Zitong Lu

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(Update by 11/2020)

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:

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/ZitongLu1996/PyCTRSA/blob/master/test/Decoding_Classification_VS_CTRSA.ipynb.

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 base 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

Dynamic representation of features 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 both the attended feature and the unattended feature based on data from different phase to explore the dynamic mechanism of memory storage.

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 multimode 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.

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. (Submitted to *Frontiers in Neuroinformatics*, latest version: https://github.com/ZitongLu1996/NeuroRA/blob/master/docs/NeuroRA_Revision.pdf)

Lu, Z., & Ku, Y. (In preparation). Dynamic object-based encoding 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.

Software & Toolboxes

NeuroRA: https://zitonglu1996.github.io/NeuroRA/ (39 stars on GitHub!)
Citation: Lu, Z., & Ku, Y. (2020). NeuroRA: A Python toolbox of representational analysis from multi-modal neural data. *Preprint*. https://doi.org/10.1101/2020.03.25.008086

PyCTRSA: https://github.com/ZitongLu1996/PyCTRSA (6 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)