ZIZHEN DENG

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🏛 EDUCATION

Institute of Automation, Chinese Academy of Sciences   2021 – 2024

Research Interests: Causal Learning, Model Alignment, Social Computing   M.S.

North China Electric Power University   2017 – 2021

GPA 91.46 (**1/119**), National Scholarship, Outstanding Graduate   B.E.

🎓 RESEARCH

1.Causal Alignment for Large Language Models   2023.05 –

We propose a new method based on **causal abstraction** and **mixture of experts** to find the neural representation corresponding to a given causal variable in the SCM model. The highlights:

- We introduce the **intervention** operation in causal inference into the LLMs, and use the different inputs of the design to achieve soft intervention on causal variables.
- This work **first** uses MoE for causal alignment of LLMs, explores the **disentanglement** function of MoE, and separates high-dimensional semantic causal variables in **nonlinear** neural representations.

2.Social Resilience Research Based on Causal Discovery   2022.02 – 2023.05

We use the resilience of the **social cognitive network** generated by **causal discovery** to characterize **social resilience** as a entirety rather than the fragmented indicators. The highlights:

- We use LIWC to extract **cognitive dimensions** in social media texts, and use causal discovery methods to find causal relationships among them to construct social cognitive networks.
- This work **first** brings cognitive networks into the study of social resilience to capture changes in people's cognition. In addition, we use the GBB algorithm to simplify the multi-dimensional structure of network resilience to a one-dimensional structure so that allowing analytical description.

3.Modeling Information Cascading Behavior Based on Causal Inference   2022.09 – 2023.02

We use causal inference to calculate the extent to which individual decision-making is influenced by **internal motivation** and **external environment** to understand the reasons behind cascading behaviors. The highlights:

- We use the collide in the SCM to parameterize the user's internal motivation and extrinsic environment, and in the case of known cascading behavior, use optimization of loss to complete the missing representation.
- This work is the **first** attempt to achieve an understanding of the cascading behavior of individuals in the absence of information.

4.Deep Causal Learning: Representation, Discovery, and Inference   2021.11 – 2022.09

We point out the existing problems in the field of causal learning, and lead to the inevitability of combining with deep learning. Then we introduce the latest methods for the three core directions of causal representation learning, deep causal discovery, and deep causal inference. The highlights:

- This work provides a comprehensive overview of deep causal discovery and deep causal inference.
- It contains classic and latest methods, such as NOTEARS, DAG-GNN, Grad-DAG; CFR, DragonNet, CE-VAE, GANITE, DeepIV, etc.
- **Publication**: Deep Causal Learning: Representation, Discovery and Inference.
- **First author, ACM Computing Survey (under review), arXiv:2211.03374**

5.Application of Causal Inference to Social Media 2021.06 – 2021.11

We use the CCM method to construct a causal network of influence between countries based on large-scale news media data to describe the influence of countries. The highlights:

- This work **<u>first</u>** applies causal inference to news media worldwide, measuring causal influence between countries.
- Through the causal influence network we have constructed, we can know which countries have influence on other countries through their own influence.
- **<u>Publication</u>**:Credible Influence Analysis in Mass Media Using Causal Inference.
- **<u>First author, 2021 IEEE International Conference on Intelligence and Security Informatics (ISI)</u>**

👥 COMPETITION

The 2022 PCIC Causal Inference Competition 2022.09 – 2022.12

- We use TCN, CNN+Transformer and other methods to enable different model blocks to capture abnormal features at different time and maximize the generalization of the model.
- Ranked No.5, won the Bronze Award, and was invited to participate in the 2022 Pacific Causal Inference Conference Workshop

DataFountain Training Competition 2021.11 – 2021.12

- We construct features and implement pattern recognition using various classifiers such as Random Forest, XGBoost, CNN, LSTM, etc.
- Accuracy is 0.944, ranked 21/396

Competition awards 2017-2021

- National Outstanding Innovation and Entrepreneurship Project for College Students, Leader
- International Underwater Robot Competition, Second Prize
- Chinese Undergraduate Mathematical Contest in Modeling, Provincial Second Prize
- Mathematical Contest in Modeling, Honorable Mentions

⚙️ ABILITY

- Programming language: Python > C++
- English: CET-4(530), CET-6(507)
- Machine learning: PyTorch,TensorFlow and other machine learning frameworks
- Causal learning: YLearn, DoWhy, CausalML, EconML and other causal learning frameworks

💠 STATEMENT

- Solid foundation: I have deep research on causal learning, especially in combination with deep learning. I have a comprehensive and in-depth understanding of the field of causal science, clear development and existing problems, and have a certain perception of the future direction.
- Interdisciplinary: As a student majoring in social computing, I have a multidisciplinary perspective, can look at problems from multiple perspectives, and am good at cross-innovation.
- Strong ambition: First, I will study the theory of artificial intelligence in depth and make technological breakthroughs. After that, I will apply advanced AI technology to social scenarios to bring tangible improvements to people's lives.