T4 – Design and construction, including integration;
- T5 – Testing and evaluation;
- T6 – The writing of the dissertation.

Expected result

In this research work the following deliverables are expected:

- A validated computational tool;
- A publication describing the method and the validation results.

Timeline

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
T1	X	X	X						
T2		X	X	X					
T3			X	X					
T4				X	X	X			
T5						X	X	X	
T6					X	X	X	X	X

References:

1. Graja S., J.-M. Boucher J.-M., Hidden Markov tree model applied to ECG delineation. IEEE Transactions on Instrumentation and Measurement, 54 (6), 2005, 2163:2168.
2. Guilak F.G, McNames J., A spline framework for ECG analysis. *Engineering in Medicine and Biology Society EMBC 2011 Annual International Conference of the IEEE*, 2011, 957:960.
3. Kim S.-H., Faloutsos Ch., and Yang H.-J., Coercively Adjusted Auto Regression Model for Forecasting in Epilepsy EEG. Computational and Mathematical Methods in Medicine, Vol. 2013, Article ID 545613.
4. Stamkopoulos T., Maglaveras N., Bamidis P.D., and Pappas C., Wave segmentation using nonstationary properties of ECG. Computers in Cardiology, 2000, 529:532.