# Maedbh **King**

· Ph.D. Candidate ·

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## Summary

Current Ph.D. candiate in Cognitive Neuroscience at the University of California, Berkeley. 7+ years experience in designing and testing multi-task fMRI experiments and applying machine learning tools in python to fMRI, eye-tracking, and behavioral data. Keen interest in utilizing big data to map the cognitive and transcriptomic domains of the human cerebellum ("little brain") and in building predictive models to better understand cerebellar function. Experience in contributing to and benefiting from the open-science community. Motivated to advance predictive models of brain function in an industry/research environment.

## Education

### University of California, Berkeley
*Berkeley, California*

Ph.D. in Cognitive Neuroscience (GPA: 3.96/4.00)
*Sep. 2017 - Expected: May. 2022*

- **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**: **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** experimental 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 using **supervised learning** (L1 regularization).
- Used **dimensionality reduction** (PCA, ICA, semi-nonnegative matrix factorization), **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.
- I designed and collected a 26-task fMRI experiment and used **semi non-negative matrix factorization** to generate a **novel functional map** of the human cerebellum.
- I used **feature-based encoding models** and **natural language processing** to assign cognitive labels (sourced from **cognitiveatlas.org**) to functional domains of the cerebellum.
- The rich dataset that I generated has been made publicly available on **openneuro.org** and has been downloaded by hundreds of researchers.

## Selected Projects

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

2021

- A core developer of **SUITPy**, a **python** toolbox based on a highly popular MATLAB toolbox, to analyze and visualize cerebellum data.
- Incorporated **HTTP** requests to fetch **brain atlases** from **open-source** repositories and improved the **mapping** of brain data to 2D surface space.

**Evaluating functional boundaries of the brain using a boundary-controlled distance coefficient**                                                                                      *Paper [Link]*

2021

- Co-developed a novel **statistical metric** to evaluate the strength of functional boundaries in the **human brain**, evaluating open-source brain data from **Human Connectome Project**
- This method is a big improvement on **Homogeneity and Silhouette coefficients** traditionally used in **brain parcellation research**.

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

2020

- The goal of the project was to investigate **genetic gradients** in the **human cerebellum** using **open-source** postmortem data from the **Allen Human Brain Atlas**.
- Used feature-based encoding to find important gene samples in the cerebellum, and **hierarchical clustering and PCA** (using scikit-learn) to determine **organizational structure** of genetic gradients in a **low dimensional** space.

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

2020

- Used **economic** and **mobility** factors to **predict COVID-19** deaths across the U.S. in 2020 using data from the 2019 **U.S. Census** and **Google Maps** mobility reports.
- Model **features** were extracted using **dimensionality reduction** and **elastic net** regularization and **ridge regression** was used to **train and test models**.

## Skills

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|---|---|
| **Programming Languages** | Python, SQL, R, MATLAB, HTML |
| **Frameworks and Tools** | Keras, OpenCV, Git, Vim, Blender, Nipype, PsychoPy, Pyglet, NumPy, scikit-learn, Scipy |

## 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