



Jacek Urbanek

John Hopkins University

Friday, March 10, 2017

3:00 pm

Informatics East, Rm. 150

Objective quantification of human activity in large health studies using wearable accelerometers

Abstract: Accelerometers are now ubiquitous in health studies, where they are used to provide objective proxy measurements of physical activity. The data produced by these devices is extremely large and complex, while most health studies only use crude summaries of the 24-hour activity cycle. We introduce analytic methods designed to quantify the macro- and micro-structure of the data and its association with health outcomes. The macro-structure refers to minute-level aggregated data, which characterizes activity intensity, while the micro-structure refers to the sub-second level of the raw data (10-100Hz), which characterizes individual movement patterns. We introduce a complete analytical pipeline for processing, storing, and fusing macro-scale accelerometry data collected in large-scale health studies. Based on the resulting data structure we propose a new method for quantifying the individual sleep chronotype and social jet lag. Methods are motivated by and illustrated on the National Health and Nutrition Examination Survey (NHANES), which collected accelerometry data on tens of thousands of subjects. To characterize the micro-structure of the data we will introduce new methods for detection and identification of walking in the free-living environment. Results indicate that the micro-scale characteristics of free-living walking are associated with physical function, mobility, fatigability, and fitness in community-dwelling older adults.

Biography: Dr. Urbanek is a postdoctoral fellow in the Department of Biostatistics, Bloomberg School of Public Health, Johns Hopkins University, under the supervision of Prof. Ciprian Crainiceanu. Dr. Urbanek is an active member of the Statistical Methods and Applications for Research in Technology (SMART www.smart-stats.org). His research is focused on measurements from wearable and implantable devices and their association with health. His research interests include: 1) analysis and management of high-dimensional, high-throughput biological data; 2) methods development for analysis of high-volume time-series data and multi-modal dynamic measurements of biological signals; and 3) development and dissemination of reproducible, open source software. He is the lead investigator on several projects including recognition and quantification of walking from raw accelerometry data. Dr. Urbanek has a Master in mechanical engineering and a Ph.D. in automatics and robotics from the University of Science and Technology, Poland. He spent one-year as a visiting faculty at the Indiana University, where he worked on wearable computing with health applications. In 2014 he joined Johns Hopkins University as a postdoctoral fellow in Biostatistics, where he is currently working on activity, heart rate, and blood glucose monitors. Dr. Urbanek has published over 20 peer-reviewed articles in scientific journals and a handbook on vibration analysis. He is a member of The International Biometric Society and Gerontological Society of America and a reviewer for several scientific journals.

