

Megan deBettencourt

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About Me

I am a scientist with a background in computational cognitive neuroscience and engineering research, and over a decade of experience building AI and ML tools to model human behavior and physiology. My expertise includes multimodal data analysis, LLMs (prompt engineering and simulated user modeling), and cognitive science. I develop real-time, closed-loop systems, ranging from brain-computer interfaces to human-AI interactions, that enhance health and improve user behavior.

Education

Princeton University, Princeton Neuroscience Institute

PhD, Neuroscience

Sept. 2016

MA, Neuroscience

Aug. 2012

Columbia University, School of Engineering and Applied Science

BS, Applied Mathematics *magna cum laude*

May 2010

Experience

Senior Research Scientist, Ruby Neurotech

Feb. 2023 – Present

- Developed an AI-powered scalable digital mental health platform for PTSD that reduced memory intrusions by 50%
- Engineered LLM-based evaluation system to score human-AI conversations (Spearman $\rho = 0.5$ vs. human graders)
- Discovered pupil biomarker of cognitive effort via multivariate modeling to predict intrusion outcomes ($p < 0.01$)
- Analyzed eye gaze and heart rate synchronization during video watching to quantify engagement across individuals
- Led full-stack development of a cloud-based platform (React, OpenAI API, Node, Websockets, REST) synchronized with real-time behavioral and physiological data streams
- **Skills:** AI LLMs, Prompt engineering, Version control, Data visualization, Web development, Statistics, Python

Consultant, Stanford University, [Wu Tsai Human Performance Alliance](#)

2023 - 2024

- Advised on experimental design and software architecture to advance real-time human memory retrieval studies
- Engineered real-time forecasting pipeline using pupil signals to detect and predict attention lapses
- **Skills:** Experimental design, Statistics, Eye-tracking, Psychophysics, Mentorship, Python

NIH K99 and F32 Post-doctoral fellow ([NIH BRAIN Initiative K99/R00](#)), University of Chicago

2016 – 2023

- Analyzed multimodal biosensing data using machine learning models to classify brain states at 1 ms precision
- Built multivariate models to predict image memory from real-time attention states and fine-tuned DNNs
- Developed hardware and software for collecting and analyzing neural dynamics from neurosurgical inpatients
- Directed a team of 10+ junior researchers, overseeing project timelines, ensuring data quality and scientific rigor
- Presented findings to academic and industry stakeholders, authored scientific publications, and secured NIH funding
- **Skills:** Machine learning, High-performance computing, Experimental design, Statistics, Python, R, MATLAB

NSF Graduate Research Fellow PhD Student, Princeton University, Princeton Neuroscience Institute

2010 – 2016

- Analyzed high-dimensional multivariate patterns in whole-brain brain fMRI data (~100,000 voxels) to decode attention
- Developed real-time closed-loop fMRI neurofeedback system to train human visual attention
- Delivered ML platform to collaborators at UT Austin and UPenn, enabling research into real-time clinical interventions
- Launched partnership with **Intel Labs** to build cloud-based neuroimaging analysis software platform [Brainiak](#)
- Supervised behavior and multimodal physiology in-person data collection from 500+ users
- **Skills:** Machine learning, High-performance computing, Brain-computer interfaces, Neuroimaging, Python, MATLAB

Undergraduate Researcher, Columbia University, Biomedical & Electrical Engineering Departments

2008 – 2010

- Built signal processing pipelines and used ML tools to decode single-trial neural data

Selected publications and presentations

Over 100 presentations for academic and industry audiences (e.g., CMU, Intel, Microsoft, UCSF, Stanford)

Over 1000 citations for 20+ publications in top journals. For a full list of publications, see [Google Scholar](#) or [Pubmed](#)

- **MT deBettencourt** et al. ([arXiv](#)) AI-guided digital intervention with physiological monitoring reduces intrusive memories after experimental trauma.
- Invited panelist for **NeurIPS 2022** workshop ([All Things Attention](#))
- **MT deBettencourt** et al. (2019) Real-time triggering reveals concurrent lapses of attention and working memory. *Nat. Hum. Behav.* [Article](#) | [Github](#)
- **MT deBettencourt** et al. (2015) Closed-loop training of attention with real-time brain imaging. *Nat. Neurosci.* [Article](#)

Recent project

- Built a RAGbot using LangChain and Mistral's LLM, implementing Retrieval-Augmented Generation (RAG) pipeline, and deployed on Hugging Face Spaces using Gradio. [Chatbot demo](#)

General Skills

- Programming & Data Analysis: Python (numpy, pandas, scipy, scikit-learn, statsmodels, pytorch), R, MATLAB
- AI & ML: LLM prompt engineering, simulated user modeling, few/zero-shot learning, supervised & unsupervised learning
- Statistics & Experimental Design: Hypothesis testing, regression modeling, mixed-effects models, multivariate analysis, parametric and non-parametric statistical tests (e.g., permutation tests), power analysis, A/B testing
- Data Visualization: matplotlib, seaborn, streamlit dashboards, Adobe Illustrator, Canva
- Neuroscience & Physiology: gaze-tracking, pupillometry, PPG, face/pose tracking via webcam, EEG, fMRI, fNIRS

Languages

English native; **French** fluent