Yifei Cao

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Education

- **University of California, Los Angeles** *September 2025 - June 2030*
  PhD in Cognitive Neuroscience
  – Research interest: neural representation of human cognitive map, NeuroAI
- **ETH Zurich & University of Zurich** *September 2023 - August 2025*
  Master of Science in Interdisciplinary Brain Science
  – Coursework: Methods & Models for fMRI Data Analysis (5.25/6); Systems, Computation and Neural Technology (5.25/6).
- **Beijing Normal University** *September 2021 - June 2023*
  Master of Science in Cognitive Neuroscience
  – Coursework: Computational Neuroscience (85/100); Neural Signal Processing (81); Brain Imaging Data Modelling (82/100); fMRI: Principles, Experiment Design and Data Analysis (87/100).
- **Northeast Normal University** *September 2017 - June 2021*
  Bachelor of Science in Psychology
  – Coursework: Calculus (99/100); Information Technology (97/100); Statistical Analysis (93/100); General Biology (90/100); Experimental Psychology (91/100).

Publications and Proceedings

- **Cao. Y.F.**, Li. L.Y., Cai. C.H., Eckstein. K. M. (2025) "Interpretable Hybrid Neural-Cognitive Models Discover Cognitive Strategies Underlying Flexible Reversal Learning," *Oral @ NeurIPS CogInterp Workshop 2025.*
- Peng. X.J, **Cao. Y.F.**, Levy. D., Xue. G. (2025) "A position coding model that accounts for the effects of event boundaries on temporal order memory," *Cognitive Psychology.*
- Yuan. Y, **Cao. Y.F.**, Guan. L.L*. (2024) "The distinct effects of fearful and disgusting scenes on self-relevant face recognition," *The Journal of General Psychology.*
- **Cao. Y.F.**, Wu. Y.H. (2024) "Unrevealing Neural Factors Underlying Human Intelligence with Large-Scale Functional Neuroimaging Meta-Analysis and Exploratory Factor Analysis," *Conference on Cognitive Computational Neuroscience 2024.*
- Tang. C., Huang. T., Huang. J.P., Xu. N., Lyu. H., Wang. Y., **Cao. Y.F.*** (2023) "Effortful and Effortless Training of Executive Functions Improve Brain Multiple Demand Systems Activities Differently: An Activation Likelihood Estimation Meta-Analysis of Functional Neuroimaging Studies," *Frontiers in Neuroscience*, 17, 1243409.
- Shi. L., Liu. C.Q., Peng. X.J, **Cao. Y.F.**, Levy. D., Xue. G. (2023) "The neural representations underlying asymmetric cross-modal prediction of words," *Human Brain Mapping*, 44, 6.
- **Cao. Y.F.**, Huang. T., He. M.X. (2020) "Effects of peer influence, friendship and gender on adolescents' risky decision making," *SPSP Convention*, Undergraduate Student Poster Session.
- **Cao. Y.F.**, Huang. T., Huang. J., Wang. Y. (2020) "Effects and Moderators of Computer-Based Training on Children's Executive Functions: A Systematic Review and Meta-Analysis," *Frontiers in Psychology*, 11, 580329.
- Wang. Y, Li. K, Gai. X.S., **Cao. Y.F.** (2020) "Training and Transfer Effects of Response Inhibition Training with on-line Feedback on Adolescents' and Adults' Executive Function," *Acta Psychologica Sinica*, 52, 10.

Research Projects

- **Prof. Valerio Mante, Institute of Neuroinformatics, ETH Zurich** *May 2024 - Present*
  Neural dynamics underlying primate reversal learning
  – Research question: Does low-dimensional neural embedding from CEBRA have higher decodability?
  – Methods: Used CEBRA as dimension reduction technique to infer the latent state of pre-saccade neural signals and decoded behavioral variables with machine learning algorithms; performed neural signal reconstruction from CEBRA embeddings to test feature loss during dimensionality reduction.
  – Result: We achieved more cross-sessionly consistent low-dimensional neural embeddings with CEBRA, and showing that choice decodability increased with training days. We also observed decreased choice decodability in reconstructed neural signals which is related to feature loss.
  – Skills: Pytorch, dimensionality reduction, machine learning, neural decoding.

- **Dr. Maria Eckstein, Google DeepMind** *May 2024 - Present*
  Hybrid ANN and RL modeling on human reversal learning
  - Research question: Do hybrid neural network-cognitive models improve predictability and interpretability on human reversal learning process?
  - Methods: Modeled human reversal reinforcement learning with cognitive models, classical recurrent neural networks (Vanilla RNN, GRU and LSTM), and hybrid network-cognitive models (with different cognitive components); quantitatively and qualitatively compared simulated behavior from different models and real human participants.
  - Results: Hybrid ANN model with context information was the model with the best predictability, which indicates the importance of context but not memory in reversal learning task.
  - Skills: Deep neural network modeling, cognitive computational modeling
- **Prof. Silvia Brem, University Hospital of Psychiatry Zurich** *October 2023 - February 2024*
  Neurocomputational mechanisms underlying children's multisensory learning
  - Research question: What computational factors are associated with individual difference in children's multisensory integration process?
  - Methods: Developed MATLAB code for RL-Drift Diffusion Model and RL-Racing Diffusion Model to fit behavioral data of children multisensory learning task; conducted model-based fMRI analysis to investigate brain regions correlated with the prediction error signal and reward belief values of children's learning and decision-making processes.
  - Results: Found that better multisensory learning (MSL) task performance was mainly correlated with higher learning rate and faster processing speed.
  - Skills: Drift diffusion model, reinforcement learning model, model-based fMRI analysis, SPM.
- **Prof. Gui Xue, IDG/McGOVERN Institute for Brain Research** *October 2021 - April 2023*
  Cognitive and neural architecture of human memory
  - Research Question: Neural and computational process underlying human episodic memory.
  - Methods: Designed and developed over 15 cognitive tasks measuring different aspects of human memory, including working memory, episodic memory, short-term memory etc.; collected large-scale behavioral dataset including over 1,000 participants measuring all cognitive tasks, performed dimensionality reduction and modeling on behavioral dataset.
  - Skills: Experimental task design, computational modeling, neural representation analysis, large-scale behavioral data analysis, R.

Technical Skills and Interests

Certifications: Deep Learning Specialization (Coursera), NMA-Deep Learning (Neuromatch Academy)
Programming Languages: R (tidyverse, Lavaan, ggplot), Python (PsychoPy, NiPype, Sklearn, MNE, Jax), MATLAB (SPM, NIRS-SPM, PsychToolbox)
Computational Modeling: Reinforcement Learning Model, Drift Diffusion Model
Neuroimaging Techniques: fMRI, EEG, fNIRS

Awards and Honors

- **First class academic scholarship, Beijing Normal University** *September 2022*
  Top 10% academic performance
- **First class student researcher scholarship, Northeast Normal University** *June 2021*
  Top 5 academic research performance
- **Fundamental research funds for the central universities** *April 2020*
  Student principle investigator, $1,000
- **National undergraduate innovation and entrepreneurship training program** *May 2019*
  Student principle investigator, $1,000
- **First class academic scholarship, Northeast Normal University** *September 2019*
  Top 5 academic performance