Gabriel Fajardo

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Education

Boston College, Morrissey College of Arts and Sciences Chestnut Hill, MA
Bachelor of Science, *cum laude* May 2023

Major: Neuroscience | **Minor:** Mathematics | **GPA:** 3.70/4.00

Research Experience

Columbia University | Social Cognitive & Neural Sciences Lab | *Lab Manager* Aug 2023-Present
Advisor: **Dr. Jon Freeman**, Associate Professor, Department of Psychology

- Investigate the neural basis of categorical and individuated social processing through behavioral paradigms, fMRI, and multivariate pattern analysis (MVPA)
- Explore the neural relationship between conceptual representations of personality traits and facial stereotypes using cross-modal classification in fMRI MVPA
- Challenge contemporary models of face perception by using diverse stimuli, computational models, and representational similarity analysis to convey a data-driven, multidimensional face-trait space
- Analyze the interaction and competition between facial stereotypes and identity-related information
- Implement automated annotation systems for various features, including facial expressions, speech, and identity detection, across 60 hours of naturalistic video clips
- Mentor research assistants through Honors Theses, summer projects, and independent research
- Enhance the lab infrastructure by creating an fMRI analysis pipeline, streamlining online study creation, and managing daily lab operations

Columbia University | Business School | *Summer Intern* May 2023 - July 2023
Advisor: **Dr. Paul Ingram**, Kravis Professor of Business, Management Division

- Analyzed Identity Maps—network representations that provide a comprehensive view of multifaceted identities—to investigate identity concealment, tie formation, and shared identities
- Applied computer vision models to transform identity maps into analyzable formats and used NLP word embeddings to examine the stigma and social class associations of identity elements
- Explored factors influencing the concealment of identities, identifying key predictors that increase the likelihood of an identity being hidden

Harvard University | Vision Lab | *Research Assistant* June 2022 - Aug 2022
Advisor: **Dr. George Alvarez**, Fred Kavli Professor of Neuroscience, Department of Psychology

- Investigated the weight space of voxel-wise encoding representational similarity analysis (veRSA) and developed metrics for identifying model features that significantly predict neural activity
- Conceptualized a study using 'dropout' as a method to systematically manipulate sparse versus distributed coding in neural networks
- Evaluated the geometric representations and accuracies of computer vision models with varying degrees of dropout, and compared these model activations to neural activations

Boston College | Social & Cognitive Comp Neuro Lab | *Research Assistant* May 2021 - May 2023
Advisor: **Dr. Stefano Anzellotti**, Associate Professor, Department of Psychology and Neuroscience

- Employed univariate GLM fMRI analyses to identify auditory regions of interest (ROIs) in the brain, complemented by an anatomical probability atlas to define visual ROIs
- Conducted multivariate statistical dependence analyses based on neural networks (MVPN) to identify brain regions involved in audio-visual integration

Boston College | Canine Cognition Center | *Research Assistant* Sep 2020 - May 2023
Advisor: **Dr. Angela Johnston**, Assistant Professor, Department of Psychology and Neuroscience

- Designed and implemented a flexible experimental paradigm to evaluate dogs' ability to follow human goal-directed actions
- Ran several behavioral studies with dogs, ensuring a positive experience for dogs and their parents
- Developed an efficient pipeline for the random assignment of experimental conditions, optimizing study design and execution

Publications

Fajardo, G., Fang, M., Anzellotti, S. (Under Review). Distinct Brain Regions Combine Auditory Representations with Different Visual Streams. [Preprint]

Prince, J.S., **Fajardo, G.**, Alvarez, G.A., Konkle, T. (2024). Manipulating dropout reveals an optimal balance of efficiency and robustness in biological and machine visual systems. *ICLR 2024*. [Paper]

Conference Presentations

Fajardo, G., Chwe, J.A., Davachi, L., Freeman, J. (April, 2024). *The neural basis of social categorization and individuation.* Poster presented at the Social and Affective Neuroscience society annual conference, Toronto, Canada.

Fajardo, G., Hong, Y., Freeman, J. (February, 2024). *The shared cognitive and neural mechanisms of trait concepts and facial stereotyping.* Poster presented at the Society for Personality and Social Psychology annual convention, San Diego, CA.

Prince, J.S., **Fajardo, G.**, Alvarez, G.A., Konkle, T. (August, 2023). *Dropout as a tool for understanding information distribution in human and machine visual systems.* Poster presented at the Cognitive Computational Neuroscience annual conference, Oxford, UK.

Fajardo, G., Alvarez, G.A., Konkle, T., Prince, J. (July, 2022). *Artificial vision model features most predictive of neural data.* Poster presented at the Leadership Alliance National Symposium, Hartford, CT.

Selected Courses

Neuroscience and Psychology: Cognitive and Neural Bases of Person Knowledge, fMRI, Cognitive Neuroscience, Research Practicum in Artificial Intelligence, Current Topics in Moral Psychology, Computational Models of Cognition

Computer Science: Data Science, Biomedical Image Analysis, Computer Vision, NLP

Mathematics: Multivariable Calculus, Linear Algebra, Probability, Statistics, Math and Machine Learning

Teaching Experience

Teaching Assistant in the course *Biomedical Image Analysis* (CSCI 3397) Jan 2023 - May 2023

Honors and Awards

Cientifico Latino Graduate Student Mentorship Initiative Scholar 2024
Boston College Honors Program in Psychology and Neuroscience 2021-2023
Dean's List 2nd Honors 2020-2023

Course Projects

How Latent and Perceptual Features Jointly Shape Social Group Inference
Employed a Bayesian computational model of cognition to investigate how perceptual features and latent trait attributions interact to inform inferences about an agent's social group membership.

Political Twitter Sentiment Analysis
Applied deep learning and statistical machine learning sentiment classifiers to analyze tweets about political candidates, aiming to predict Senatorial election outcomes. Results indicated that Democrats tweeted more positively than Republicans, and that candidates with more positive sentiment in tweets tended to win.

Reliable Comparison Between DNN Models and the Brain
Attempted to match the subject-to-subject variability of fMRI data for artificial vision models by training models with identical architectures but different initial weights. We generated a distribution of the model's performance, and identified which of the models most accurately represented neural data.

Convolutional Neural Network Perception of Global and Local Facial Features
Trained a convolutional neural network to classify faces, then tested it on "scrambled faces" with disrupted global features but intact local features. Found that classification performance dropped to chance, suggesting the model primarily relied on global facial features.

Anatomical and Behavioral Correlates of Dementia
Used logistic regression, KNN, Gaussian Naive Bayes, and decision tree classifiers to identify dementia in subjects based on MRI and behavioral data.

Relevant Skills

Programming: Python, Java, R, HTML, CSS, JavaScript, jsPsych, WebPPL, GitHub, PsychoPy, Bash

Data Science/ML: PyTorch, TensorFlow, SKlearn, Scipy, Pandas, Matplotlib, Seaborn, NetworkX, NLTK, SpaCy, Gensim

Cognitive Neuroscience: Nilearn, NLTools, fMRIPrep, Nibabel, FSL, MRIcroGL, SPM, SnPM, Connectome Workbench, PyMVPA, PyMVPD, Optseq, AFNI

Languages: English (Fluent), Spanish (Fluent), French (Intermediate Proficiency)