

# JACEK K. URBANEK, PhD, MEng

+1 (443) 835-7202

jurbane2@jhu.edu

[jacekurbanek.com](http://jacekurbanek.com)



## PERSONAL STATEMENT

I am an expert in wearable computing and digital health with over 8-years of experience in collecting, analyzing, and managing high-dimensional **wearable devices** data in health research applications in both children and adults. I am trained in dynamic data acquisition and digital signal processing, with an essential understanding of statistics and software development.

My work focuses on wearable **accelerometry** and ambulatory **ECG** measurements. As the founder and director of the Accelerometry Resource Core (ARC) at Johns Hopkins Medicine ([accelerometry.org](http://accelerometry.org)), I have designed and implemented the collection and analysis of **free-living, multiday** physical activity **in over 13 000** participants/visits across multiple large, NIH-funded observational studies and clinical trials, making the **ARC** the **largest** repository of **harmonized, sub-second** level, **wrist** accelerometry data of older adults in the United States.

**I lead the multidisciplinary team** of biostatisticians, software engineers, administrative support, and media relations staff, focused on conducting and promoting research with wearable devices with particular emphasis on interpretable metrics of physical activity, mobility, and heart-rate variability.

*My academic resume is available [here](#).*

## EXPERTISE

- Wearable computing
- Digital signal processing
- Data science
- Actigraphy
- Remote data collection
- Health research

## PROGRAMMING

- MATLAB – proficient
- R – proficient
- Python – basic

## LANGUAGES

- English
- Polish

## CURRENT APPOINTMENTS

**Assistant Professor of Medicine** 11/30/2017 - present

### **Tenure Track**

Johns Hopkins University, School of Medicine,  
Department of Medicine, Division of Geriatric  
Medicine and Gerontology

### **Director**

01/02/2021 - present

Accelerometry Resource Core,  
Center on Aging and Health  
Johns Hopkins University

### **Core Faculty**

02/19/2018 - present

Center on Aging and Health,  
Johns Hopkins University

### **Joint Faculty**

07/01/2018 - present

Department of Biostatistics,  
Johns Hopkins Bloomberg School of Public Health

## **PAST APPOINTMENTS**

### **Postdoctoral fellow**

2014 - 2017

Department of Biostatistics,  
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

- Developed methods for detection and identification of walking in free-living accelerometry data
- Characterized sleep habits of the US population using self-developed Objective Bedtime algorithm in the NHANES 2003-2006 accelerometry data
- Co-developed scalable analytical pipelines for processing and analyzing accelerometry data in ~12 000 participants of NHANES 2003-2006

### **Visiting Adjunct Faculty Member**

2013 - 2014

Department of Biostatistics,  
Richard M. Fairbanks School of Public Health,  
Indiana University, Indianapolis, IN

- Developed Fourier-based methods to characterize human gait using sub-second level accelerometry data
- Co-developed and conducted the accelerometry data collection in a controlled environment focused on characterizing walking and driving activities of healthy adults

### **Diagnostic engineer**

2008 - 2013

EC Systems Ltd.  
Krakow, Poland

- Developed digital signal processing methods for mechanical vibration time series to characterize the technical condition of machinery operating under a non-stationary regime
- Co-developed, implemented, and used distributed monitoring systems for large wind turbine farms

## **EDUCATION**

### **Postdoctoral Fellowship**

2014 - 2017

Department of Biostatistics,  
Johns Hopkins Bloomberg School of Public Health,  
Baltimore, MD

### **Doctor of Philosophy, Automatics and Robotics**

2008 - 2013

University of Science and Technology,  
Krakow, Poland

### **Master of Engineering**

2003 - 2008

University of Science and Technology,  
Krakow, Poland

## RELEVANT PROJECTS AND COLLABORATIONS

### **Accelerometry Resource Core (ARC)**

2017 - present

I have designed and implemented large-scale measurements of physical activity with wrist-worn accelerometers in multiple observational studies, clinical trials, and interventions. To that end, I have created a set of software tools, measurement protocols, and standards that allow streamlining and automation of the process. I am currently responsible for overseeing and maintaining the collection, management, analysis, and archiving the wrist-worn accelerometry in several health studies including 1) [Atherosclerosis Risk in Communities \(ARIC\)](#), 2) [National Aging and Health Trends Study \(NHATS\)](#), 3) [Baltimore Longitudinal Study of Aging \(BLSA\)](#), 4) [Chronic Kidney Disease in Children \(CKiD\)](#), 5) [Peripheral Artery Disease Study of SOL \(PASOS\)](#), 6) [Aging, Cognition and Hearing Evaluation in Elders \(ACHIEVE\)](#), 7) [Study To Understand Fall Reduction and Vitamin D in You \(STURDY\)](#), 8) [Characterizing Resiliencies to Physical Stressors in Older Adults \(SPRING\)](#).

### **Atherosclerosis Risk in Communities (ARIC)**

2019 - present

Atop overseeing an ongoing collection of wrist-accelerometry, I lead research efforts on joint modeling of free-living **ambulatory ECG and accelerometry** collected with Zio XT device in ~3000 community-dwelling adults monitored for 14 consecutive days. The project focuses on characterizing heart rate variability, sympathetic and parasympathetic nervous system responses in conjunction with daily physical activity.

### **Study To Understand Fall Reduction and Vitamin D in You (STURDY)**

2017 - 2021

I have co-designed the longitudinal accelerometry measurements protocols in ~650 low-functioning older adults and was responsible for providing the analytical sample of physical activity characteristics to other co-investigators. Additionally, I have extracted characteristics of **free-living gait cadence** and used them as predictors of falls, superior to traditional in-clinic metrics of **mobility**.

### **Peripheral Artery Disease Study of Study of Latinos (PASOS)**

2019 - present

I am responsible for the ongoing collection of accelerometry measurements. I also lead the research team focused on analytical aspects of the objectively measured physical activity. The major areas of focus include **harmonization** between hip-worn Actical (N = 20 000) and wrist-worn ActiGraph (N = 6 000) measurements, characterizing **mobility**, and understanding the COVID-19 burden in relation to physical activity and the quality of life.

## SELECTED PUBLICATIONS

1. **Urbanek** JK, Roth D, Karas M, Wanigatunga A, Mitchell C, Juraschek S, Cai Y, Appel L, Schrack J, Free-living gait cadence measured by wearable accelerometer: a promising alternative to traditional measures of mobility for assessing fall risk, Accepted, Journals of Gerontology Medical Sciences
2. Karas, M., Bai, J., Strączkiewicz, M., Harezlak, J., Glynn, NW., Harris T., Zipunnikov, V., Crainiceanu, C., **Urbanek**, JK, Accelerometry data in health research: challenges and opportunities. Review and examples, Stat. Biosci 11, 1-28, 2019
3. Smirnova E, Leroux A, Cao Q, Tabacu L, Zipunnikov V, Crainiceanu C, **Urbanek** JK. The predictive performance of objective measures of physical activity derived from accelerometry data for 5-year all-cause mortality in older adults: National Health and Nutritional Examination

- Survey 2003–2006. The Journals of Gerontology: Series A. 2020;75(9):1779-1785.
4. Heravi AS, Etzkorn LH, **Urbanek** JK, Crainiceanu CM, Punjabi NM, Ashikaga H, Brown TT, Budoff MJ, D'Souza G, Magnani JW. HIV infection is associated with variability in ventricular repolarization: the multicenter AIDS cohort study (MACS). *Circulation*. 2020;141(3):176-187.
  5. Leroux A, Di J, Smirnova E, MCGuffey EJ, Cao Q, Bayatmokhtari E, Tabacu L, Zipunnikov V, **Urbanek** JK, Crainiceanu C. Organizing and analyzing the activity data in NHANES. *Statistics in biosciences*. 2019;11(2):262-287.
  6. **Urbanek** JK, Spira AP, Di J, Leroux A, Crainiceanu C, Zipunnikov V. Epidemiology of objectively measured bedtime and chronotype in US adolescents and adults: NHANES 2003–2006. *Chronobiology international*. 2018;35(3):416-434.
  7. **Urbanek** JK, Zipunnikov V, Harris T, Fadel W, Glynn N, Koster A, Caserotti P, Crainiceanu C, Harezlak J. Prediction of sustained harmonic walking in the free-living environment using raw accelerometry data. *Physiological measurement*. 2018;39(2):02NT02.
  8. **Urbanek** JK, Harezlak J, Glynn NW, Harris T, Crainiceanu C, Zipunnikov V. Stride variability measures derived from wrist-and hip-worn accelerometers. *Gait & posture*. 2017;52:217-223.
  9. **Urbanek** JK, Zipunnikov V, Harris T, Crainiceanu C, Harezlak J, Glynn NW. Validation of gait characteristics extracted from raw accelerometry during walking against measures of physical function, mobility, fatigability, and fitness. *The Journals of Gerontology: Series A*. Published online 2017.

For the full list visit: <https://scholar.google.com/citations?user=5X-it4IAAAJ&hl=en&oi=ao>

## **PUBLISHED SOFTWARE**

1. Software package – R – ARCTOOLS – (with Marta Karas) – 2020  
cran.r-project.org/web/packages/arctools/index.html
2. Software Package – R – iGlu – (with Irina Gaynanova) – 2020  
cran.r-project.org/web/packages/iglu/index.html
3. Software package – R – ADEPT – (with Marta Karas, Jaroslaw Harezlak, and William Fadel) – 2019  
cran.r-project.org/web/packages/adept/index.html  
placed in the top 3 packages of CRAN "Medicine" section for May 2019
4. Software package – R – ADEPT Data – (with Marta Karas, Jaroslaw Harezlak, and William Fadel) – 2018  
cran.r-project.org/web/packages/adeptdata/index.html
5. Software package – R – Runstat (with Marta Karas) – 2018  
cran.r-project.org/web/packages/runstats/index.html
6. Software package – MATLAB -Separation of generalized angular/temporal components – 2014  
krim.agh.edu.pl/wp-content/uploads/2015/06/DRS\_GATP\_JU.pdf
7. Software package – MATLAB - Angular/Temporal Short Time Fourier Transform – 2014  
krim.agh.edu.pl/wp-content/uploads/2015/06/Angular\_Temporal\_STFT.pdf
8. Software package – MATLAB - Modulation intensity distribution (MID) – 2012  
www.mathworks.com/matlabcentral/fileexchange/43102-modulation-intensity-distribution-gui
9. Software package – MATLAB - Two-step method for instantaneous phase reconstruction – 2012  
www.mathworks.com/matlabcentral/fileexchange/43240-two-step-method

## **AWARDS AND HONORS**

- W. Leigh Thompson Excellence in Research Award, Baltimore, MD, 2021
- First place in the postdoctoral poster competition - 9th Annual Research on Aging Showcase, Baltimore, MD, 2016
- Best poster award – ENAR, Miami, FL, 2015
- Best paper award - The 4th International Conference on Condition Monitoring of Machinery in Non-Stationary Operations (CMMNO'2014), Lyon, France, 2014
- Best PhD student AGH Rector's award, Cracow, Poland, 2012
- First position in the ranking of PhD students of Lesser Poland Province in the project „Doctus Malopolski fundusz stypendialny dla doktorantów”, Cracow, Poland, 2011
- First place in Wladyslaw Bogusz contest – Polish Acoustic Association, Zakopane, Poland, 2009

## **SELECTED TALKS**

- 11/19/21 Accelerometry Resource Core (ARC) - Comprehensive Support for Research with Wearable Devices, Pepper Center Directors Meeting, Online
- 11/19/21 Accelerometry Resource Core (ARC) - Comprehensive Support for Research with Wearable Devices, Center for Transformative Geriatric Research - Work in Progress Meeting, Baltimore, MD
- 11/15/21 Increasing the accessibility of large-scale remote measurements of physical activity, mobility, and sleep with wearable devices through the Accelerometry Resource, Geriatrics Grand Rounds, Baltimore, MD
- 11/12/21 Free-Living Gait Cadence Measured by Wearable Accelerometers for Assessing Fall Risk, Symposium Presenter, Gerontological Society of America Annual Meeting 2021, Online
- 11/04/20 Large-Scale Measurements of Physical Activity With Wearable Devices: An International Perspective: Streaming Symposia, Discussant, Gerontological Society of America Annual Meeting 2020, Online
- 04/29/20 Application of wearable devices in large cohort studies and clinical trials, Behavioral Pharmacology Research Unit, JH SOM, Baltimore, MD
- 02/24/20 Streamlining the collection and processing of accelerometry data in large cohort studies and clinical trials, Use of Wearable and Implantable Devices in Health Research Workshop, Banff International Research Station for Mathematical Innovation and Discovery, Banff, CA
- 09/23/19 Accelerating big data computing with Graphics Processing Units (GPUs) and its application in free-living gait analysis in older adults at risk of falls, Center on Aging and Health Biostatistical Meeting, August 2019, Baltimore, MD
- 06/20/19 Introduction to objective measurement of physical activity with wearable devices, West China Hospital Department of Gerontology, June 2019, Chengdu, China