

Shunxing Fan

Email: shunxing.fan@gmail.com Phone: +971 585239613

Education

Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI) Abu Dhabi, UAE
M.Sc. in Machine Learning 2021 - 2023

Full scholarship including tuition and stipend

Supervised by Prof. Kun Zhang

Huazhong University of Science and Technology (HUST) Wuhan, China
B.Sc. in Statistics 2017 - 2021

Outstanding Undergraduate Thesis Award (Top 4%)

Research Experience

Research Assistant 2024 - present

MBZUAI, Causality Group (supervisor: Prof. Kun Zhang) Abu Dhabi, UAE

Focus: Causal Representation Learning and Healthcare

• Causal Representation Learning on Organ-on-Chip Data (with Quris-AI)

- Main lead of a collaborative project between MBZUAI and Quris-AI focused on developing causal representation learning models for organ-on-chip image data, aiming to replace animal testing in pre-clinical drug trials. This project leverages 3D cell cultures, or "spheroids," to assess drug safety, providing a more ethical, cost-effective, and predictive alternative to traditional animal testing.
- Developed a GAN-based generative model to generate videos showing organ tissue changes over the experimental period, with identifiability guarantees to obtain disentangled latent representations for each image.
- Predicted cell viability based on these learned representations and linked them with semantic factors, enabling interpretation of predictions and assessment of drug toxicity.

• Synergy Between Sufficient Changes and Sparse Mixing Procedure for Disentangled Representation Learning:

- Proposed a novel identifiability theory for disentangled representation learning by combining auxiliary variables and sparse mixing assumptions to improve applicability in real-world scenarios. Co-first author paper published at ICLR 2025.
- Led the experimental work for the project, including developing a GAN-based generative model based on our proposed theory and conducting all real-world experiments and some of the simulation experiments.
- Wrote the experimental section of the paper, including result analysis and creating visualizations and figures to illustrate the framework of our methods and demonstrate the model's effectiveness on real-world datasets.

• Foundation Model for Multi-Modality Health Data (with Weizmann Institute of Science)

- Collaborated on building a foundation model using multi-modality health data from Project 10K, a large-scale longitudinal study in Israel designed to uncover lifestyle and disease correlations and predict future medical conditions.

- Led the causal discovery analysis and feature extraction for bone density data.

Graduate Research

MBZUAI, Causality Group (supervisor: Prof. Kun Zhang)

2022 - 2023

Abu Dhabi, UAE

• On the Recoverability of Causal Relations from Temporally Aggregated Data:

- Warned that many real-world datasets involve the aggregation of causal effects, and demonstrated that causal discovery methods often perform poorly on such data. First-author paper published at ICML 2024.
- Gave proof and analysis for recoverability of simultaneous causal discovery performing in highly temporally aggregated data.
- Performed experiments to show the risk and feasibility of performing classical causal discovery methods to discover the simultaneous causal relationship causing by aggregation.

• Unsupervised Sampling Promoting for Stochastic Human Trajectory Prediction:

- Presented a novel approach, BOsampler, that improves trajectory prediction by adaptively exploring long-tail paths with Bayesian optimization, addressing the limitations of random sampling in capturing realistic paths. Co-authored paper published at CVPR 2023.
- Wrote the draft of the paper, including problem definition, theoretical formulation, and algorithm design, as well as creating visualizations and illustrations.
- Collaborated in developing a demo to showcase the practical application of our technique.

Graduate Research

MBZUAI, Supervisor: Prof. Bin Gu

2021

Abu Dhabi, UAE

• A Unified Convergence Analysis of Zeroth Order Optimization Methods from ODE Perspective:

- Revisited the optimization from the perspective of the ordinary differential equation (ODE).
- Used Lyapunov stability to analyze the convergence rate of different optimization methods.

Published & Submitted Papers

* indicates equal contribution.

1. **On the Recoverability of Causal Relations from Temporally Aggregated IID Data**
Shunxing Fan, Mingming Gong, Kun Zhang
International Conference on Machine Learning (ICML), 2024
2. **Synergy Between Sufficient Changes and Sparse Mixing Procedure for Disentangled Representation Learning**
Zijian Li*, Shunxing Fan*, Yujia Zheng, Ignavier Ng, Shaoan Xie, Guangyi Chen, Xinshuai Dong, Ruichu Cai, Kun Zhang
International Conference on Learning Representations (ICLR), 2025
3. **Unsupervised Sampling Promoting for Stochastic Human Trajectory Prediction**
Guangyi Chen*, Zhenhao Chen*, Shunxing Fan, Kun Zhang
Conference on Computer Vision and Pattern Recognition (CVPR), 2023
4. **Permutation-based Rank Test in the Presence of Discretization and Application in Causal Discovery with Mixed Data**
Xinshuai Dong, Ignavier Ng, Boyang Sun, Haoyue Dai, Guang-Yuan Hao, Shunxing Fan, Peter Spirtes, Yumou Qiu, Kun Zhang
Submitted

Academic Service & Teaching

Teaching Assistant

MBZUAI

MTH701 (Mathematical Foundations of Artificial Intelligence)

Instructors: Prof. Huan Xiong and Prof. Karthik Nandakumar

Reviewer/PC member

ICDM 2024

2022

Abu Dhabi, UAE

Skills

- Programming: Python, R, MATLAB
- Packages/Tools: PyTorch, Lightning, Slurm, Wandb
- Symbolic Computation: Mathematica, Maple