

Zitong Lu

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(Update by 12/2020)

Education Background

East China Normal University Shanghai, China
Master of Science, Cognitive Neuroscience expected 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)

Northeastern University Shenyang, China
Bachelor of Engineering, Software Engineering 2018
Department of Software Engineering, Software College

Research Interests

Visual working memory, Mental Imagery, Object/Face Perception, Emotion, Attention
Multivariate Pattern Analysis (MVPA): Classification-based Decoding, Representational
Similarity Analysis (RSA)
Machine Learning, Deep Learning.

Research Experience

Independent Projects:

Similar and Dissimilarity Representations between the Human Brain and the Deep Convolutional Neural Network in Face Perception

Institute of Cognitive Neuroscience, ECNU 09/2020 – Present

- To explore the information of faces such as famous/unfamous, normal/scrambled in perception by RSA based on EEG data.
- To use different deep neural networks (such as Face-identity network and Facial-expression network) to see how the information encodes in DCNN and explore the different representations between brain and DCNN in face perception.

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.

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) representation analysis.
- Typical features in NeuroRA: calculating neural pattern similarity, calculating spatiotemporal pattern similarity (STPS), calculating inter-subject correlation (ISC), calculating representational similarity analysis (RSA), doing statistical analysis and plotting results.

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:

The Influence of Facial Expression on Visual Working Memory

Institute of Cognitive Neuroscience, ECNU

11/2020 – Present

Participating in analyzing fMRI data and applying MVPA method to explore the differences in facial working memory under different load conditions (load 1 or load 2).

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. doi: 10.3389/fninf.2020.563669. (latest version: https://zitonglu1996.github.io/docs/NeuroRA_Latest.pdf)

Lu, Z., Chen, H., & Ku, Y. (submitted). 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). Dynamic representation between deep convolutional neural network and EEG in a visual short-term memory task.

Software & Toolboxes

NeuroRA: <https://zitonglu1996.github.io/NeuroRA/> (68 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> (8 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

- 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)

Presentations

12/17/2020 invited by Dept of Biomedical Engineering, Shenzhen University
Representational Analysis for Cognitive Neuroscience based on NeuroRA

12/28/2020 invited by Dept of Biomedical Engineering, UESTC
Representational Analysis for Cognitive Neuroscience based on NeuroRA

References

Yixuan Ku, Professor

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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

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

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