Maedbh **King**

· Ph.D. Candidate ·

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Summary

Current Ph.D. candidate in Cognitive Neuroscience at the University of California, Berkeley. 5+ years experience in designing and testing multi-task fMRI experiments and applying machine learning tools in python to fMRI, eye-tracking, and behavioral data. Motivated to advance predictive models of brain function with a keen interest in utilizing big data to map the cognitive and transcriptomic domains of the human cerebellum ("little brain"). Experience in contributing to and benefiting from the open-science community.

Education

University of California, Berkeley — *Berkeley, California*

Ph.D. in Cognitive Neuroscience (GPA: 3.96/4.00) — *Sep. 2017 - Expected: May. 2023*

- **Advisor: Richard Ivry, Ph.D.**
- Applied Data Science Certificate, School of Information.*Awards: Mark R. Rosenzweig Graduate Fellowship (2021); Cognitive Computational Neuroscience Travel Award (2020)*

Western University — *London, Ontario*

M.Sc. in Neuroscience (GPA: 4.0) — *Sep. 2015 - May. 2017*

- **Advisor: Joern Diedrichsen, Ph.D.** *Awards: Gordon Cerebellum Student Travel Award (2017)*

Trinity College Dublin — *Dublin, Ireland*

B.A. in Psychology and French (Double Major; GPA: 4.0) — *Sep. 2010 - May. 2014*

- **Advisor: Redmond O'Connell, Ph.D.** *Awards: Irish Research Council Postgraduate Scholarship (2015); Ussher Fellowship, Trinity College Dublin (2015); US Fulbright Program (shortlisted); Wellcome Trust Biomedical Scholarship (2014); Entrance Scholarship, Trinity College Dublin*

Experience

Thesis: Mapping cerebro-cerebellar networks of the human brain during learning — *Github [Link]*

University of California, Berkeley — *Graduate Student Researcher (2017-)*

- The aim of my thesis is to use *machine learning* to predict cognitive function across learning in the human cerebellum using *cortical features*.
- *Led a team of 9* (3 Ph.D. students, 5 research assistants, 1 postbac student) to design and collect *300* hours of *fMRI* and *eye-tracking* data.
- Developed *encoding models* to build an optimal model of *cerebro-cerebellar connectivity*, features were *extracted* by parcellating the human cerebral cortex and *feature selection* was performed with *L1 regularization*.
- Used *dimensionality reduction* (PCA, ICA), *clustering*, *regression*, *permutation tests* and other machine learning techniques to analyze *behavioral* and *eye-tracking* data to predict human *learning* performance on *movie-based* action prediction tasks.

Thesis: Understanding the functional organization of the human cerebellum — *Paper [Link]*

Western University — *Graduate Student Researcher (2015-2017)*

- My thesis used *machine learning* to map cognitive sub-domains of the human cerebellum.
- *Led a team of 2* (1 research assistant and one post-doctoral fellow) to design and collect a 26-task *fMRI* experiment and used *semi non-negative matrix factorization* to generate a *novel functional map* of the human cerebellum.
- *Initiated* a *collaboration* with scientists from Stanford University to use *natural language processing and regularized regression* to assign cognitive labels (*cognitiveatlas.org*) to the human cerebellum.
- Invested in *open-source science*. My data, which are publicly available on *openneuro.org*, have been downloaded by *hundreds of researchers*.

Selected Projects

SUITPy: Analysis and visualization of cerebellum imaging data — *Github [Link]*

2021

- Core developer of *SUITPy*, an open-source *python* toolbox based on a highly popular *MATLAB* toolbox. I implemented *mapping* of brain data to 2D surface space and incorporated *brain atlases* from *open-source* repositories.

Evaluating functional boundaries of the brain using a novel distance coefficient — *Paper [Link]*

2021

- Co-developed a novel *statistical metric* to evaluate the validity of *brain parcellations*, an advancement on *Homogeneity and Silhouette coefficients*. Evaluated metric on *open-source* brain data from *Human Connectome Project*.

Predicting brain activation maps for arbitrary tasks with cognitive encoding models *Poster [Link]*

2021

- Evaluated cognitive *encoding models* on brain data and used *natural language processing* to extract features from a formal *cognitive ontology*.

Low dimensional embedding of genetic gradients in the human cerebellum *Paper [Link]*

2021

- Investigated *genetic gradients* in the *human cerebellum* using postmortem data from the *Allen Human Brain Atlas*. Used feature-based encoding to locate gene samples in the cerebellum, and *hierarchical clustering and PCA* to determine *organizational structure* of genetic gradients

Predicting penalty shots using markerless pose estimation *Github [Link]*

2021

- Implemented *markerless labeling* of video data (>12 hours of soccer players taking penalty shots) and feature-based encoding to *compare model and human performance* in predicting penalty outcomes

Predicting COVID-19 mortality rates across the U.S. using mobility and census data *Report [Link]*

2020

- Implemented *elastic net* regularization using *economic* and *mobility* features to *predict COVID-19* deaths across the U.S. in 2020 using data from the 2019 *U.S. Census* and *Google Maps* mobility reports.

Skills

Programming Languages	Python, SQL, R, MATLAB, HTML, Bash
Frameworks and Tools	Keras, OpenCV, Git, Vim, Blender, Nipype, Deeplabcut, PsychoPy, Pandas, NumPy, Scikit-learn, Scipy
Conceptual	High performance computing (Savio), MRI certificate from Henry H. Wheeler Jr. Brain Imaging Center
Languages	English (Native), Irish (Native), French (Proficient), German (Basic)

Leadership & Service

Graduate Assembly Students of Psychology *Member and RSO Signatory*

University of California, Berkeley *Sep. 2018 -*

- *Created*, *mangaged*, and *edited* Berkeley Psychology blog to *spotlight* graduate student research.
- *Co-founded and operated* Twitter account for Berkeley Psychology.
- *Writer and contributor* of Berkeley Psychology *newsletter*.
- *Data analysis, statistics, visualization* for Berkeley Psychology *state of the department* annual meeting.
- Co-organized *faculty fundraisers* in Silicon Valley and co-led Psychology *"Big Give"* to fund-raise for Berkeley Psychology.
- Assembled *working committee* to improve *lab culture* and mentor-mentee relationships, co-wrote *mentorship and lab policy agreements* resulting in new departmental *policies* on mentorship.

Prison University Project *Volunteer and Lecturer*

Richmond, California *Sep. 2019 - Mar. 2021*

- *Designed* and *lectured* a course in General Psychology to incarcerated students in *San Quentin State Prison*.
- Created care packages and holiday art for incarcerated people in California prisons during the *COVID-19 pandemic*.

Bay Area Scientists in Schools (BASIS) *Volunteer*

University of California, Berkeley *Jan. 2018 - Jan. 2020*

- *Presented* multiple lectures on the "Feel Human Brains" to *elementary school children* in Bay Area schools.

Teaching

General Psychology *Mount Tamalpais College*

Lecturer *San Quentin State Prison*

Sep. - Dec. 2019

Biological Psychology, PSYCH 110; Cognitive Neuroscience, PSYCH 127 *University of California, Berkeley*

Graduate Student Instructor *Berkeley, California*

Aug. - Dec. 2018 and Aug. - Dec. 2017

Introduction to Statistics, STAT 1024; Probability and Statistics, STAT 2857 *Western University*

Graduate Student Instructor *London, Ontario*

Jan. - May. 2017; Sep. - Dec. 2016