

Yusi Chen

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Education

University of California, San Diego (UCSD)

Ph.D. candidate in Computational Neuroscience

Advisor: Dr. Terrence Sejnowski

09/2017 – Present

M.S. in Electrical Engineering

Track: Intelligent Systems, Robotics & Control

09/2017 – 02/2021

Equivalent M.S. in Applied Mathematics

Track: Probability Theory & Applied Statistics

09/2017 – Present

Tsinghua University

B.S. in Pharmaceutical Sciences; Graduated with honors

09/2013 – 07/2017

Courses and Skills

- Probability theory; Applied statistics; Nonlinear theory; Stochastic dynamical system; Sensing and estimation in robotics; Convex optimization; Cooperative control; Statistical learning; Information theory; Systems Neuroscience; Computational Neuroscience; Models of Neurons and Networks; Predictive Mind.
- Computational analysis skills: Python (PyTorch, Scipy, Matplotlib, Keras and Scikit-learn), MATLAB, R, SQL.

Project Experiences

Causal inference in high-dimensional time series:

- Developed a novel algorithm (Dynamical Differential Covariance) to **infer causality** from multi-unit neural recordings; Incorporated **robust PCA** for sparse matrix recovery; Exhibited superior performance than Granger causality, **probabilistic graphical modeling** and **manifold inference**. Recommended publication at *Proceedings of the National Academy of Sciences*.
- Processed resting-state functional Magnetic Resonance Imaging data (~1TB dataset) from 1003 subjects through PCA and group ICA.

Robust and generalizable recurrent auto-encoder (RNN-AE):

- Designed a **recurrent auto-encoder** with a predictive loss function based on hippocampal cortical interactions in human brain; Trained to reconstruct given sensory input by back propagation through time and **reservoir computing (PyTorch, Scipy and Keras)**.
- Successfully extracted interpretable hidden unit representation (e.g. figure orientation and label) of MNIST sequences and navigational cues in a maze.

Visual-inertial simultaneous localization and mapping (SLAM)

- Implemented SLAM based on camera and IMU data through **extended/unscented Kalman filter**.
- Traced static visual landmarks in footages recorded on a high-speed vehicle; Texture mapping through a RGBD camera model and coordinate transformation (**OpenCV**).

Convolution neural network (CNN) based image classification and transfer learning

- Trained deep CNN to classify CIFAR-10 and ImageNet. Achieved **one-shot classification** of CIFAR-10 through transfer learning.
- Employed **network tuning techniques** such as dropouts, loss function regularization and data augmentation.

Awards

Kavli-Helinski Fellowship, Division of Biological Sciences, UCSD

08/2021

National Scholarship of China

09/2016

Teaching and Mentoring

- Teaching assistant for Computational Neuroscience 03/2019-06/2019 & 03/2021-06/2021
- Teaching assistant for Bioinformatics Lab 01/2020-03/2020
- Mentored junior graduate student 02/2021-Present

Publications

- Chen, Y., Zhang, H. & Sejnowski, T.J. (2021). Hippocampus as a generative circuit for predictive coding of future sequences. *Society for Neuroscience*, 2021;
- Chen, Y., Rosen, B. Q., & Sejnowski, T. J. (2021). Dynamical differential covariance recovers directional network structure in multiscale neural systems. *Proceedings of the National Academy of Sciences (Recommended publication)*, Cosyne 2021
- Chen, Y., Bukhari, Q., Lin, T.W. & Sejnowski, T.J. (2021) Differential covariance of fMRI predicts structural connectivity and behavior. *Network Neuroscience (accepted)*; Cosyne 2020
- Lin, T. W.*, Chen, Y.*, ... & Sejnowski, T. J. (2020). Differential covariance: A new method to estimate functional connectivity in fMRI. *Neural Computation*, 32(12), 2389-2421.
- Zhou, J.*, Ma, J.*, Chen, Y.*, ..., & Ecker, J. R. (2019). Robust single-cell Hi-C clustering by convolution-and random-walk-based imputation. *Proceedings of the National Academy of Sciences*, 201901423.
- Chen, Y., ..., & Ma, P. (2017). Population pharmacokinetic analysis of tacrolimus in Chinese myasthenia gravis patients. *Acta Pharmacologica Sinica*, 38(8), 1195.
- Chen, Y., ..., & Ji, J. (2020). Dynamics of HBV surface antigen related end points in chronic hepatitis B infection: a systematic review and meta-analysis. *Antiviral Therapy*, 25(4), 203-215.