

Zitong Lu

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(Update by 08/2021)

Education Background

The Ohio State University
PhD, Cognitive Neuroscience

Columbus, Ohio, the United State
2021-

Department of Psychology
Advised by [Julie Golomb](#)

Vision and Cognitive Neuroscience Lab <https://u.osu.edu/golomblab/>

East China Normal University
MSci, Cognitive Neuroscience

Shanghai, China
2021

The Institute of Cognitive Neuroscience, School of Psychology and Cognitive Science
Advised by [Yixuan Ku](#), [Yong-di Zhou](#) & [Huimin Wang](#)

Memory and Emotion Lab (now in Sun Yat-sen University) <https://sysumelab.com>

Northeastern University
BEng, Software Engineering

Shenyang, China
2018

Department of Software Engineering, Software College

Research Interests

Feature/Object/Face Perception, Visual working memory, Mental Imagery, Emotion, Attention

Multivariate Pattern Analysis (MVPA): Classification-based Decoding, Representational Similarity Analysis (RSA)

Machine Learning, Deep Learning.

Research Experience

Independent/leading Projects:

A Chinese Handbook for EEG Data Analysis based on Python

06/2021 – 07/2021

- The first Python EEG data analysis handbook in Chinese, including preprocessing, basic data analysis, statistical analysis, ERP analysis, time-frequency analysis, EEG decoding and representational similarity analysis.
- Website: <https://github.com/ZitongLu1996/Python-EEG-Handbook>. (59 stars on GitHub!)

Representation Comparisons between Human Brain and Hierarchical Deep Convolutional Neural Network in Face Perception Reveal a Fatigue Mechanism of Repetition Suppression

Institute of Cognitive Neuroscience, ECNU

09/2020 – 05/2021

- Used a hierarchical deep convolutional neural network as a tool to simulate the neural mechanism of facial repetition suppression as fatigue or sharpening of neurons.
- Cross-modalities Representational Similarity Analysis (RSA) was used to reveal a fatigue mechanism of repetition suppression.

Cross-Temporal Representational Similarity Analysis-based E/MEG Decoding on PyCTRSA

Institute of Cognitive Neuroscience, ECNU

07/2020 – 09/2020

- Independently designed and realized a cross-temporal E/MEG decoding method based on traditional RSA.
- Independently implemented a Python toolbox for Cross-Temporal RSA (CTRSA)-based decoding, called PyCTRSA.
- Wrote a document for comparing classification-based decoding and CTRSA-based decoding:
https://nbviewer.jupyter.org/github/ZitongLui996/PyCTRSA/blob/master/test/Decoding_Classification_VS_CTRSA.ipynb.
- Website: <https://github.com/ZitongLui996/PyCTRSA>. (12 stars on GitHub!)

Dynamic Representation between Deep Neural Network and Human Brain in Visual Working Memory

Institute of Cognitive Neuroscience, ECNU

04/2019 – 04/2019

- Obtained features of each layer in a VGG-11 model and calculated representational dissimilarity matrices (RDMs) corresponding to each layer.
- Collected and analyzed EEG data independently, and calculated time series RDMs based on ERP, Theta power and Alpha power of different regions.
- Compared temporal representational similarities between deep convolutional neural network and brain activities in VWM.

Dynamic Object-based Encoding Mechanism in Visual Working Memory by EEG Decoding

Institute of Cognitive Neuroscience, ECNU

03/2019 – 03/2020

- Collected and analyzed EEG data independently from a VWM experiment with three different tasks.
- Applied Linear-SVM to conduct time-by-time and cross-temporal decoding for different visual features based on ERP and Alpha power to assess the representation of different features in VWM.
- Decoded for both the attended feature and the unattended feature based on data from different phase to explore the dynamic mechanism of memory storage.

NeuroRA: A Python Toolbox of Representational Analysis from Multi-modal Neural Data

Institute of Cognitive Neuroscience, ECNU

03/2019 – Present, continuously updated

- Independently designed and implemented a Python toolbox (NeuroRA) for multimodal neural data (behavioral, EEG, MEG, fNIRS, fMRI, and some other neuroelectrophysiological data) representational analysis.
- Typical features in NeuroRA: calculating neural pattern similarity, calculating spatiotemporal pattern similarity (STPS), calculating inter-subject correlation (ISC),

calculating representational similarity analysis (RSA), classification-based EEG decoding, doing statistical analysis and plotting results.

- Website: <https://zitonglu1996.github.io/NeuroRA/>. (87 stars on GitHub!)

Image Recognition and Object Detection of Fused Magnesium Furnace Based on Deep Learning

Department of Software Engineering, NEU

11/2017 – 05/2018

- Completed an object algorithm based on Darknet and an image classification algorithm based on Caffe.
- Independently developed a piece of software for real-time working status recognition of fused magnesium furnace based on Qt, C and C++.

Joint Projects:

Transcultural Differences of Theory of Mind among Chinese and Japanese Cultures: A fMRI Study

Institute of Cognitive Neuroscience, ECNU

04/2021 – 06/2021

Participating in analyzing fMRI data and applying RSA and ISC method to explore the different representations of the theory of mind between Chinese and Japanese participants.

Working Memory Mechanism of Methamphetamine Addicts

Institute of Cognitive Neuroscience, ECNU

10/2020 – Present

Participating in analyzing EEG data and comparing the neural activities under different conditions.

Differences in Working Memory Mechanism between Normal and Mild Cognitive Impairment

Tongji Hospital & Institute of Cognitive Neuroscience, ECNU

09/2018 – Present

Participating in classifying the health control and the MCI patients and decoding different tasks based on EEG data.

Reward and Penalty Expectations Facilitate the Precision of Visual Working Memory through Dissociable Neural Mechanisms

Institute of Cognitive Neuroscience, ECNU

04/2019 – 06/2020

Participating in doing Searchlight RSA and ROI-based RSA among behavioral data, different decision-making coding models and fMRI data.

Decoding Different Visual Features of Visual Short-Term Memory: An EEG Study

Dept of Computer Science & Institute of Cognitive Neuroscience, ECNU

09/2018 – 03/2019

Participating in designing and realizing a novel memory decoding model based on deep learning to decoding the attended feature(orientation) and unattended feature(position).

Publications

Lu, Z., & Ku, Y. (2020). NeuroRA: A Python toolbox of representational analysis from multi-modal neural data. *Frontiers in Neuroinformatics*. 14:563669.

<https://doi.org/10.3389/fninf.2020.563669>

Lu, Z., Chen, H., & Ku, Y. (in preparation). Dynamic object-based encoding and automatically prioritized position encoding in visual working memory by EEG decoding. (latest manuscript: https://zitonglu1996.github.io/docs/DOBE_draft.pdf)

Sun, Y., **Lu, Z.**, & Ku, Y. (in preparation). Reward and penalty expectations facilitate the precision of visual working memory through dissociable neural mechanisms.

Lu, Z., Ku, Y. (in preparation). Representation Comparisons between Human Brain and Hierarchical Deep Convolutional Neural Network in Face Perception Reveal a Fatigue Mechanism of Repetition Suppression.

Presentations

12/17/2020 Dept of Biomedical Engineering, Shenzhen University
[Talk] Representational Analysis for Cognitive Neuroscience based on NeuroRA

12/28/2020 Dept of Biomedical Engineering, UESTC
[Talk] Representational Analysis for Cognitive Neuroscience based on NeuroRA

06/08/2021 Lightning Talk, 2021 UNIQUE Student Symposium
[Talk] Representation comparisons between human brain and hierarchical deep convolutional neural network in face perception reveal a fatigue mechanism of repetition suppression

06/27/2021 Centre for Cognition and Brain Science, University of Macau
[Talk] Using computational methods to explore the neural representational mechanism in cognitive neuroscience

08/27/2021 The European Conference on Visual Perception (ECVP) 2021
[Poster] Representation comparisons between human brain and hierarchical deep
convolutional neural network in face perception reveal a fatigue mechanism of repetition
suppression

Software & Toolboxes

NeuroRA: <https://zitonglu1996.github.io/NeuroRA/> (87 stars on GitHub!)

Citation: Lu, Z., & Ku, Y. (2020). NeuroRA: A Python toolbox of representational analysis from multi-modal neural data. *Frontiers in Neuroinformatics*. 14:563669.
<https://doi.org/10.3389/fninf.2020.563669>

PyCTRSA: <https://github.com/ZitongLu1996/PyCTRSA> (12 stars on GitHub!)

Citation: Lu, Z. (2020). PyCTRSA: A Python package for cross-temporal representational similarity analysis-based E/MEG decoding. *Zenodo*. <https://doi.org/10.5281/zenodo.4273674>

Programming & Experiment Skills

Computer Languages: Python, C, C++, MATLAB, Java, Julia

Software & Toolboxes: EEGLAB, MNE, SPM, Nibabel, Nilearn, NeuroRA, Tensorflow, PyTorch

Experimental Experience: EEG, fMRI, Eye tracker and TMS

Working Experience

05/2017-08/2017

Programmer (as Project Leader)

iSoftStone corporation, Shenyang, China

09/2020-Present

Research Assistant Brain-Like Memory Group, Peng Cheng Laboratory, Shenzhen, China

Honors & Awards

08/2021 University Fellowship (about **USD 30,000**, by OSU)

04/2021 Outstanding Graduate Student (**3%**, Department of Education of Shanghai City)

12/2019 Short-Term Overseas Research Scholarship (about **USD 7,000**, by ECNU)

12/2018 Third prize (**30%**, China Graduate Student Mathematical Contest in Modeling)

12/2017 Outstanding Graduate Student (**3%**, Department of Education of Liaoning Province)

11/2017 Second-Class Merit Scholarship (**13%**, by NEU)

04/2017 Meritorious Winner (**13%**, Mathematical Contest in Modeling, by the U.S COMAP)

12/2016 First-Class Liu Dajie & Fang Wenyu's Scholarship (**<1%**, **USD 1500**, by NEU)

11/2016 Provincial First Prize (**3%**, China Undergraduate Mathematical Contest in Modeling)

11/2016 First-Class Merit Scholarship (**3%**, by NEU)

04/2016 Honorable Mention (**30%**, Mathematical Contest in Modeling, by the U.S COMAP)

11/2015 Second-Class Merit Scholarship (**13%**, by NEU)

References

Julie Golomb, Associate Professor

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Yixuan Ku, Professor

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Department of Psychology, Sun Yat-sen University

Yong-Di Zhou, Professor

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NYU-ECNU Insititute of Brain and Cognitive Science, NYU-Shanghai

Department of Psychology, Shenzhen University

Hui Chen, Research Professor

chenhui@zju.edu.cn

Department of Psychology and Behavior Science, Zhejiang University

Qing Cai, Professor

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NYU-ECNU Insititute of Brain and Cognitive Science, NYU-Shanghai

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