

# Zitong Lu

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(Update by 09/2020)

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## 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 (new 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): SVM-based decoding, Representational similarity analysis (RSA)  
Machine Learning, Deep Learning.

## Research Experience

### *Independent Projects:*

09/2020 – Present Peng Cheng Laboratory & Dept of Psychology, SYSU  
**Face Representations in Human Brain and Deep Convolutional Neural Network**

- 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.

07/2020 – 09/2020

Institute of Cognitive Neuroscience, ECNU

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

- 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](https://nbviewer.jupyter.org/github/ZitongLui996/PyCTRSA/blob/master/test/Decoding_Classification_VS_CTRSA.ipynb).
- PyCTRSA Website: <https://github.com/ZitongLui996/PyCTRSA>.

04/2019 – 04/2019

Institute of Cognitive Neuroscience, ECNU

### **Dynamic Representation between Deep Neural Network and Human Brain in Visual Short-Term Memory**

- 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 base on ERP, Theta power and Alpha power of different regions.
- Compared temporal representational similarities between deep convolutional neural network and brain activities in VSTM.

03/2019 – 03/2020

Institute of Cognitive Neuroscience, ECNU

### **Representation of the unattended feature in Visual Short-Term Memory by EEG Decoding**

- Collected and analyzed EEG data independently from a VSTM 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 VSTM.
- Decoded for unattended feature based on data from different phase to explore whether the coding of unattended features would weaken as the experiment went on.

03/2019 – Present, continuously updated

Institute of Cognitive Neuroscience, ECNU

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

- Independently designed and implemented a Python toolbox (NeuroRA) for multimode (behavioral, EEG, MEG, fNIRS, ECoG, electrophysiology, fMRI) neural 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.
- NeuroRA Website: <https://neurora.github.io/NeuroRA/>.

11/2017 – 05/2018

Department of Software Engineering, NEU

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

- 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:***

09/2018 – Present

Tongji Hospital & Institute of Cognitive Neuroscience, ECNU

### **Differences in working memory mechanism between normal and mild cognitive impairment**

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

04/2019 – 06/2020

Institute of Cognitive Neuroscience, ECNU

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

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

09/2018 – 03/2019

Dept of Computer Science & Institute of Cognitive Neuroscience, ECNU

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

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.** (under review). NeuroRA: A Python toolbox of representational analysis from multi-modal neural data. (bioRxiv version: <https://doi.org/10.1101/2020.03.25.008086>)

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

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

**Lu, Z.**, Chen, H., Ku, Y. (in prepare). Decoding unattended features in visual short-term memory.

**Lu, Z.** (in prepare). PyCTRSA: A Python package for cross-temporal representational similarity analysis-based E/MEG decoding.

## 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

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|---------|--|
| 12/2019 | Short-Term Overseas Research Scholarship (about <b>USD 7,000</b> , by ECNU)                |
| 12/2018 | Third prize ( <b>30%</b> , China Graduate Student Mathematical Contest in Modeling)        |
| 12/2017 | Outstanding Graduate Student ( <b>3%</b> , Department of Education of Liaoning Province)   |
| 11/2017 | Second-Class Merit Scholarship ( <b>13%</b> , by NEU)                                      |
| 04/2017 | Meritorious Winner ( <b>13%</b> , Mathematical Contest in Modeling, by the U.S COMAP)      |
| 12/2016 | First-Class Liu Dajie & Fang Wenyu's Scholarship (< <b>1%</b> , <b>USD 1500</b> , by NEU)  |
| 11/2016 | Provincial First Prize ( <b>3%</b> , China Undergraduate Mathematical Contest in Modeling) |
| 11/2016 | First-Class Merit Scholarship ( <b>13%</b> , by NEU)                                       |
| 04/2016 | Honorable Mention ( <b>30%</b> , Mathematical Contest in Modeling, by the U.S COMAP)       |
| 11/2015 | Second-Class Merit Scholarship ( <b>13%</b> , by NEU)                                      |