Alfred Chao

Papers

Interpretability-first modular machine learning models for subjective evaluations - **Chao, A**., Kannan, T. You, J., Alborhn, D., Uddenberg, S., Todorov, A., Hoffmann, H., Berman, M. In prep.

Optimized convolutional neural networks for fMRI coregistration quality control - **Chao, A**., Janey, E., Pruin, J., Kardan, O., Stier, A., Shertz, K., Rim, N., Chamberlain, T., Tindel, L., Sereeyothin, M., Ceru, J., Eracar, D., Ordonez, M., Madsen, A., McConnell, K., Meredith, W., Lakhtakia, T., Bowman, J., Zhang, X., Cardenas-Iniguez, C., Berman, M., Rosenberg, M. In prep.

Recognition memory fluctuates with sustained attention regardless of task-relevance - Corriveau, A.*, **Chao, A.***, deBettencourt, M.**, Rosenberg, M. **, In prep.

"EBK" : Leveraging Crowd-Sourced Social Media Data to Quantify How Hyperlocal Gang Affiliations Shape Personal Networks and Violence in Chicago's Contemporary Southside - Tucker, R., Rim, N., **Chao, A.**, Berman, M., In prep.

Functional brain connectivity predicts sleep duration in youth and adults - Mummaneni, A. Kardan, O., Stier, A., Chamberlain, T., **Chao, A.**, Berman, M., Rosenberg, M., *Human Brain Mapping* (2023)

Other work

A Machine-Learning Model to Emulate Gesture Coding - Liu, Q., **Chao, A.**, Chandran, A., Berman, M., Goldin-Meadow, S., Submitted at MMSYM 2024

Recognition memory fluctuates with the floodlight of attentional state - Corriveau, A.*, **Chao, A.***, deBettencourt, M.**, Rosenberg, M. **, Poster at VSS 2024

Investigating Face Perception with Interpretable Machine Learning - **Chao, A.**, Kannan, T. You, J., Uddenberg, S., Alborhn, D., Todorov, A., Hoffmann, H., Berman, M., Poster at MACSS 2023

fNIRS Preprocessing: Motivation, Techniques, and Implementation - Invited talk, University of Chicago fNIRS User Group, October 2023

Studying Chicago Gangs Through Crowd-Sourced Online Information - Tucker, R., Rim, N, **Chao, A.**, Berman, M., Panel at ASC 2023

Functional Brain Connectivity Predicts Sleep Duration in Youth and Adults - Mummaneni, A. Kardan, O., Stier, A., Chamberlain, T., **Chao, A.**, Berman, M., Rosenberg, M., Poster at OHBM 2023

Research Experience

2022 - Present: University of Chicago

Environmental Neuroscience Lab - Full-Time Research Assistant

PI: **Marc Berman**

Projects:

fMRI Coregistration Quality Control Classifier Development:

- We developed a CNN for fMRI coregistration quality control with 10-fold CV AUC > 0.99 using a large fMRI dataset (*n* > 10,000) on UChicago's Midway3 and Argonne National Lab's Theta HPC clusters.

Interpretable Machine Learning:

- We developed a novel interpretable machine learning approach which outperforms ResNet transfer learning on several facial processing tasks.

Google Street View Vision Model Research and Development

- We used ResNet transfer learning to model six scene gist measures using UChicago's Midway3 HPC cluster. We applied these models to ask how scene gist and neighborhood features relate from block to block throughout Chicago.

Chicago Gang Network Research

- We applied graph-theoretic analyses to predict real world mortality from co-mentions in a scraped dataset of online posts about Chicago gang members.

fNIRS Math Equivalence Research

- We applied fNIRS univariate and functional connectivity analysis in a developmental population to investigate neural mechanisms underlying the relationship between gesture and learning for math equivalence problems.

2020 - 2022: University of Chicago

Cognition, Attention, and Brain Lab - MA Student

PI: **Monica Rosenberg**

Projects:

fMRI Sustained Attention Lapse Model Research and Development

- We developed a connectome-based predictive model of sustained attention lapses using functional cofluctuation measured during an *n*-back task in a large fMRI dataset (*n* > 1000). We applied this model to forecast task errors from preceding neural activity.

fNIRS Connectome-Based Predictive Model Research and Development

- We developed connectome-based predictive models of *n*-back task performance using functional connectivity measured in an fNIRS dataset. Then, we investigated translating connectome-based approaches between fMRI data and fNIRS data.

fMRI Sleep Duration Model Development

- We developed connectome-based predictive models of sleep duration using functional connectivity measured in two large fMRI datasets (combined *n* > 2000) and custom parallel computing implementations on UChicago's Midway3 HPC resources.

Online Attention and Memory Research

- We developed a browser-based task, deployed it using Qualtrics, Prolific, and Amazon Mechanical Turk to collect a large sample (*n* > 500), and analyzed the resulting data to investigate the effects of sustained attention lapses on recognition memory.

2018 - 2020: University of British Columbia

Cognitive Neuroscience and Psychophysics Lab - Part-Time Research Assistant

PI: **Lawrence Ward**

Projects:

EEG and tDCS Consciousness Research

- We preprocessed and analyzed an EEG dataset to investigate the functional connectivity correlated with a Troxler-like optical illusion. Then we developed, applied, and analyzed the data from a tDCS protocol testing the modulatory effect of frontoparietal stimulation on susceptibility to that illusion.

EEG Mismatch Negativity Replication

- We collected, preprocessed, and analyzed EEG data for a replication of the 1994 Connolly et. at. phonological mismatch negativity ERP result.

2018 - 2020: University of British Columbia

Reactions to Environmental Stress and Trauma Lab - Part-Time Research Assistant

PI: **Peter Suedfeld**

Projects:

International Space Station Research

- We collected and analyzed survey, text, and image data from astronauts aboard the International Space Station to investigate behavioral correlates of psychological adaptation to long-duration spaceflight.

Arctic and Antarctic Research Station Research

- We collected and analyzed survey, text, and experience sampling data from personnel stationed at Arctic and Antarctic Research Stations to investigate behavioral correlates of psychological adaptation to isolated and extreme environments.

Relevant Skills

Software: Python, MATLAB, R

HPC: ANL Polaris, ANL Theta, UChicago Midway3, UChicago Midway2, AWS

Methods:

- *Neuroimaging*
  - **fMRI**: Data preprocessing, univariate analysis, MVPA, functional connectivity, functional cofluctuation
  - **fNIRS**: Data preprocessing, univariate analysis, functional connectivity
  - **EEG**: Data preprocessing, ERP analysis, transfer entropy, functional connectivity
- *Analysis and applications*
  - **Machine Learning**: Linear models, support vector machines, decision trees, cross-validation, clustering, dimensionality reduction, network analysis
  - **Deep Learning**: FC networks, CNNs, transformers, transfer learning and fine-tuning, GPU acceleration, hyperparameter optimization
- *Experimental*
  - **In person**: fNIRS, tDCS, EEG, behavioral tasks
  - **Online**: Prolific, Amazon Mechanical Turk, Qualtrics

Education

2020 - 2022 **University of Chicago**, Chicago, IL
Degree: Master of Arts in Computational Social Science
Thesis: *Identifying Predictors of Lapses in Sustained Attention*

2016 - 2020 **University of British Columbia**, Vancouver, BC
Degree: Bachelor of Arts in Psychology, minor in Philosophy