Mrugank Dake

A Boltzmann Brain

PhD Student, Department of Psychology
New York University
Email: mrugank.dake@nyu.edu | Website: mindemory.github.io
X: @the_memory_guy | Linkedin: mrugank-dake-71911113b

Education

New York University - *Ph.D. in Cognition & Perception*
Advisor: Dr. Clayton Curtis | *GPA: 3.93/4* | *Sept 2021 - Present*
- **Research Focus:** Cognitive neuroscience, visual working memory, fMRI, TMS, EEG, MEG, ECoG
- **Key Skills:** Experiment design, ideation, data collection, data analysis (statistics, signal processing, machine learning)

Indian Institute of Science Education & Research (IISER,) Trupati - *B.S. - M.S. Dual Degree in Biology (w/ minor in Physics)*
Thesis Advisor: Dr. Nandini Rajamani | *CGPA: 8.2/10* | *Sept 2016 - May 2021*
- **Thesis:** Comparative acoustic analysis of Indian squirrel species using statistical and computational methods; building neural network models to detect target squirrel vocalization in recordings
- **Key Skills:** Signal processing, statistics and data analysis, machine learning and neural networks

Research & Technical Skills

- **Programming:** Python, MATLAB, R, JavaScript, HTML, CSS
- **Data Analysis & Tools:** TensorFlow, keras, scikit-learn, PyTorch, MNE-Python, fMRIprep, SimNIBS
- **Cloud & Platform Tools:** Google Cloud, Docker, Git, Github
- **Neuroimaging & Modeling:** EEG/MEG/ECoG, fMRI, TMS, signal processing, neural networks, computational modelling
- **Machine Learning:** Classification, regression models, deep learning for neural signal analysis

Research Experience

Visual Cortex Perturbation & Working Memory (2021 - Present)
New York Unviersity
- Investigated neural representations of working memory using advanced neural imaging techniques (EEG and fMRI) and perturbing activity in the brain using TMS
- Developed custom pipeline for communication between multiple systems thereby permitting fast (millisecond resolution) control of devices necessary to trigger TMS and monitor brain activity

- Working on optimizing a massive parameter-estimation pipeline (Popeye) over GPUs for faster and accurate estimation of visual receptive fields using fMRI
- Developing custom-pipeline for preprocessing and decoding representations in brain networks from MEG and ECoG data during visual working memory

Squirrel acoustics: charaecterizing species differences and detecting target vocalizations (2020-21)
Indian Institute of Science Education and Research (IISER) Tirupati
- Annotating massive amounts of data for detecting acoustic features from individual recordings of squirrel calls
- Statistical and machine learning models to disentagle patterns across species and populations
- Creating machine learning and neural network models (CNN via transfer learning) to detect target vocalizations from spetrograms for automated recordings from rainforests

EEG and MRS Analysis for underpinning neural correlates of attentional blink (2019)
Indian Institute of Science (IISc) Bangalore
- Collected EEG data and assisted in developing preprocessing pipeline and performing statistical analysis to investigate neural correlates of attentional processing
- Assisted in establishing and optimizing magnetic resonance spectroscopy (MRS) to estimate levels of glutamate in healthy subejcts

CoCa coli: Probiotic Immunotherapy for colorectal cancer (2019)
Indian Institute of Science Education and Research (IISER) Tirupati
- Team Lead for a synthetic biology project developing a prototype of probiotic to target colorectal cancer using interleukin-12
- Developed the team, brainstormed ideas, formalized idea, applied and received national grant (INR 10lakh), established mammalian and bacterial cell cultures, perform molecular biology techniques to characterize and genetic expressions and manipulations, developed mathematical model for optimizing genetic expression repertoire as well as for modeling biophysics of probiotic administration, performed rural school outreach promoting science and biology, presented at an international conference Giant Jamboree (Boston 2019) and won a Gold Medal

Work Experience

Teaching Assistant for EEG/MEG/iEEG Methods Course (Graduate Course) (Fall 2024)
New York Unversity
Roles: Collecting EEG and MEG data, creating tutorials in Python and MATLAB to demonstrate basics of signal processing, digital filtering, convolutions, and creating pipelines to analyze neural data; and identify and decode patterns

Teaching Assistant for Introduction to Cognitive Neuroscience (Undegraduate Course) (Fall 2023)
New York Unversity
Roles: Discussing research articles, grading assignments and quizzes, recitations for revising class materials and research articles

Teaching Assistant for Math Tools III: Linear Systems (Graduate Course) (Spring 2024)
New York Unversity
Roles: Creating tutorials in MATLAB to demonstrate signal processing and Fourier transforms, grading coding assignments, teaching MATLAB and signal processing in recitations

Statistics & Biology Tutor (2019 - 2021)
Chegg India Inc.
Roles: Taught statistical concepts and data analysis methods to students across a wide-range of grades using various tools like Python, R, and answering conceptual questions in both statistics and biology; developed interactive data visualizations using Google Drawings and Adobe Illustrator to help facilitate making concepts clearer for students

Statistics & Biology Tutor (2019 - 2021)
Chegg India Inc.
Roles: Taught statistical concepts and data analysis methods to students across a wide-range of grades using various tools like Python, R, and answering conceptual questions in both statistics and biology; developed interactive data visualizations using Google Drawings and Adobe Illustrator to help facilitate making concepts clearer for students

Publications

Dake M., Curtis C. E. (in prep). Investigating the role of V3AB in visuospatial working memory.
Dake M., Rajamani N. (in prep). Inter and intra species similarities and differences using acoustic analysis of *Funambulus* squirrels of the Indian subcontinent.
Dake M., Curtis C. E. (2024). Perturbing human V1 degrades the fidelity of visual working memory. *bioRxiv*.

Posters

Dake M., Curtis C. E. Do perturbations to visual cortex impact working memory?; In *Society for Neuroscience (SfN), Washington D.C.*, USA (2023)
Khare S., Chopra S., Grover H., Vohra T., Mahmood U., Jatwani K., Kaushik D., Pandey A., Bhardwaj S., Tanwar A., Singh J., Shekhar C., **Dake M.**, Krishnamoorthy K., Kumar K. Li-Koff: To Detect and Degrade N-Nitrosamines; In *Giant Jamboree (iGEM), Boston*, USA (2020)
Amar I., Avadhani K., Bajaj M., Balasubramanian D., Bhagat S., Chutani N., **Dake M.**, Khatri U., Krishna N., Jacob M., Mal S., Mohapatra O., Pal A., Saha D., Tripathy B., Mukherjee R., Rao B.J. CoCa coli: probiotic immunotherapy against colon cancer; In *Giant Jamboree (iGEM), Boston*, USA (2019)

Conference & Workshop Talks

Dake M., Curtis C. E. Perturbing human V1 degrades the fidelity of visual working memory; In *Working Memory Symposium (Virtual),* (2024)

Fellowships & Awards

2021 - present	MacCracken Doctoral Fellowship, New York University
2020	Indian Biological Engineering Competition (iBEC) 2020 Grant: Team mentor for International Genetically Engineered Machine (iGEM) Manav Rachna Institute
2019	Indian Biological Engineering Competition (iBEC) 2019 Grant and Gold Medal at Giant Jamboree, Boston: Student Team Leader for International Genetically Engineered Machine (iGEM) IISER_Tirupati
2016 - 2021	Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellowship, DST India
2015	Pune Regional Winner and 5th at National Level for Indian National Brain Bee (INBB)

Mentoring

2024 - present	Michael George, Research Assistant, NYU
2024	Adwita Joglekar, BS-MS Student, IISER Pune
2024	Malavika B, BS-MS Student, IISER Tirupati
2023 - present	Jacob Serfaty, Masters Student, NYU
2023 - 24	Yuyang Xu, Undergraduate Student, NYU
2020	iGEM Team, Manav Rachna Institute
2020 - 21	Kunal Gokhale, Research Assitant, IISER Tirupati
2020 - 21	Madhurika Abhyankar, Research Assistant, IISER Tirupati
2020 - 21	Dilshad Kanniyan, Research Assitant, IISER Tirupati

In Real World

2023	Website Coordinator for Climatematch Academy 2023
2023	Student organizer for PhD Cognition and Perception 2023 Open House, NYU
2016 - 2020	Co-ordinator at Bio wissen (Biology Club), IISER Tirupati
2017	Co-ordinator at Shemushi (Quiz Club), IISER Tirupati
2016	Rural education volunteer at Disha, Student Outreach Club, IISER Pune