Kambiz Tavabi, PhD

Research Scientistt · Neuroscience Expert

Seattle, WA.

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Summary

Research Science Engineer with 13+ years of postgraduate experience in biomedical and health data science projects. Expert in behavioral neuroscience, data science, and data engineering.

Education

University of Münster *Münster, Germany*

Ph.D. in Neuroscience *Sep 2004 - Jun 2007*

- Received a scholarship (Bat/2a) from the German Education Ministry to attend the Medical Faculty to study auditory neuroscience with Prof. Christo Pantev.
- Completed dissertation after delivering two first-authored articles and graduated magna cum laude (GPA 3.4 of 4.0) as one of the first student alums from the nascent program in interdisciplinary neuroscience.
- **Courses:** Digital Signal Processing, Electrophysiology, Neuroscience, Psycholinguistics, Neuropsychology

University of Oregon *Eugene, OR*

MSc in Cognitive Psychology *Sep 2002 - June 2004*

- Accepted into the terminal Master's Program in Psychology with a specialization in cognition with Prof. Helen Neville in the Brain Development Lab.
- Delivered a research proposal to use biomedical imaging technologies to explore developmental neural plasticity in the human brain.
- **Courses:** Magnetic Resonance Imaging, Philosophy of Mind, Statistics for Data Analysis, Neurobiology of Attention & Arousal, Cognitive Psychology, Social & Personality Psychology, Developmental Psychology, Neuroplasticity, Principles of Psychology, Modern Investigation Methods in Human Neuroscience, Evolution of Mind

University of California Los Angeles *Los Angeles, CA*

BSc in Physiological Science *Sep 1995 - June 2000*

- Graduated from the premed training curriculum with two-yearGraduated from the premed training curriculum with 2+ years volunteering as a student research assistant in the Department of Psychiatry & Biobehavioral Sciences.
- **Courses:** Neurobiology of Learning & Memory, Biological Basis of Psychiatric Disorders, Genetics, Vertebrate Physiology, Chemistry, Organic Chemistry, Biology, Physics, Calculus, Linear Algebra, Logic

Work Experience

University of Washington *Seattle, WA*

Research Science Engineer *Nov 2011 - Dec 2022*

- I Joined the ILABS MEG Brain Imaging lab as a postdoctoral researcher and developed collection, aggregation, exploratory analysis, and small-data visualization workflows for human health data (HIPPA), resulting in publications on terabytes of data for 100+ participants in various scientific journals (i, ii, iii).
- Since 2013 I have contributed to open-source computing software tools for small data mining or 'fishing,' automation & collaborative workflows, and statistical modeling of human neurophysiological data (MEG, EEG). MNEFUN is a small-scale, Python wrapper application used to deploy data science solutions for individual MEEG data at ILABS.
- Contributed to software application for digital signal processing and analysis of individual health data geared at faster coding implementation, more robust analysis, and code sharing between co-workers and collaborations at the institution level MNE-bids.
- MNE-bids codebase was featured in a Journal of Open Source Software publication and is actively maintained by a vibrant open-source developer community.
- In 2014 I was promoted to UW staff scientist (RSE-IV) after developing a series of biomedical imaging data science projects to study language learning in infants and cognition in individuals with autism spectrum disorders and generating $1.5M in funding for ILABS from organizations including the Simms Mann, Bezos Family, and Paros Foundations.
- I served in advisory roles with junior colleagues and students to provide technical expertise for planning data acquisition and analysis strategies for the timely delivery of data science products. In Joo, S. J., Tavabi, K., et al. (2021), I helped to develop strategies for data quality control, wrangling, and analysis resulting in a publication of findings on the neuronal correlates of reading proficiency in the journal Brain and Language. In the publication by Clarke M. et al. (2020), I mentored a graduate student with Python script development and scientific writing of digital signal denoising or signal-to-noise enhancement methodology paper in the Journal of Neuroscience Methods.
- **Technical Skills:** Experimentation, Digital Signal Processing (DSP), A/B testing, Analysis of Variance (ANOVA), general linear model, Case Control, Longitudinal Data, Exploratory Data Analysis (EDA), Principal Component Analysis (PCA), Dimensionality Reduction, Feature Engineering, Data visualization (R, Tidyverse), Data Mining, Extraction Transformation & Loading (ETL), Data Modeling, Machine Learning, LOGIT, Random Forest, MATLAB, Python, Pandas SQL, Xarray, Scikit-learn, Pandas SQL, Linux, MacOS, Bash Scripting, Git.
- **Soft Skills:** Teamwork, Leadership, Time Management, Communication, Presentation skills, Grant Writing, Project Management, and Paradigm Development.

The Children's Hospital of Philadelphia *Philadelphia, PA*

Post-Doc Fellow *Nov 2008 - Oct 2011*

- After one year of post-graduate training abroad, I joined The Department of Radiology Lurie Family Foundations MEG Imaging Center to design an experimental paradigm to examine language cognition in a National Institute for Health (R01-DC008871-02, Timothy Roberts Ph.D.) funded case-control study of 100+ school-aged participants with autism. The results from the paradigm were published in two NeuroReport journal articles (i, ii) and awarded a college loan repayment award ($35k) by the NIH for outstanding translational research.
- The paradigm leveraged psycholinguistic parameters to localize neuronal correlates of semantic cognition in the brain. Due to its reliability, the exam was incorporated into the Radiology Department's standard battery of preoperative brain mapping exams for epilepsy treatment neurosurgery in pediatric patients.
- As a co-principal investigator on R01-DC008871-02, I implemented advanced non-parametric statistics to improve the reliability of hypothesis testing on large-array sensor data for autism case-control data resulting in a highly-cited publication in Biological Psychiatry.
- Planned and instructed accelerated applied research statistics seminar to facilitate data science research projects required for first-year medical school residents in the Radiology Department.
- **Technical Skills:** Case-Control, Mixed Linear Modeling, Analysis of Variance (ANOVA) MATLAB, Time-Frequency Analysis.
- **Soft Skills:** Course Planning, Presentation Skills, Scientific writing.

MRC Cognition and Brain Sciences Unit *Cambridge, UK*

Visiting Scientist *Aug 2007 - Aug 2008*

- After completing my Doctoral degree in neuroscience, I joined the Cognition Brain Sciences Unit's newly established magnetoencephalography (MEG) lab to design an experimental paradigm to pilot data on speech perception and develop standard operating procedures for data acquisition.
- **Technical Skills:** MATLAB, Unix Cluster computing, Quality Control, Standard Operating Procedures.
- **Soft Skills:** Teamwork, Presentation Skills.

Projects

Automaticity in the reading circuitry *Seattle, WA*

University of Washington *2015 - 2019*

- We measured magnetoencephalography in school aged children (N = 42, 7–12 years of age) to measure examine word-selective brain responses under multiple experimental conditions. The results show that even in the presence of overt distraction, strong word-selective responses were found in select language regions. Critically, this automatic word-selective response was indicative of reading skill: the strength of word-selective responses correlated with individual reading skill.
- **Technical Skills:** Data Engineering, Python, Digital Signal Processing, Data Modeling.
- **Soft Skills:** Time management, Teamwork, Technical Writing.

Effectively combining temporal projection noise suppression methods in magnetoencephalography *Seattle, WA*

University of Washington *2018 - 2020*

- This project examined the effects of temporal signal space separation (tSSS) and oversampled temporal projection (OTP) on noise suppression in low SNR magnetoencephalography data. The findings apply to clinical populations such as epilepsy, single-trial data, or cases of sparse data.
- **Technical Skills:** Data Visualization, Python, Digital Signal Processing, Data Modeling.
- **Soft Skills:** Mentoring, Teamwork, Scientific Writing.

Mne-Bids: Organizing Electrophysiological Data into the Bids Format and Facilitating Their Analysis *Seattle, WA*

University of Washington *2018 - 2019*

- MNE-BIDS links BIDS and MNE-Python to speed up analyses, develop more reliable code, and facilitate sharing of data and code with co-workers and collaborators. BIDS, the Brain Imaging Data Structure, is a standard that describes how to organize neuroimaging and electrophysiological data. MNE-Python is an open-source Python package for exploring, visualizing, and analyzing human neurophysiological data such as MEG, EEG, sEEG, ECoG, and more. It includes data input/output modules, preprocessing, visualization, source estimation, time-frequency analysis, connectivity analysis, machine learning, and statistics.
- **Technical Skills:** Python Software Development, Git, Github
- **Soft Skills:** Teamwork

Using magnetoencephalography to examine word recognition, lateralization, and future language skills in 14-month-old infants *Seattle, WA*

University of Washington *2014 - 2019*

- I developed an acquisition protocol and managed data collection for word learning in young infants (N = 27, 39–42 weeks gestational age) using magnetoencephalography (MEG) during a spoken word recognition experimental paradigm. Used Python software tools for digital signal processing and 3D modeling to examine the relationship between brain responses and prospective measures of vocabulary growth. The findings were discussed in terms of theory on cerebral lateralization and individual differences related to attention that play an essential role in language learning.
- **Technical Skills:** Python, Digital Signal Processing, Statistical Modeling
- **Soft Skills:** Teamwork, Project Management, Data Management

Auditory Magnetic Mismatch Field Latency: A Biomarker for Language Impairment in Autism *Philadelphia, PA*

The Children's Hospital of Philadelphia *2010 - 2011*

- I applied mixed-linear modeling to data for children with ASD (N = 51, 6–15 years of age) who underwent neuropsychological evaluation, including tests of language function and magnetoencephalographic (MEG) recording during speech discrimination. Features in the MEG timeseries data were used to operationalize a biomarker for neuronal speech discrimination in response to stimulation. Mixed-linear modeling ANOVA revealed significantly slower ($p < .001$) discrimination in children with ASD than in control subjects. Receiver operator characteristic analysis indicated a sensitivity of 82.4% and specificity of 71.2% for diagnosing language impairment based on MEG feature engineering.
- **Technical Skills:** Mixed Linear Modeling, Analysis of Variance, SPSS, Receiver Operator Curve Analysis, Case Control
- **Soft Skills:** Scientific Writing

Skills

Data Science	Experimentation, Digital Signal Processing, A/B testing, Analysis of Variance, General Linear Modeling, Case Control, Longitudinal Data, Exploratory Data Analysis, Principal Component Analysis, Dimensionality Reduction, Feature Engineering, Data visualization (Seaborn, Tidyverse), Data Mining, Extraction-Transformation-Loading, Data Wrangling, Data Modeling, Machine Learning, LOGIT, Random Forest.
Programming	Python, R (ggplot2, lme4), HUGO HTML/CSS, SQL, MATLAB.
Miscellaneous	Linux, MacOS, Windows, Shell (Bash/Zsh), LaTeX(Overleaf/R Markdown), Git.
Soft Skills	Time Management, Teamwork, Problem-solving, Documentation, Scientific Writing, Grant Management.

Languages

English	Fluent
Farsi	Intermediate
Spanish	Intermediate
German	Beginner