MACIEJ KOS

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RESEARCH INTERESTS

Methods: behavior modeling using data-driven, statistical, and mechanistic approaches; mHealth; sensing; JITAI

Application areas: health monitoring; cognitive aging; physical activity; decision-making; data for social good

EDUCATION

Northeastern University, Boston, MA — 02/2024
Ph.D. Personal Health Informatics (GPA: 4.0) (Advisor: Prof. Misha Pavel)

University of Michigan, Ann Arbor, MI — 12/2012
Master of Arts in Information Science

Barcelona Graduate School of Economics, Barcelona, Spain — 06/2009
Master of Science in Economics of Science and Innovation

University of Gdansk, Sopot, Poland — 06/2005
Bachelor and Master of Arts in Economics and E-business

SELECTED AWARDS

- NIH National Institute of Aging: Transition to Aging Research F99 Predoctoral Fellowship 9/2020 – 8/2023 (46,000 – 56,000 USD annually for tuition and stipend)
- Harvard John A. Paulson School of Engineering and Applied Sciences, Institute for Applied Computational Science, 2022 – tuition waiver to participate in Harvard Bedrock Machine Learning courses
- Association for Computing Machinery HPC/Intel Corporation Computational and Data Sciences Fellowship, 2017 – 2020 (15,000 USD annually)
- Google Scholarship, 2020 (10,000 USD)
- Graduate Cohort Workshop for Underrepresented Minorities and Persons with Disabilities, 2020 – Computing Research Association Travel Award
- Grace Hopper Conference, 2019 – Google travel award
- Complex Physical, Biological & Social Systems Winter School at New England Complex Systems Institute, MIT, Cambridge, MA, 2019 – tuition waiver
- Disability: IN, 2017 - NextGen Leader award
- Barcelona Graduate School of Economics, 2008/2009 – merit-based full tuition waiver (12,000 EUR)

During my PhD, I raised $166,000 of extramural funding for my research and training.

RESEARCH EXPERIENCE

Northeastern University — Boston, MA
Graduate Researcher — 09/2015 – present

"Multidimensional Digital Biomarker of Cognitive Health: Unobtrusive and Continuous Monitoring of Cognitive Changes Using Smartphones" with Misha Pavel (advisor), Stephen Intille, Holly Jimison, Joe Kvedar, and Art Kramer

- To infer changes in cognitive functions, I developed software and algorithms for collecting and analyzing smartphone data collected passively (location, typing speed and frequency of errors, app use).
- Designed cognitive lab experiments, including cognitive and motor tasks and EEG.
- Obtained funding for hiring a team of five research assistants; recruited, trained, and managed the team

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

- 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 socio-demographic data.
- Helped build a pipeline for processing over 0.5 petabytes of data.

"Strengthening Human Adaptive Reasoning," in collaboration with Harvard and Oxford:

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

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"WearTech:"
- Used machine learning and signal processing techniques to develop a method for removing motion artifacts from heart rate data. Improved upon Microsoft's state-of-the-art algorithm.

Roku   Remote
Research Data Scientist Intern   06/2021 – 09/2021
- Implemented and assessed methods for creating lookalike audiences using behavioral data (lift > 20x).
- Proposed novel algorithms for creation of lookalike audiences.

Google   San Francisco, CA
Quantitative UX Research Intern (with Material Design)   05/2019 – 09/2019
- Developed an algorithm for computing the website's cognitive complexity based on Shannon's entropy.
- Prototyped an analytics pipeline to parse 400 billion pages and fuse Google's diverse signals about each website (e.g., vertical, location, reach).

Philips Healthcare Research   Cambridge, MA
Research Intern (with Clinical Data Analytics)   05/2018 – 09/2018
- Proposed and prototyped system architectures and UX for two clinical decision-support systems for preventing delirium and critical illness brain injury.
- Submitted two patent applications to the legal department.

Polish National Science Center, Research Grant   Poland & Boston, MA
Investigator / Research Group Manager   07/2013 – 05/2018
- Conceptualized a study of genetic health information avoidance and wrote a Research Strategy for a winning grant application ($77,000; the largest grant awarded to researchers at the host economics department).
- Wrote software for running online experiments, managed online and offline experiments with > 1000 participants.
- Analyzed data and presented findings at four conferences.

Agile Axons (self-employed)   Poland and Rome, Italy
User Experience and Research Consultant   01/2013 – 08/2015
- 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.

Earlier positions
- Graduate Research Assistant at the University of Michigan
- Localization tester at Electronic Arts in Spain
- IT content editor at Softonic in Spain
- Product Manager (intern) at Internet Advantage in Spain
- Researcher/Lecturer at the University of Gdansk (Poland)

SELECTED TEACHING EXPERIENCE
- Northeastern University (2018–2023):
  - Programming with Data (DS2000): undergraduate course; Teaching assistant
  - Health Data Analytics (HDA6400): graduate course; Teaching assistant
- University of Gdansk (2006-2009):
  - Web usability: undergraduate and graduate course; Instructor
  - Internet Marketing and online communities: graduate course; Instructor

MENTORSHIP
- Northeastern University (2019–2024):
  - Guided three graduate students through completing their data science capstone project
  - Mentored a graduate student in health data analytics and an undergraduate student in computer science
- University of Gdansk (2005-2009):
  - Mentored two teams of graduate students participating in the Google Online Marketing Challenge; one of the teams won first place in Poland
  - Advised 20 undergraduate students on their thesis projects

GRANTS (SELECTED)
- Network Science Institute Seed Grant Program, 2021 (10,000 USD) – grant for exploratory research on "App Networks Analysis for Developing a Digital Biomarker of Cognitive Health"

- Northeastern University Tier I grant, 2020 (approx. 50,000 USD) – grant for developing digital biomarkers using smartphone data; co-PIs Dr. Rampersad and Dr. Pavel
- Northeastern University Dissertation Research Grant, 2019 (3,000 USD)
- Polish National Science Center, 2013 (77,000 USD) – research grant to study why individuals often avoid actionable genetic health risk information; I wrote the Research Strategy for the application that <u>won the largest grant awarded to researchers at the host economics department</u> (before beginning my Ph.D. program at Northeastern University)
- Erasmus Life-long Learning Grant, 2008 (1,900 EUR)
- University of Gdansk, 2007 (2,000 USD) – research grant to characterize usability of academic websites
- Erasmus Socrates Mobility Grant, 2005 (1,850 EUR)

ACADEMIC SERVICE
- Ad hoc reviewer for:
  - SIG Computer-Human Interaction,
  - IEEE Engineering in Medicine and Biology Society
  - American Medical Informatics Association
  - PLOS
- Northeastern Personal Health Informatics Faculty Committee, 2018/2019 – elected student representative
- Personal Health Informatics seminar, 2016/2018 – organizer (with C. Gordon and S. Ólafsson)
- Northeastern University Ph.D. task force, 2016 – representative of the Personal Health Informatics program
- Rackham's International Connect, 2010/2011 – mentor
- Poland Foresight 2020 national research program – external expert
- Barcelona Graduate School of Economics, 2008/2009 – student representative
- E-business Science Association, 2006-2008 – chair at the University of Gdansk
- Baltic Science Festival, 2007/2008 – departmental coordination team member

PROFESSIONAL ASSOCIATIONS
- Association for Computing Machinery
- IEEE
- Digital Medicine Society (DiMe)
- American Medical Informatics Association

SIDE PROJECTS (PRO-BONO VOLUNTEERING)
- The Lives of the Dissidents: helped launch a charity project dedicated to spreading the message of peaceful dissent as a means of dissolving oppression; designed information architecture, conducted usability studies and card sorting sessions
- Child Aid: analyzed data and consulted on the research design of a large-scale experimental intervention to increase the literacy of Guatemalan children

PUBLICATIONS (PEER-REVIEWED)
- Klein, B., LaRock, T., McCabe, S., Torres, L., Friedland, L., Kos, M., Privitera, F., Lake, B., Kraemer, M.U., Brownstein, J.S., Gonzalez, R., Lazer D., Eliassi-Rad T., Scarpino V.S, Vespignani A., and Chinazzi M. (2023). *Characterizing collective physical distancing in the US during the first nine months of the COVID-19 pandemic.* PLOS Digit Health 3(2): e0000430. https://doi.org/10.1371/journal.pdig.0000430
- Pavel M., Caves K., Jarvis L., Hasson C.J., Kos M., Jimison H. (2021). *Unobtrusive, Continuous LIDAR-Based Measurement of Gait Characteristics at Home.* 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 2339-2342. IEEE
- Kos M., Pavel M., Jimison H., Saczynski J. (2022). *Sensitivity of dual-task motor performance to varying levels of cognitive impairment: a systematic review and quality assessment* (paper under review)
- Khaghani-Far, I., Li, X., Kos, M., Gordon, C. M., Williams, H., Pavel, M., & Jimison, H. B. (2019). NUCoach: *A Customizable Coaching Platform for Designing Rehabilitation Mobile Apps.* Archives of Physical Medicine and Rehabilitation, 100(7), e2.
- 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.
- Blajer-Golebiewska, A. and Kos, M. (2016). *Investors are more sensitive to information about financial rather than ethical reputation of a company: evidence from an experimental study.* Economics & Sociology, 9(1), p.11.

- Kos M. (2013). *Structural and behavioral determinants of play in a repeated network coordination game – preliminary report.* Contemporary Economy Economic Scientific Journal, 3(4), 43-69.
- Kos, M. (2010). *Business aspects of user-centric design.* In J. Winiarski (Ed.), E-commerce. University of Gdansk Print House.
- Kos, M. (2008). *Cultural factors in online marketing communications through corporate websites.* In J. Winiarski, K. Dobrowolski, O. Dębicka, T. Gutowski, & A. Oniszczuk (Eds.), Enterprise on a global market. University of Gdansk Print House.
- Kos, M. (2007). *Virtual communities as a new channel in Internet marketing communications.* In Dobrowolski K. and Kujawa J. (Eds.), Electronic Business. University of Gdansk Print House.

CONFERENCE PRESENTATIONS (PEER-REVIEWED)

- 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.
- Kos M., Ponnada A., Pavel M., Intille S. (2018). *Evidence That Microinteraction Ecological Momentary Assessment (µEMA) is a Non-Reactive In-Situ Affect Assessment Method.* Poster presentation at the 2019 Society for Affective Science Annual Conference in Boston, MA.
- Rampersad S., Orhan K., Kos M., Mansfield K., Marghi Y. M., Sheffield J., Dillard M., Erdogmus D., Pascual-Leone A., Yeung N., Mathan S., Cohen K. R., Pavel M. (2018). *Effects of EEG-Based Closed-Loop Transcranial Alternating Current Stimulation on Theta Power during a Cognitive Task.* Poster presentation at the 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Hawaii.
- 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.

CONFERENCES AND WORKSHOPS (NOT PEER-REVIEWED)

- Kos M., Babula E., Kołatka M., Mrzygłód U., Wach D. (2022). *Characterization of the reflection effect across DOSPERT risk content domains.* Poster presentation at the Society for Judgment and Decision-Making annual conference, San Diego, IL, virtual
- 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
- 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.
- Kos M., Yew J. (2019). *Computational methods for understanding cognitive density preferences; foundations for adaptive user experiences*, Google Ph.D. Intern Research Conference, Mountain View, CA.
- McKanna J., Kos M., Plessow F., Dillard M., Almquist J., Kimball G., Myers E., Orhan U., Rampersad S., Marghi Y., Cornhill D., Brem A., Mansfield K., Yeung N., Thompson T., Santarnecchi E, Erdogmus E., Pascual-Leone A., Kadosh C. R., Mathan S., Pavel M. (2017). *Components of cognition: identifying contributors to learning speed in a game training intervention.* Poster presentation at xTech, San Francisco, CA.
- Kos M., McKanna J., Pavel M., Dillard M., Almquist J., Kimball G., Brem A., Orhan U., Rampersad S., Cornhill D., Yeung N., Erdogmus D., Pascual-Leone A., Kadosh R., Mathan S. (2017). *The impact of stimulus features on learning and accuracy in an adaptive category learning task designed to train fluid intelligence*, Poster presentation at the Association for Psychological Science annual convention, Boston, MA.
- Kos M., Blajer-Gołębiewska A., Wach D., Pavel M., Gonzalez R. (2016). *Decision-making under threat: what determines our engagement in preventive behaviors?* Poster presentation at the Society for Judgment and Decision-Making annual conference, Boston, MA.
- Kos M., Blajer A., Wach D. (2015). *When do we avoid health-risk information?* Poster presentation at the Society for Judgment and Decision-Making annual conference, Chicago, IL.
- Kos M., Blajer A., Wach D. (2015). *Identifying predictors of preventive behaviors using a financially incentivized experiment – a pilot study.* Poster presentation at the 37th Annual North American Meeting of Society for Medical Decision Making, St. Louis, MO.

- Blajer A., Wach D., Kos M. (2015). *When inducing affective decision-making statistical significance may be not enough*, Oral presentation at the 10th Nordic Conference on Behavioral and Experimental Economics, Tampere, Finland.
- Kos M., Blajer A., Wach D. (2015). *When do individuals avoid potentially life-saving risk information?* Poster presentation at the Subjective Probability, Utility, Decision Making conference, Budapest, Hungary.

Book chapters (not peer-reviewed)

- 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