(Julie) Xueyan Niu

Updated April 18, 2023

Contact

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About

I study how self-supervised learning can be achieved by leveraging spatio-temporal dependencies and predicting future representations, with natural movies as the primary context. There are two main anchors of this work: 1) Experiments show the brain transforms visual inputs into representations that follow **straighter temporal trajectories** than the original pixels, facilitating prediction by linear extrapolation. Can this be a proper principle to learn visual representations? 2) If so, can the visual system make predictions at different time scales and different levels of abstraction by applying the straightening principle along the visual hierarchy?

Skills

Coding: Python (pytorch, numpy, matplotlib, sklearn, scipy, torchvision), Matlab, C++
Tools: LaTeX, Git, Bash, CUDA, Jupyter Notebook
Technical Expertise: Deep learning, machine learning, signal processing, visual perception, Bayesian statistics

Education

New York University — Sep 2020 – Dec 2025 (anticipated)
PhD in Neural Science — New York, NY
Advisors: Eero Simoncelli, Cristina Savin
GPA: 3.96

The University of Hong Kong — Sep 2015 – Jun 2019
BSc in Mathematics, minor in Cognitive Science — Hong Kong
First Class Honor

Experience

Graduate Teaching Assistant — Jan 2022 – May 2022
Center for Neural Science, New York University
Course: Behavioral and Integrative Neuroscience

Visiting Scholar — Aug 2019 – Jan 2020
Department of Computer Science, Carnegie Mellon University
Advisor: Tai Sing Lee

- Proposed a decentralized neural circuit involving congruent neurons and opposite neurons to achieve multisensory cue integration and segregation. The circuit learned by Hebbian and anti-Hebbian rules reproduced the experimentally observed tuning properties of congruent neurons and opposite neurons and achieved optimal integration.
- Proposed a recurrent excitation - surround competition circuit of V1 neurons and reproduced the experimentally observed visual familiarity effect.

Undergraduate Research Assistant — Jul 2017 – Dec 2017
The University of Hong Kong
Advisor: Akaysha Tang

- Presented solid EEG evidence of two distinct stages of novelty processing in vision and audition: early sensory and late P300, based on the theta power marker in EEG signal.
- Solely wrote a Matlab pipeline for analyzing EEG data.

Leadership Roles

Student Representative on the Faculty Search Committee — Spring 2022
Center for Neural Science, New York University

Publications

1. (preprint) Deying Song, **Xueyan Niu**, Wen-Hao Zhang, Tai Sing Lee. (2020). A spiking neural circuit model for learning multi-sensory integration. BioRxiv link.

2. (preprint) **Xueyan Niu**, Ho Yin Chau, Tai Sing Lee, Wen-Hao Zhang. (2019). Emergence of opposite neurons in a decentralized firing-rate model of multisensory integration. BioRxiv link.

3. Shiping Cao*, Anthony Coniglio*, **Xueyan Niu***, Richard Rand*, Robert S. Strichartz* (*in alphabet order). (2019). The Mathieu Differential Equation and Generalizations to Infinite Fractafolds. Communications on Pure and Applied Analysis,19,3,1795-1845. Link.

Conference Presentations

1. **Xueyan Niu**, Cristina Savin, Eero Simoncelli. Learning predictive neural representations by straightening natural videos. Computational and Systems Neuroscience, March 2023. Link.

2. **Xueyan Niu**, Edoardo Balzani, Jean-Paul Noel, Baptiste Caziot, Eric Avila, Cristina Savin, Dora E. Angelaki. Neural correlates of naturalistic decision-making in parietal and frontal cortices. Society for Neuroscience, Nov 2021.

3. Ho Yin Chau, **Xueyan Niu**, Wenhao Zhang, Tai Sing Lee. Emergence of opposite neurons in a circuit for multisensory processing. Computational and Systems Neuroscience, Feb 2020.

4. Eric W. Tsang, Rui Sun, **Xueyan Niu**, Renee Fung, Akaysha C. Tang. Theta power increase in the human visual cortex in response to novelty. Society for Neuroscience, Nov 2019.

5. **Xueyan Niu**, Guang Ouyang, Yunqing Hua, Akaysha C. Tang. P300 and theta-band oscillation: two expressions of a single novelty response. Cognitive Neuroscience Society, 2018.