# MACIEJ KOS, PH.D.

OFFLINE: BROOKLINE, MA

ONLINE: MKOS.PL | GITHUB | EMAIL

Previously: Google, Roku, Philips Healthcare Research

## EDUCATION

### Northeastern University, Khoury College of Computer Sciences — 2024

*Ph.D. in Personal Health Informatics* — Boston, MA

- GPA: 4.0/4.0
- Dissertation: Digital biomarkers of cognitive health: unobtrusive monitoring of cognitive changes using smartphones
- Selected awards:
  - NIH National Institute of Aging, Predoctoral Fellow (F99), 2020 - 2023
  - ACM/Intel Corporation Computational and Data Sciences Fellowship, 2017 – 2021
  - Network Science Institute Seed Grant, 2021
  - Northeastern University Dissertation Grant, 2020
  - Google Scholar, 2020
  - Multiple conference, workshop, and summer school awards omitted

### University of Michigan, School of Information — 2012

*M.A. in Information Science* — Ann Arbor, MI

### Barcelona Graduate School of Economics — 2009

*M.Sc. in Economics of Science and Innovation* — Barcelona, Spain

## SKILLS

- **Programming:** Python, R, Stata, SQL (GCP BigQuery, AWS Athena)
- **Statistics:** GLM (univariate, multivariate, some multilevel), SEM, psychometric modeling, time series, repeated measures
- **Machine Learning/AI:** dimensionality reduction, clustering, SVMs, ridge regression, logistic classification, random forests, sequential pattern mining, LLM few-shot learning
- **Other:** data visualization, network analysis, wearables, GPS data, behavioral modeling, qualitative UX research
- **Eager to learn:** computer vision, deep learning, NLP, signal processing

## RESEARCH EXPERIENCE, ACADEMIA

### Northeastern University Center for Cognitive and Brain Health — 6/2024–

*Postdoctoral Research Fellow* — Boston, MA

- NIH NIA Career Award recipient (K00)

- Leads a DIGITAL BIOMARKERS research project on detecting changes in cognitive health using unobtrusively collected smartphone data by combining neuro approaches with data science, AI, and mechanistic modeling methods.

## Northeastern University Khoury College of Computer Sciences 9/2015 – 3/2024

*Graduate Researcher* Boston, MA

"**Digital Biomarkers of Cognitive Health**" (Dissertation), with Dr. Pavel and Dr. Rampersad

- To infer cognitive changes, I developed software and algorithms for collecting and analyzing smartphone data collected passively (location and motion, typing speed and frequency of errors, app use, and screen events).
- Designed cognitive lab experiments, including cognitive and motor tasks and EEG.
- Recruited, trained, and managed a team of five research assistants; secured their funding.

"**Measurement of collective physical distancing during the COVID-19 outbreak using large-scale mobility data**" in collaboration with the MOBS lab, PI: Alessandro Vespignani

- Developed an approach for reducing selection bias in smartphone location data of over 40 million US users by combining well-established statistical techniques with multivariate simulations applied to geospatial sociodemographic data (Python, R).
- Helped build a pipeline for processing over 0.5 petabytes of data (Python, BigQuery).

"**Strengthening Human Adaptive Reasoning and Problem-solving**" in collaboration with Harvard, Oxford, and HoneyWell

- Built a statistical model to characterize the relationship between different types of brain stimulation, estimates of fluid intelligence, and performance during adaptive cognitive training (R).
- Helped develop a computational model of participants' performance during adaptive cognitive training (R).

"**WearTech - determining the accuracy of wearable sensors for ambulatory stress monitoring**"

- Used machine learning and signal processing techniques to develop a method for removing motion artifacts from heart rate data (R).
- The developed method improved upon Microsoft's state-of-the-art algorithm.

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**RESEARCH EXPERIENCE, INDUSTRY**

## Roku 6/2021 – 9/2021

*Research Data Scientist Intern* Remote

"**Development and assessment of algorithms for creating lookalike audiences (ads)**"

- Implemented and assessed machine learning methods for creating lookalike audiences using behavioral data (lift > 20x).
- Proposed novel algorithms for lookalike creation.

## Google 5/2019 – 9/2019

*User Experience Research Intern (quant)* San Francisco, CA

"**Quantification of Material Design (Google's open-source design system)**"

- Developed an algorithm for computing websites' cognitive complexity based on Shannon's entropy.
- Prototyped analytics pipeline to parse 400 billion pages and fuses Google's diverse signals about each website (e.g., vertical, location, reach).

## Philips Healthcare Research 5/2018 – 9/2018

*Research Intern (Clinical Data Analytics)* Cambridge, MA

**"Intensive care unit of the future: health informatics technologies for preventing critical illness brain injury (CIBI)"**

- Proposed and prototyped system architectures and UX of two clinical decision support systems for preventing delirium and CIBI using ICU data.
- Submitted two patent applications (internally).

## Agile Axons (self-employed) 1/2013 – 8/2015

*User Experience and Research Consultant* Poland and Rome, Italy

- Led a UX team developing a consumer-facing mobile app for a large Italian telco (with **McKinsey** and **Ericsson**).
- Consulted on research design and statistical programming for behavioral finance and economics projects.

### SIDE PROJECTS

- **Child Aid:** Analyzed data and consulted on research design for a large-scale experimental intervention to increase the literacy of Guatemalan children.
- **Lives of Dissidents:** Led UX research and design effort to help launch a charity project dedicated to spreading the message of peaceful dissent as a means of dissolving oppression.

### ADDITIONAL ACTIVITIES

- Ad hoc reviewer for SIG Human-Computer Interaction, IEEE Engineering in Medicine and Biology Society, and American Medical Informatics Association, PLOS ONE, Journal of Gerontology: Psychological Sciences
- Northeastern Personal Health Informatics Faculty Committee, 2018/2019 – elected student representative
- Poland Foresight 2020 national research program – external expert

### PAPERS, PRESENTATIONS, AND POSTERS (SELECTED)

1. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Gonzalez R., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi (2024). *Characterizing the collective physical distancing of the United States during the first nine months of the COVID-19 pandemic*. PLOS Digit Health 3(2): e0000430. https://doi.org/10.1371/journal.pdig.0000430
2. Jimison, H., **Kos M.**, Pavel, M. (2022). *Early Detection of Cognitive Decline Via Mobile and Home Sensors*. In: Hsueh, PY.S., Wetter, T., Zhu, X. (eds) Personal Health Informatics. Cognitive Informatics in Biomedicine and Healthcare. Springer, Cham. Online version: https://rdcu.be/c1niL
3. Pavel M., Caves K., Jarvis L., Hasson C.J., **Kos M.**, Jimison H. (2021). *Unobtrusive, Continuous LIDAR-Based Measurement of Gait Characteristics at Home*. Paper presentation at the 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Virtual
4. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi M. (2020). *Reshaping a nation: Mobility,*

*commuting, and contact patterns during COVID-19*. Presentation at COVID-19 Satellite of Sunbelt XL, International Sunbelt Social Network Conference, virtual

5. **Kos M.** (2020). *Towards a digital biomarker of cognitive health: passive monitoring of cognitive changes using smartphone-based data*. Poster presentation at the Computing Research Association Grad Cohort Workshop, Austin, TX
6. **Kos M.**, Yew J. (2019). *Computational methods for understanding cognitive density preferences; foundations for adaptive user interfaces*. Google Ph.D. Intern Research Conference, Mountain View, CA
7. **Kos M.**, Pavel M., Jimison H. (2019). *How to Validate Heart Rate Monitoring Wearables for Just-in-Time Adaptive Health Interventions? Development of Comparison Testing Guidelines*. Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC
8. **Kos M.**, Ponnada A., Pavel M., Intille S. (2019). *Evidence That Microinteraction Ecological Momentary Assessment (μEMA) is a Non-Reactive In-Situ Affect Assessment Method*. Poster presentation at the Society for Affective Science Annual Conference in Boston, MA
9. **Kos M.**, Gordon C., Li X., Khaghani-Far I., Pavel M., Jimison H. (2017). *The Accuracy of Monitoring Stress from Wearable Devices*. Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC
10. **Kos M.**, Li X., Khaghani-Far I., Gordon C., Pavel M., Jimison H. (2017). *Can accelerometry data improve estimates of heart rate variability from wrist PPG sensors?* Paper presentation at the 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, South Korea