# Zhaoning Li

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## EDUCATION

**University of Macau (UM)** — Macao, China
*Doctor of Philosophy in Psychology* — 2021.08-
**Sun Yat-sen University (SYSU)** — Guangzhou, China
*Master of Engineering in Software Engineering* — 2016.09-2018.07
♦ Graduation thesis: Research on causal knowledge extraction method based on deep learning and sequence labelling
*Bachelor of Engineering in Information Security* — 2012.09-2016.07

## RESEARCH INTERESTS

*Topics*
♦ Social Cognition, social neuroscience, mentalising (讀心術), artificial intelligence, natural language processing
*Methods*
♦ Experimental design, computational modelling, fMRI, machine learning

## AWARDS

**Best Presentation Award, the 3rd Place** — Macao, China
The 1st International Symposium on Addiction and Decision Making, University of Macau — 2021
**Award of Excellence** — Macao, China
The 1st International Symposium on Addiction and Decision Making, University of Macau — 2021
**Best Oral Presentation, the 3rd Place** — Online
Greater Bay Area Young Scholar Forum on Psychological Science — 2021
**The Third Prize Scholarship for postgraduate students** — Guangzhou, China
Sun Yat-sen University — 2016-2017

## PUBLICATIONS

**Li, Z.**, Li, Q., Zou, X., & Ren, J. (2021). Causality extraction based on self-attentive BiLSTM-CRF with transferred embeddings. *Neurocomputing*, *423*, 207-219. https://doi.org/10.1016/j.neucom.2020.08.078

**Li, Z.**, & Ren, J. (2020). Fine-tuning ERNIE for chest abnormal imaging signs extraction. *Journal of Biomedical Informatics*, *108*, 103492. https://doi.org/10.1016/j.jbi.2020.103492

**Li, Z.,** Jiang, Q., Wu, Z., Liu, A., Wu, H., Huang, M., Huang, K., Ku, Y. (under revision). Towards human-compatible autonomous car: A study of Turing test in automated driving with affective variability modelling. *IEEE Transactions on Affective Computing*.

**Li, Z.,** Dong, Q., Hu, B., Wu, H. (under review). Every individual makes a difference: A trinity derived from linking individual brain morphometry, connectivity and mentalising ability. *Human brain mapping*. https://doi.org/10.1101/2022.04.11.487870

## PATENTS

**Li, Z.** Causal Knowledge Extractor based on Deep Learning V1.0. China Patent Application 2018SR275268, Certificate No.: 2604363, filed 2018.

## RESEARCH EXPERIENCE

**Linking Individual Brain Morphometry, Connectivity and Mentalising Ability** — Macao, China
*Individual Research, with Prof. Haiyan Wu and Prof. Qunxi Dong, A. N. D Lab at UM* — 2021.06-Present
♦ Exploited inter-subject representational similarity analysis (IS-RSA) to assess relationships between amygdala and hippocampal morphometry (MMS), connectivity (rs-FC) and mentalising ability (IMQ) across the participants
♦ Proposed a novel pipeline, i.e., computing patching and pooling operations-based surface distance (CPP-SD), to obtain a

decent representation for high-dimensional MMS data in IS-RSA.

- ♦ Found significant correlations between three distinct modalities, i.e., a trinity existed in idiosyncratic patterns of brain morphometry, connectivity and mentalising ability.
- ♦ Found a region-related mentalising specificity emerged from these associations: self-self and self-other mentalisation are more related to the hippocampus, while other-self mentalisation shows a closer link with the amygdala.
- ♦ Observed significant interactions such that subject pairs with similar morphometry had even greater mentalising similarity if they were also similar in rs-FC by utilising the dyadic regression analysis.
- ♦ Demonstrated the feasibility and illustrated the promise in using IS-RSA to study individual differences, deepening understanding of how individual brains give rise to their mentalising abilities.
- ♦ Github link: https://github.com/andlab-um/trinity

**A Study of Turing Test in Automated Driving with Affective Variability Modelling**     Guangzhou, China
*Research Assistant, with [Prof. Yixuan Ku](), [Memory & Emotion Lab at SYSU]()*     2020.09-Present
- ♦ Conducted a Turing test of automated driving based on 69 passengers' feedback in a real-road scenario
- ♦ Collected passengers' choices of response after the process in which passengers rode in the autonomous car (driven by either the human driver or AI driver) and inferred the intentions of the driver (i.e., mentalising)
- ♦ Test results showed that Level 4 autonomous cars could pass the Turing test with less than 50% accuracy
- ♦ Proposed a computational model based on signal detection theory, where signal strength was represented by affective variability (tested by modified Differential Emotions Scale and transformed by pre-trained language models), to understand cognitive mechanisms underlying passengers' mentalising process in the Turing test
- ♦ Analysis showed that the greater affective variability that passengers had, the more likely they identified the driver as the AI algorithm
- ♦ Suggested that future automated driving should incorporate and improve the affective stability of passengers

**Causality Extraction based on Self-Attentive BiLSTM-CRF with Transferred Embeddings**     Guangzhou, China
*Research Assistant, with [Prof. Jiangtao Ren]()*     2018.09-2020.03
- ♦ Designed a causality tagging scheme and transformed the causality extraction into a sequence labeling task to handle multiple causal triplets and embedded causal triplets in the same sentence
- ♦ Identified cause and effect without extracting candidate causal pairs and identifying their relations separately by proposing SCITE (Self-attentive BiLSTM-CRF with Transferred Embeddings), a neural-based causality extractor with transferred contextual string embeddings trained on a large corpus
- ♦ Introduced the multi-head self-attention mechanism into SCITE to capture long-range dependencies between cause and effect
- ♦ Proposed a model outperformed BiLSTM-CRF by 7.24% by verifying that the causality tagging scheme achieved an improvement rate of 10.06% over the general tagging scheme
- ♦ Github link: https://github.com/Das-Boot/scite

**Causality Extraction based on Bi-directional LSTM Networks with Focal Loss**     Guangzhou, China
*Individual Research, with [Prof. Jiangtao Ren]()*     2017.09-2018.04
- ♦ Formulated causality extraction as a sequence labeling problem based on deep learning models to minimize feature engineering and extract the causal knowledge directly
- ♦ Investigated different BiLSTM-based end-to-end models to achieve the best performance
- ♦ Addressed the tag class imbalance problem in causal sequence labeling by proposing an end-to-end model with focal loss as the loss function, named BiLSTM-Softmax (FL)
- ♦ Evaluated on a public dataset and identified that the proposed model can effectively enhance the association between cause and effect

## PROFESSIONAL EXPERIENCE

**Fine-tuning ERNIE for Chest Abnormal Imaging Signs Extraction**     Guangzhou, China
*NLP Engineer, Department of Big Data and Artificial Intelligence at [Tianpeng Technology Co., Ltd]().*     2019.04-2020.05
- ♦ Formulated chest abnormal imaging sign extraction as a sequence tagging and matching problem
- ♦ Alleviated the problem of data insufficiency by proposing a transferred abnormal imaging signs extractor with pre-trained

ERNIE as the backbone, named EASON (fine-tuning ERNIE with CRF for Abnormal Signs ExtractiON)
- Designed a tag2relation algorithm based on the nature of chest imaging report text with more than 2,500 training sets
- Evaluated the algorithm with over 450 test sets to serve the matching task
- Proved the effectiveness of the proposed model for chest abnormal imaging signs extraction, which outperformed ERNIE by 1.05 points in abnormal imaging identification, 0.37 points in attributes identification, and 2.15 points in matching in terms of F1-score
- Github link: https://github.com/Das-Boot/eason

**Multi-task Learning for Diagnosis Assistance based on Information Extraction and Text Classification** Guangzhou, China
*NLP Engineer, Department of Big Data and Artificial Intelligence at Tianpeng Technology Co., Ltd.* 2019.09-2019.12
- Improved the interpretability of the deep learning-based diagnosis prediction model by proposing a multi-task learning model based on information extraction and text classification
- Programmed with Keras to predict the disease and extract relevant proof from each patient's e-medical records, providing evidence for the prediction
- Reached a hypothesis that diagnosis prediction and interpretability analysis are mutually reinforcing

**Rare Disease Diagnosis based on Similarity Measuring and Additive Margin Softmax** Guangzhou, China
*NLP Engineer, Department of Big Data and Artificial Intelligence at Tianpeng Technology Co., Ltd.* 2019.08-2019.12
- Trained the classification model to get the vector representation of each patient by applying the diagnosis prediction model for common diseases as an encoder
- Employed K-nearest neighbor algorithm on the basis of cosine similarity to contrast and sort the vector representations, achieving the results of the prediction
- Applied AM-Softmax in face recognition as the loss function to reduce intra-class variation and increase inter-class difference

## CONFERENCE PRESENTATIONS

**Li, Z.,** Dong, Q., Hu, B., Wu, H. (2022). Every individual makes a difference: A trinity derived from linking individual brain morphometry, connectivity and mentalising ability. Poster presented virtually at *the 14th Annual Meeting of the Social & Affective Neuroscience Society*, May 4-6.

**Li, Z.,** Jiang, Q., Wu, Z., Liu, A., Wu, H., Huang, M., Huang, K., Ku, Y. (2021). Towards human-compatible autonomous car: A study of Turing test in automated driving with affective variability modelling. Presented at *the 1st International Symposium on Addiction and Decision Making*, Macao, China, November 19-20. Best Presentation Award, the 3rd Place.

**Li, Z.,** Dong, Q., Hu, B., Wu, H. (2021). Every individual makes a difference: A trinity derived from linking individual brain morphometry, functional connectivity and mentalising abilities. Presented at *the 1st International Symposium on Addiction and Decision Making*, Macao, China, November 19-20. Award of Excellence.

**Li, Z.,** Jiang, Q., Wu, Z., Liu, A., Wu, H., Huang, M., Huang, K., Ku, Y. (2021). Bot or not: How passenger tells apart AI and human drivers in the Turing test of automated driving? Presented virtually at *the Greater Bay Area Young Scholar Forum on Psychological Science*, October 8-10. Best Oral Presentation, the 3rd Place.

## ORGANISED SEMINARS

*Social Cognition Seminar* 2022
- *theme:* Social cognition, from brains to culture
- fifteen participants, six presenters, fifteen seminars

*Seminar on computational modelling of cognition and behaviour* 2021
- *theme:* Computational modelling of cognition and behaviour
- thirteen participants, eleven presenters, fourteen seminars

## ADDITIONAL TRAINING

The Computational and Cognitive Neuroscience (CCN) summer school (2021), *Cold Spring Harbor Laboratroy*
Online summer school for Computational Neuroscience (2021), *Neuromatch Academy*

## LANGUAGE

Mandarin Chinese, Jin Chinese (Bingzhou subgroup), English