

# Zitong Lu

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(Update by 11/2020)

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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 (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:*

Peng Cheng National Laboratory 09/2020 – Present  
**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.

Institute of Cognitive Neuroscience, ECNU

07/2020 – 09/2020

### **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>.

Institute of Cognitive Neuroscience, ECNU

04/2019 – 04/2019

### **Dynamic Representation between Deep Neural Network and Human Brain in Visual Working 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 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.

Institute of Cognitive Neuroscience, ECNU

03/2019 – 03/2020

### **Representation of the unattended feature in Visual Working Memory by EEG Decoding**

- 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 unattended feature based on data from different phase to explore whether the coding of unattended features would weaken as the experiment went on.

Institute of Cognitive Neuroscience, ECNU

03/2019 – Present, continuously updated

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

- 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.
- NeuroRA Website: <https://ZitongLui996.github.io/NeuroRA/>. (37 Stars on GitHub!)

Department of Software Engineering, NEU

11/2017 – 05/2018

### **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:***

Tongji Hospital & Institute of Cognitive Neuroscience, ECNU

09/2018 – Present

### **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.

Institute of Cognitive Neuroscience, ECNU

04/2019 – 06/2020

### **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.

Dept of Computer Science & Institute of Cognitive Neuroscience, ECNU

09/2018 – 03/2019

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

**Lu, Z., Chen, H., Ku, Y.** (In preparation). Dynamic representations of unattended features in visual working memory by EEG decoding.

**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.

**Lu, Z.** (In preparation). 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

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 (13%, 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)