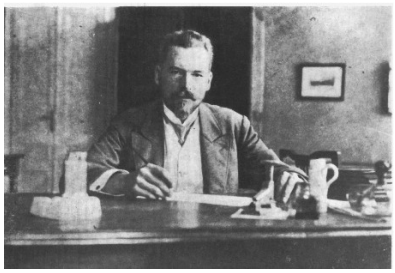

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# Cardiovascular dynamics models for hypertension patients based on symbolized signals of heart rate and arterial blood pressure

*Thursday, 6 September 2018 15:00 (3 hours)*

Hypertension - a long-term elevation of blood pressure - is a major risk factor for cardiovascular disease like coronary artery disease, stroke and kidney failure. The dynamic relationships in cardiovascular system are altered in hypertensive patients but there is a lack of methods providing qualitative and quantitative assessment of these changes. Therefore, the aim of the study is to compare the dynamics of the cardiovascular system of healthy and hypertensive people using symbolization by three-event-patterns, and then to reproduce the properties of physiological series in simulations.
The study was based on symbolized signals of heart rate and arterial pressure recorded in 25 healthy people and 38 hypertension patients, resting in the comfortable supine position. Two types of pattern symbolization were used for the subsequent three signal values. The first one focuses on variations of signal values and the second type emphasizes monotonic trends of a signal. For each signal representation, a transition matrix, describing probability to observe pair of patterns subsequently in a time series, was constructed. Transition matrices offer a Markov chain approach to the signal dynamics.
It has occurred that there are only irrelevant differences between transition matrices arising from signals of the healthy group and of hypertensive patients. One could claim that both dynamics are driven by the same Markov rules, though dynamics are performed with specific to the group: healthy or hypertensive. Based on the Markov rates the artificial signals were produced. Their complexity were compared to the original signals by Shannon entropy. The Shannon entropy indicates at almost flat distribution of patterns in artificial signals for both symbolizations (SE(MAP,dyn)=1.59+/-0.03, SE(MAP,det)=1.33+/-0.06) what is significantly different from entropy of physiological signals (SE(MAP,dyn)=1.24+/-0.13, SE(MAP,det)=1.02+/-0.11). Hence the Markovian approach is not efficient in revealing complexity of vascular dynamics. There is not such evident difference when signals of RR-intervals are considered (artificial signals: SE(RR,dyn)=1.50+/- 0.03 , SE(RR,det)=1.27+/-0.05, physiological signals: SE(RR,dyn)=1.34+/- 0.23 , SE(RR,det)=1.08+/-0.19).

**Primary author:** Ms WEJER, Dorota (University of Gdańsk, Faculty of Mathematics, Physics and Informatics, Institute of Experimental Physics)

**Co-authors:** Dr GRAFF, Beata (Medical University of Gdansk, Department of Hypertension and Diabetology); Prof. MAKOWIEC, Danuta (University of Gdansk, Faculty of Mathematics, Physics and Informatics, Institute of Theoretical Physics and Astrophysics); Prof. NARKIEWICZ, Krzysztof (Medical University of Gdansk, Department of Hypertension and Diabetology)

**Presenter:** Ms WEJER, Dorota (University of Gdańsk, Faculty of Mathematics, Physics and Informatics, Institute of Experimental Physics)

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