

# Jacek K. Urbanek, PhD

## PERSONAL INFORMATION

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Research group: <http://www.smart-stats.org>  
Webpage: <https://jacekurbanek.com>

## RESEARCH INTERESTS

Wearable computing, Biostatistics, Health research, Digital signal processing, Quantification of physical activity, Data science

## ONGOING PROJECTS

- Analysis of biological signals from wearable monitors
- Big data problems in large scale observational studies on human activity
- Objective measures of social jetlag and chronotype
- Prediction of walking in the free-living environment using raw accelerometry data
- Prediction of activity types and energy expenditure based on free-living accelerometry data
- Estimation of temporal gait parameters for clinical trials
- Modeling of wearable blood glucose monitors data

## EDUCATION

### Postdoctoral Fellow

10/01/2014 – 11/24/2017

Advisor: **Ciprian Crainiceanu**  
Department of Biostatistics  
Johns Hopkins Bloomberg School of Public Health  
Johns Hopkins University  
615 N. Wolfe Street,  
Baltimore, MD 21205

### PhD

10/01/2009 – 07/12/2013

Thesis title: *Cyclostationarity analysis methods for diagnostics of machinery under varying operational conditions*

Advisors: **Jerome Antoni, Tomasz Barszcz**  
University of Science and Technology - Krakow,  
Department of Mechanical Engineering and Robotics,  
Scientific discipline: Automatics and Robotics

### Master of Engineering

10/01/2004 – 06/30/2009

University of Science and Technology - Krakow,  
Department of Mechanical Engineering and Robotics,  
Discipline: Mechanical Engineering  
Specialization: Vibro-acoustic and Sound Engineering

### High School

09/01/1999 – 06/24/2004

Technical Scientific Departments - Czestochowa,  
Technical School of Telecommunication  
Technician of telecommunication

## WORK EXPERIENCE

11/27/2017 – current

Department of Medicine  
Division of Geriatric Medicine and Gerontology  
Johns Hopkins University School of Medicine  
2024 E. Monument Street, Suite 2-700  
Baltimore, MD 21205  
**Assistant Professor of Medicine**

05/27/2018 – current

Center on Aging and Health  
Johns Hopkins University  
2024 E. Monument Street, Suite 2-700  
Baltimore, MD 21205  
**Core Faculty**

11/01/2018 – current	Department of Biostatistics Johns Hopkins Bloomberg School of Public Health Johns Hopkins University 615 N. Wolfe Street, Baltimore, MD 21205 <b>Joint Appointed Faculty</b>
10/01/2014 – 11/24/2017	Department of Biostatistics Johns Hopkins Bloomberg School of Public Health 615 N. Wolfe Street, Baltimore, MD 21205 <b>Postdoctoral Fellow</b>
10/01/2013 – 09/30/2014	Department of Biostatistics Richard M. Fairbanks School of Public Health and School of Medicine Indiana University 410 W 10th St., Suite 3000 Indianapolis, IN 46202 <b>Visiting Adjunct Faculty Member</b>
07/01/2008 – 06/30/2013	EC Systems Sp. z o.o. Lublanska street 34, 31-476 Cracow <a href="http://www.ec-systems.pl">http://www.ec-systems.pl</a> <b>Diagnostic engineer</b>
07/14/2006 – 09/15/2006	Savcon Engineering Ltd. Atherstone on Stour, Stratford-Upon-Avon Warwickshire, CV37 8DX <b>Intern</b>

#### AWARDED RESEARCH GRANTS

06/23/2013 – 06/23/2015	<b>Development of novel signal processing methods for analysis of vibro-acoustical signals generated by rotor machinery under extremely varying operational conditions</b> Polish Ministry of Science and Higher Education <b><u>Principal Investigator</u></b>
12/15/2011 – 12/15/2013	<b>Cyclostationarity methods for analysis of signal sources operating under varying regime,</b> Polish National Science Center <b><u>Principal Investigator</u></b>

#### COLLABORATION IN RESEARCH STUDIES

- Baltimore Longitudinal Study of Aging
- Study to Understand Fall Reduction and Vitamin D in You
- Atherosclerosis Risk in Communities
- Hispanic Community Health Study / Study of Latinos
- National Health and Nutrition Examination Survey
- Chronic Kidney Disease in Children

#### TEACHING EXPERIENCE

10/01/2012 – 12/15/2012	Lectures – <b>Maintenance of Mechatronic Devices</b> Co-lecturer in Polish and English
10/01/2011 – 02/15/2012	Lectures – <b>Maintenance of Mechatronic Devices</b> Co-lecturer in Polish and English
10/01/2010 – 02/15/2012	Seminars – <b>Maintenance of Mechatronic Devices</b> Teaching in Polish and English
10/01/2009 – 02/15/2011	PC Lab – <b>Monitoring Systems in Automatics and Robotics – LabView</b> Teaching in Polish and English

#### INVITED TALKS

1. Accelerating big data computing with Graphics Processing Units (GPUs) and it's application in free-living gait analysis in older adults at risk of falls, Center on Aging and Health Biostatistical Meeting, August 2019, Baltimore, MD
2. Introduction to objective measurement of physical activity with wearable devices, West China Hospital Department of Gerontology, June 2019, Chengdu, China

3. Objective quantification of human activity using wearable accelerometers  
- Challenges and Opportunities, Plenary talk, JinSha Conference, June 2019, Chengdu, China
4. Objective Quantification of Human Activity in Large Health Studies Using Wearable Accelerometers, University of District of Columbia, November 2018, Washington, DC
5. Learning More from Patterns of 400-meter Walk, Invited Symposium: Digging Deeper: Insights into Physical and Cognitive Health Using Novel Methods for Accelerometry and Function, Gerontological Society of America Annual Meeting, November 2018, Boston, MA
6. Objective Quantification of Human Activity in Large Health Studies Using Wearable Accelerometers, West Virginia University, November 2018, Morgantown, WV
7. Objectively Measured Physical Activity and Visual Impairment: Baltimore Longitudinal Study on Aging, Johns Hopkins University – Geriatrics Grand Rounds, October 2018, Baltimore, MD
8. Gait characteristics extracted from raw data collected by wearable accelerometers - Estimation and validation, Indiana University, April 2018, Bloomington, IN
9. Objective quantification of human activity using wearable accelerometers - Challenges and Opportunities, Center on Aging and Health Biostatistical Meeting, November 2017, Baltimore, MD
10. Analyzing raw activity data to determine stride-to-stride gait variability, Invited symposium speaker, International Association of Gerontology and Geriatrics (IAGG) World Congress 2017, San Francisco, CA
11. Statistical modeling of circadian rhythms of physical activity, Invited symposium speaker and organizer, International Conference on Ambulatory Monitoring of Physical Activity and Movement, June 2017, Bethesda, MD
12. Moderator of the panel discussion on remote data collection, Symposium on Ancillary Studies in the CKiD and CIRC studies, November 2016, Crystal City, VA
13. Objective quantification of human activity using wearable devices, IDEAS meeting for the Sandra Eskenazi Center for Brain Care Innovation, March 2016, Indianapolis, IN
14. Accelerometry-based detection and identification of walking in observational studies, Biostatistics Grand Rounds, September 2015, Bloomberg School of Public Health, Johns Hopkins University
15. Analyzing raw accelerometer output: challenges in detecting walking, Invited Symposium: The Impact of Accelerometer Wear Location in Studies of Older Adults, International Conference on Ambulatory Monitoring of Physical Activity and Movement, 2015, Limerick, Ireland
16. Automatic detection and quantification of walking using wearable accelerometry devices. How reliable are the fitness monitors?, September, 2014, Regenstrief Institute, Indianapolis, IN
17. Automatic Detection and Quantification of Walking Using Wearable Accelerometry Devices, Invited Workshop: Assessing Daily Activity in Old Age: Unraveling the Complexity of Monitors, Measures, and Methods, , Gerontological Society of America Annual Meeting, November 2014, Washington, DC
18. Automatic Detection and Quantification of Walking using Wearable Accelerometry Devices, May, 2014 Laboratory of Neuro Imaging Institute of Neuroimaging and Informatics, Keck School of Medicine of USC, Los Angeles, CA
19. Pre-Processing of the Longitudinal Structural Brain Imaging Data: A Case Study, Contributed session, March, 2014, ENAR 2014, Baltimore, MD
20. Pre-processing of structural MRI data, December, 2014, PennSIVE, Department of Biostatistics and Epidemiology, Center for Clinical Epidemiology and Biostatistics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA
21. Where machine vibrations meet human brain dynamics, October, 2013, SMART, Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD
22. Where machine vibrations meet human brain dynamics, May, 2013, Indiana University School of Medicine, Department of Biostatistics, Indianapolis, IN

#### **MEDIA RELEASES OR INTERVIEWS**

- 10/30/19 Press release “Wearable Activity Trackers a Reliable Tool for Predicting Death Risk in Older Adults“
- 06/15/17 Press release “19-Year-Olds as Sedentary As 60-Year-Olds, Study Suggests”
- 04/25/18 Interviewed by Reporter Paul Gessler on Channel 45- Fox News Baltimore, “School Sleep Study” - Original top story interview – news at 5pm
- 04/25/18 Press release “Americans’ Bedtime Habits Affirmed in New Study”

#### **MEMBERSHIPS**

- The International Society for the Measurement of Physical Behaviour
- The International Biometric Society
- Gerontological Society of America

#### **AWARDS AND HONORS**

1. Best research poster presentation – 3rd Annual Johns Hopkins University Sleep and Circadian research day 2017, Baltimore, MD
2. First place in the postdoctoral and junior faculty poster competition - 9th Annual Research on Aging Showcase 2016, Baltimore, MD
3. Best poster award – Eastern North American Region (ENAR) International Biometric Society Spring Meeting 2015, Miami, FL
4. Best paper award - The 4th International Conference on Condition Monitoring of Machinery in Non-Stationary Operations (CMMN0'2014), Lyon, France
5. Best PhD student AGH Rector’s award, 2012
6. First position in the ranking of PhD students of Lesser Poland Province in the project „Doctus – Małopolski fundusz stypendialny dla doktorantów”, 2010/2011
7. First place in Wladyslaw Bogusz contest – Polish Acoustic Association, 2009

## EXTENDED VISITS TO OTHER DEPARTMENTS

05/06/2013 – 06/03/2013	<b>Department of Biostatistics</b> , Richard M. Fairbanks School of Public Health and School of Medicine, Indiana University, Indianapolis, USA
03/01/2012 – 05/31/2012	<b>Laboratoire de Vibration et d'Acoustique</b> , INSA Lyon, France
03/10/2011 – 05/05/2011	<b>Laboratoire Roberval Département de Génie Mécanique</b> , Université de Technologie de Compiègne (UTC), France
06/19/2010 – 07/10/2010	<b>Laboratoire Roberval Département de Génie Mécanique</b> , Université de Technologie de Compiègne (UTC), France

## EDITORIAL ACTIVITIES

**Statistical editor for:** Sleep

**Referee for:** Journals of Gerontology, Mechanical Systems and Signal Processing, Applied Acoustics, Measurement, PLOS ONE, Measurement Science and Technology, Metrology and Measurement Systems, Diagnostyka, Shock and Vibration, Probabilistic Engineering Mechanics, Sensors, IAGG

## SOFTWARE AND DATA PACKAGES

1. Software package – MATLAB - Two-step method for instantaneous phase reconstruction – 2012
2. Software package – MATLAB - Modulation intensity distribution (MID) – 2012
3. Software package – MATLAB - Angular/Temporal Short Time Fourier Transform – 2014
4. Software package – MATLAB -Separation of generalized angular/temporal components – 2014
5. Software package – R – Runstat (with Marta Karas) - 2018
6. Software package – R – ADEPT – (with Marta Karas, Jaroslaw Harezlak and William Fadel) - 2019
7. Data package – R – ADEPTDATA– (with Marta Karas, Jaroslaw Harezlak and William Fadel) - 2019

## PEER-REVIEWED PUBLICATIONS

### Wearable Computing and Health Research:

8. Kuo P., **Urbanek J.**, Schrack J., Age-Related Bias in Total Step Count Recorded by Wearable Devices, JAMA Intern Med. 2019 Nov 1;179(11)
9. Wanigatunga, A., Di, J. Zipunnikov, V., **Urbanek, J.**, Kuo, P., Simonsick, E., Ferrucci, L., Schrack, J., Association of Total Daily Physical Activity and Fragmented Physical Activity with Mortality in Older Adults, JAMA network open 2(10), 2019
10. Karas, M., Strączkiewicz, M., Fadel, W., Harezlak, J., Crainiceanu, C., **Urbanek, J.**, Adaptive empirical pattern transformation (ADEPT) with application to walking stride segmentation, Biostatistics, 2019
11. Smirnova, E. Leroux, A. Cao, Q., Tabacu, L., Zipunnikov, V., Crainiceanu, C., **Urbanek, J.**, 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, 2019
12. Qiao, Y., Martinez-Amezcuca, P., Wanigatunga, A., **Urbanek, J.**, Simonsick, E., Ferrucci, L., Schrack, J., Association Between Cardiovascular Risk and Perceived Fatigability in Mid-to-Late Life, Journal of the American Heart Association 8(16), 2019
13. Martinez-Amezcuca, P., Simonsick, E., Wanigatunga, A., **Urbanek, J.**, Chiles Shaffer, N., Ferrucci, L., Schrack, J., Association Between Adiposity and Perceived Physical Fatigability in Mid-to Late Life, Obesity 2019
14. Adelnia, F., **Urbanek, J.**, Osawa, Y., Shardell, M., Brennan, N., Fishbein, K., Spencer, R., Simonsick, E., Schrack, J., Ferrucci, L., Moderate-to-Vigorous Physical Activity Is Associated With Higher Muscle Oxidative Capacity in Older Adults, Journal of the American Geriatrics Society 2019
15. Fadel, W., **Urbanek, J.**, Albertson, S., Li, X., Chomistek, A., Harezlak, J., Differentiating Between Walking and Stair Climbing Using Raw Accelerometry Data, Statistics in Biosciences 2019
16. Di, J. Spira, A., Bai, J., **Urbanek, J.**, Leroux, A. Wu, M., Resnick, S., Simonsick, E., Ferrucci, L., Schrack, J., Joint and Individual Representation of Domains of Physical Activity, Sleep, and Circadian Rhythmicity, Statistics in Biosciences 2019
17. Qiao, Y., Martinez-Amezcuca, P., **Urbanek, J.**, Simonsick, E., Schrack, J., Abstract P012: Cardiovascular Risk Scores Predict Fatigability Among Older Adults, Circulation 139, 2019
18. Leroux, A., Di, J., Smirnova, E., McGuffey, E., Cao, Q. Bayatmokhtari, E., Tabacu, L., Zipunnikov, V., **Urbanek, J.**, Crainiceanu, C., Organizing and analyzing the activity data in NHANES, Statistics in Biosciences 2019
19. Karas, M., Bai, J., Strączkiewicz, M., Harezlak, J., Glynn, NW., Harris T., Zipunnikov, V., Crainiceanu, C., **Urbanek, J.**, Accelerometry data in health research: challenges and opportunities. Review and examples Statistics in Biosciences 2019
20. Varma, V. R., Dey, D., Leroux, A., Di, J., **Urbanek, J.**, Xiao, L., & Zipunnikov, V. (2018). Total volume of physical activity: TAC, TLAC or TAC ( $\lambda$ ). Preventive medicine, 106, 233
21. Gaynanova, I., **Urbanek, J.**, Punjabi, N. M. (2018). Corrections of Equations on Glycemic Variability and Quality of Glycemic Control. Diabetes technology & therapeutics, 20(4), 317-317.

22. **Urbanek, J**, Harezlak, J, Glynn, NW, Harris, T, Crainiceanu, C, Zipunnikov, V, Stride variability measures derived from wrist-and hip-worn accelerometers, *Gait & Posture* 52 (2017) 217–223
23. Strackiewicz, M, **Urbanek, J**, Fadel, W, Crainiceanu, C, Harezlak, J, Automatic car driving detection using raw accelerometry data, *Physiological Measurement*, 2016 Sep 21;37(10):1757-1769
24. Varma, V., Day, D., Leroux, A., Di, J., **Urbanek, J.**, Xiao, L., Zipunnikov, V., Re-evaluating the effect of age on physical activity over the lifespan, *Preventive Medicine* (2017), 101, 102-108
25. **Urbanek, J**, 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: Medical Sciences*, 2018 Apr 17;73(5):676-681
26. **Urbanek, J.**, Spira, A., Di, J., Leroux, A., Crainiceanu, C., Zipunnikov, V., Epidemiology of Objectively Measured Bedtime and Chronotype in the US adolescents and adults: NHANES 2003-2006, *Chronobiology international* 35 (3), 416-434
27. **Urbanek, J**, Zipunnikov, V, Harris, T, Fadel, W, Glynn, N, Crainiceanu, C, Harezlak J, Prediction of sustained harmonic walking in the free-living environment using raw accelerometry data. 2018, *Physiological Measurement*, 39(2)
28. Zipunnikov, V., Dey, D., Leroux, A., Di, J., **Urbanek, J.**, Schrack, J., Crainiceanu, C., Total physical activity and its circadian allocation are independent predictors of mortality in NHANES 2003-2006, *PLOS One* (Revise and Resubmit)

#### **Vibro-acoustics and Signal Processing:**

29. **Urbanek, J**, Barszcz, T, Strackiewicz, M, Jablonski A, Normalization of vibration signals generated under highly varying speed and load with application to signal separation, *Mechanical Systems and Signal Processing* 82, 13-31, 2017
30. **Urbanek, J**, Barszcz, T, Jablonski, A, Application of angular–temporal spectrum to exploratory analysis of generalized angular–temporal deterministic signals, *Applied Acoustics* 109, 27-36, 2016
31. **Urbanek, J**, Barszcz, T, Antoni, J, Integrated modulation intensity distribution as a practical tool for condition monitoring, *Applied Acoustics*, 77, 184-194, 2014
32. Zimroz, R, Bartelmus, W, Barszcz, T, **Urbanek, J**, Diagnostics of bearings in presence of strong operating conditions non-stationarities - A procedure of load-dependent features processing with application to wind turbine bearings, *Mechanical Systems and Signal Processing*, 2013
33. **Urbanek, J**, Barszcz, T, Antoni, J, Time - frequency approach to extraction of selected second-order cyclostationary vibration components for varying operational conditions, *Measurement*, 46, 4, 1454-1463, 2013
34. **Urbanek, J**, Barszcz, T, Antoni, J, A two-step procedure for estimation of instantaneous rotational speed with large fluctuations, *Mechanical Systems and Signal Processing*, 38, 1, 96-102, 2013
35. **Urbanek, J**, Antoni, J, Barszcz, T. Detection of signal component modulations using modulation intensity distribution, *Mechanical Systems and Signal Processing*, 28, 399-413, 2012
36. **Urbanek, J**, Barszcz, T, Zimroz, R, Antoni, J, Application of averaged instantaneous power spectrum for diagnostics of machinery operating under non-stationary operational conditions, *Measurement*, 45, 7, 1782-1791, 2012
37. **Urbanek, J**; Barszcz, T; Uhl, T; Staszewski, WJ; Beck, SBM; Schmidt, B; Leak detection in gas pipelines using wavelet-based filtering, *Structural Health Monitoring*, 11, 4, 405-412, 2012
38. Strackiewicz, M, **Urbanek, J**, Barszcz, T. Three-dimensional representation of diagnostic features in application to wind turbines, *Diagnostyka*, 16-Sep., 2012
39. Zimroz, R, **Urbanek, J**, Barszcz, T, Bartelmus, W, Millioz, F, Martin, N, Measurement of instantaneous shaft speed by advanced vibration signal processing-application to wind turbine gearbox, *Metrology and Measurement Systems*, 18, 4, 701-712, 2011
40. **Urbanek, J**, Barszcz, T, Sawalhi, N, Randall, R, Comparison of amplitude-based and phase-based methods for speed tracking in application to wind turbines, *Metrology and Measurement Systems*, 18, 2, 295-304, 2011

#### **Books:**

41. Barszcz T, **Urbanek J**, Monitoring and diagnostics of rotating machinery: practical handbook of vibro-diagnostics (In Polish), 2008, ISBN 978-83-7204-747-2

#### **Engineering journals:**

42. **Urbanek J**, Mechanical Vibrations as the Source of Information (In Polish), *Służby Utrzymania Ruchu* 1/2011, ISSN: 1896-0677
43. **Urbanek J**, Method for Detection of Mechanical Overloads in Turbosets (In Polish), *Służby Utrzymania Ruchu* 6/2010, ISSN: 1896-0677
44. **Szumilas L, Urbanek J**, Diagnostic Center – Modern Trends in Maintenance and Reliability (In Polish), *Służby Utrzymania Ruchu* 2/2010, ISSN: 1896-0677