Marta Karas

CONTACT
INFORMATION

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PROFILE

STATISTICAL METHODS interests: power estimation in complex settings, methods for processing and statistical analysis of wearable devices and smartphone data, causal inference, machine learning, R software development.

EDUCATION

Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

Ph.D., Biostatistics   **Aug 2017 – Dec 2021**

- Dissertation: "Statistical Methods for Wearable Device Data and Sample Size Calculation in Complex Models." (*Defense slides link*). Public final oral defense held on Nov 17, 2021.
- Academic Advisors: Ciprian M. Crainiceanu, Jacek K. Urbanek

Wroclaw University of Science and Technology, Wroclaw, Poland

M.S., Mathematics (Mathematical Statistics)   **Sep 2013 – Jun 2015**

- Dissertation: "Theoretical and practical issues in change point detection." (*Thesis link*)
- Academic Advisor: Malgorzata Bogdan
- Final grade: 5.5/5.5 (Excellent). Graduation with Academic Distinction

Wroclaw University of Science and Technology, Wroclaw, Poland

B.S., Mathematics (Mathematical Statistics)   **Sep 2010 – Jun 2013**

- Final grade: 5.0/5.5 (Very good)

INDUSTRY
EXPERIENCE

Evidation Health (Digital Health), San Mateo, CA, USA

Data Science Intern   **Jun 2020 - Aug 2020**

- Designed, performed, and reported analysis to estimate post-surgery recovery trajectories and predict recovery time from wearable patient-generated health data (*first-author article published*).
- Proposed and implemented an extension of the existing methodology for measuring sedentary/active accumulation time.

Novartis (Pharmaceutical), Basel, Switzerland

Sensor Data Analytic Intern   **Jun 2019 - Aug 2019**

- Proposed, implemented, and evaluated a method for free-living walking strides segmentation from wrist-worn accelerometry sensor (*first-author article published*).
- Quantified association between walking features and PROs in a diseased population.

Opera Software (Software, Web Browser), Wroclaw, Poland

Analyst (full-time)   **Aug 2016 - Dec 2016,**
                                                                  Jul 2015 - Dec 2015

- Designed and implemented methodology for A/B-test results analysis.
- Developed time-series forecasting models for Opera browser's KPIs.
- Performed ad hoc user base analysis for software product improvements.
- Designed and implemented a Bayesian framework for inference about users' behavior.

Datarino (Big Data Services & Data Management Solutions), Wroclaw, Poland

Data Scientist (part-time)   **Jul 2014 - Mar 2015**

- Performed ad hoc analysis of user base and monetization KPIs of Polish social network service.
- Performed analyses of business partners' big-data size data sets.

ACADEMIC
EXPERIENCE

Harvard University, Department of Biostatistics, Harvard T.H. Chan School of Public Health, Boston, MA, USA

Postdoctoral Researcher   **Jan 2022 - present**

- Quantifying ALS progression with data collected with wearable devices (ActiGraph, Modus) and smartphones (surveys, accelerometry, GPS).
- Quantifying patterns of behaviour in suicidal behavior population with smartphones data (surveys, accelerometry, GPS).
- Developing methods for missing data imputation and uncertainty quantification for sensor data with missingness using functional regression.

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

Research Assistant   **Jan 2018 - Dec 2021**

- Developed and validated ADEPT, a novel statistical pattern-segmentation method, optimized for identification of walking from wrist-worn accelerometry data.
- Proposed harmonization methods of objective summary measures of physical activity, applied to a large (n=600+) multiday observational study.
- Evaluated and expanded scope of novel resampling method for estimating statistical test power sample size in complex modeling settings, including multilevel data problems.
- Developed four open-source software (R packages). Two of them are incorporated in the Accelerometry Resource Core (ARC) at Johns Hopkins Medicine (https://accelerometry.org).

Indiana University Bloomington, Department of Epidemiology and Biostatistics, School of Public Health, Bloomington, IN, USA

Research Assistant   **Jan 2017 - Jul 2017**

- Applied graph-constrained regularization methods to quantify the association between brain structural imaging markers and HIV+/HIV− status (*article published*).

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

Research Assistant   **Jan 2016 - Jul 2016**

- Proposed, implemented and evaluated extension of existing graph-constrained regularization methods for linear regression (*first-author article published*).

- Quantified association between brain structural imaging markers and alcohol abuse.

TEACHING EXPERIENCE

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

Instructor

- 140.604 Introduction to R for Public Health Researchers (2021-22)
- 140.850 Special topics course: Biostatistical Methods for Wearable Computing (2019-20)

Teaching assistant

- 140.651-2 Methods in Biostatistics I-II (2018-19, 2019-20, 2020-21)
- 140.623-4 Statistical Methods in Public Health III-IV (2018-19)
- 600.710 Statistical Concepts in Public Health 2 (2021-22)
- 140.612 Statistical Reasoning in Public Health II (2021-22)

HONORS AND AWARDS

1. Induction as a member of the Alpha chapter of the Delta Omega Society. 2022 (*link*)

2. Travel Reimbursement Award to 3rd Annual Health Data Science Symposium at Harvard. Harvard University. 2021

3. Student Poster Sponsorship for the ActiGraph Digital Data Summit 2021. ActiGraph LLC. 2021

4. Louis I. and Thomas D. Dublin Award for the Advancement of Epidemiology and Biostatistics. Johns Hopkins University, Department of Biostatistics and Department of Epidemiology. 2021 (*link*)

5. Helen Abbey Award for Excellence in Teaching. Johns Hopkins University, Department of Biostatistics. 2021 (*link*)

6. Joseph Zeger Travel Reimbursement Award to CFE-CMStatistics 2020 conference. Johns Hopkins University, Department of Biostatistics. 2020

7. Joseph Zeger Travel Reimbursement Award to ICAMPAM 2019 conference. Johns Hopkins University, Department of Biostatistics. 2019

8. Leadership, Empowerment and Learning Culture Award. Novartis US Analytics Conference. 2019

9. ENAR Poster Award. ENAR 2017 Spring Meeting. 2017

10. The 2nd Summer Institute in Statistics for Big Data Scholarship Award. University of Washington, Department of Biostatistics. 2016

PUBLISHED JOURNAL ARTICLES

1. Neishabouri, A., Nguyen, J., Samuelsson, J., Guthrie, T., Biggs, M., Wyatt, J., Cross, D., **Karas, M.**, Migueles, J.H., Khan, S., Guo, C.C. (2022). Quantification of acceleration as activity counts in ActiGraph wearable. *Scientific Reports*, 12(1), 1–8. `https://doi.org/10.1038/s41598-022-16003-x`

2. **Karas, M.***, Muschelli, J.*, Leroux, A., Urbanek, J. K., Wanigatunga, A. A., Bai, J., Crainiceanu, C. M., Schrack, J. A. (2022). Comparison of Accelerometry-Based Measures of Physical Activity: Retrospective Observational Data Analysis Study. *JMIR mHealth and uHealth*, 10(7), e38077. `https://doi.org/10.2196/38077`

3. Rubin, D.S., Ranjeva, S.L., Urbanek, J.K., **Karas, M.**, Madariaga, M.L.L., Huisingh-Scheet, M. (2022). Smartphone based gait cadence to identify older adults with decreased functional capacity. *Digital Biomarkers*, 6(2), 61–70. `https://doi.org/10.1159/000525344`

4. Urbanek, J. K., Roth, D. L., **Karas, M.**, Wanigatunga, A. A., Mitchell, C. M., Juraschek, S. P., Cai, Y., Appel, L. J., Schrack, J. A. (2022). Free-living gait cadence measured by wearable accelerometer: a promising alternative to traditional measures of mobility for assessing fall risk. *The Journals of Gerontology: Series A*, 2022;, glac013, `https://doi.org/10.1093/gerona/glac013`

5. **Karas, M.**, Urbanek, J. K., Illiano, V. P., Bogaarts, G., Crainiceanu, C. M., Dorn, J. F. (2021). Estimation of free-living walking cadence from wrist-worn sensor accelerometry data and its association with SF-36 quality of life scores. *Physiological Measurement*, 42(6), 65006. `https://doi.org/10.1088/1361-6579/ac067b`

6. Brzyski, D., **Karas, M.**, M Ances, B., Dzemidzic, M., Goñi, J., W Randolph, T., Harezlak, J. (2021). Connectivity-informed adaptive regularization for generalized outcomes. *Canadian Journal of Statistics*, 49(1), 203–227. `https://doi.org/10.1002/cjs.11606`

7. **Karas, M.**, Marinsek, N., Goldhahn, J., Foschini, L., Ramirez, E., Clay, I. (2020). Predicting Subjective Recovery from Lower Limb Surgery Using Consumer Wearables. *Digital Biomarkers*, 4(Suppl 1), 73–86. `https://doi.org/10.1159/000511531`

8. **Karas, M.**, Straczkiewicz, M., Fadel, W., Harezlak, J., Crainiceanu, C. M., Urbanek, J. K. (2021). Adaptive empirical pattern transformation (ADEPT) with application to walking stride segmentation. *Biostatistics (Oxford, England)*, 22(2), 331–347. `https://doi.org/10.1093/biostatistics/kxz033`

9. **Karas, M.**, Bai, J., Straczkiewicz, M., Harezlak, J., Glynn, N. W., Harris, T., Zipunnikov, V., Crainiceanu, C., Urbanek, J. K. (2019). Accelerometry Data in Health Research: Challenges and Opportunities. *Statistics in Biosciences*, 11(2), 210–237. `https://doi.org/10.1007/s12561-018-9227-2`

10. **Karas, M.**, Brzyski, D., Dzemidzic, M., Goñi, J., Kareken, D. A., Randolph, T. W., Harezlak, J. (2017). Brain Connectivity-Informed Regularization Methods for Regression. *Statistics in Biosciences*, 11(1), 47–90. `https://doi.org/10.1007/s12561-017-9208-x`

ACCEPTED JOURNAL ARTICLES

1. Matabuena, M.*, **Karas, M.***, Riazati, S., Caplan, N., Hayes, P.R. (2022). Estimating knee movement patterns of recreational runners across training sessions using multilevel functional regression model. Accepted in *The American Statistician*.

SUBMITTED MANUSCRIPTS

1. **Karas, M.**, Crainiceanu, C. M. (2021). Upstrap for estimating power and sample size in complex models. Preprint available on *bioRxiv*. `https://doi.org/10.1101/2021.08.21.457220`

Note: * indicates shared co-first authorship.

CONFERENCE POSTERS

1. *Comparison of accelerometry-based measures of physical activity.* JSM 2022, Washington, DC, USA, Jun 2021.

2. *Comparison of accelerometry-derived physical activity summary measures by age, sex, and BMI.* ICAMPAM 2021 virtual conference, Jun 2021.

3. *Association of Structural Brain Imaging Measures with HIV Markers Incorporating Structural Connectivity Information: a Regularized Statistical Approach.* ENAR, Washington DC, USA, Mar 2017. (Received <u>ENAR Poster Award</u>).

4. *Penalized regression inference regarding variable selection in high dimensions: presentation of selected methods implemented in R.* European R Users Conference, Poznan, Poland, Oct 2016.

CONFERENCE /
INVITED TALKS
(SELECTED)

1. *Harmonization of open-source and proprietary accelerometry-based physical activity measures.* 3rd Annual Health Data Science Symposium at Harvard, Boston, Nov 2021.

2. *Estimation of free-living walking cadence from wrist-worn sensor accelerometry data and its association with SF-36 quality of life scores.* ENAR 2021, virtual conference, Mar 2021.

3. *Estimation of free-living walking cadence from wrist-worn sensor accelerometry data and its association with SF-36 quality of life scores.* CMStatistics 2020, virtual conference, Dec 2020.

4. *Novel approach for precise walking cadence estimation from high-density tri-axial accelerometry data collected at wrist in free-living.* 41st Annual Conference of the International Society for Clinical Biostatistics, virtual conference, Aug 2020.

5. *Functional registration of walking strides in high-density accelerometry data for estimation of gait asymmetry.* CFE-CMStatistics 2019 conference, London, UK, Dec 2019.

6. *Walking measurements derived from free-living wrist-worn sensor as novel digital endpoints.* Novartis 2019 US Analytics Conference, East Hanover, NJ, USA, Oct 2019.

7. *Automatic estimation of step asymmetry from accelerometry data.* ICAMPAM 2019, Maastricht, The Netherlands, Jul 2019.

8. *ADaptive Empirical Pattern Transformation (ADEPT) with application to walking stride segmentation.* JSM 2018, Vancouver, Canada, Aug 2018.

9. *Wearable accelerometers, accelerometry data and automatic steps segmentation in R: strideter and convo R packages.* Why R? 2018 Conference, Wroclaw, Poland, Jul 2018.

SOFTWARE
DEVELOPMENT

1. `arctools` R package: Processing and Physical Activity Summaries of Minute Level Activity Data. (*CRAN*, *GitHub*)

2. `adept` R package: Adaptive Empirical Pattern Transformation. (*CRAN*, *GitHub*, *website*). (Selected in *Top 40 new CRAN packages* in May 2019; *list link*)

3. `adeptdata` R package: Accelerometry Data Sets. (*CRAN*, *GitHub*)

4. `runstats` R package: Fast Computation of Running Statistics for Time Series. (*CRAN*, *GitHub*, *website*)

5. `mdpeer` R package: Graph-Constrained Regression with Enhanced Regularization Parameters Selection. (*CRAN*)

PROFESSIONAL
ACTIVITIES

- Referee for: PLOS ONE, Digital Biomarkers, Gait and Posture, Journal for the Measurement of Physical Behaviour, Physiological Measurement, Scandinavian Journal of Medicine and Science in Sports, Sensors, Social and Personality Psychology Compass. (*Publons profile link*).

COMPUTER SKILLS

- R (expert), Python, Git.