Introduction

The length of the normal heart contraction cycle, called the RRinterval, varies depending on the body's current needs for oxygen and other nutrients. There is a lot of evidence that a series of RR-intervals carry information about the complex interdependence of various physiological processes, reflex loops, complex mechanisms operating at different time scales and often spatially distant. It is believed that heart rate variability represents the organism's ability to respond to internal and external challenges, and therefore is an indirect (and also non-invasive and inexpensive) method of assessing the overall state of human health. In healthy people, this variability is mainly associated with the activity of the autonomic nervous system - a part of the central nervous systems which stays apart from a human conscious action. Interdisciplinary cooperation has been intensively developed aiming on reading the information contained in RR-intervals. The thesis will be done in collaboration with the Institute of Theoretical Physics and Astrophysics, University of Gdańsk, who will provide support and data. They have access to long time series, consisting of ca 20000 observations of RR-intervals.

Automatic prediction of cardiovascular age using heart rate variability analysis by the feature -based methods

The set of signals with RR-intervals will be provided. The signals were collected from healthy people at different age and present heart beats of four hour of nocturnal rest.

The successful solving the thesis involves:

- obtaining the set of standard features based on eg. Kubios [1] or other public accessible software for heart rate variability analysis.
- determination of the importance between these features which best classifies the human age by the feature-based methods [2, 3]: random-forest method, gradient boosting, support vector machines.

* construction of the best decision tree for prediction of the risk of arrhythmia in elderly people [**?**] (additional task).

References

[1] see the page
`https://www.kubios.com/hrv-standard/`

[2] Melillo P, Izzo R, Orrico A, Scala P, Attanasio M, Mirra M, et al. (2015) Automatic Prediction of Cardiovascular and Cerebrovascular Events Using Heart Rate Variability Analysis. PLoS ONE 10(3): e0118504. doi:10.1371/journal.pone.0118504

[3] Kowalek P, Loch-Olszewska H, and Szwabiński J, (2019) Classification of diffusion modes in single-particle tracking data: Feature-based versus deep-learning approach. Physical Review E 100, 032410