Chenxi Liu

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EDUCATION

Northwestern University, IL, USA *Sep. 2021 ~ Jun. 2023 (expected)*

M.S in Electrical Engineering, Department of Electrical and Computer Engineering (GPA: **4.0/4.0**)

Relevant Courses: Machine Learning, Deep Learning; Computer Vision, Machine Learning in Medical Imaging, Deep Learning for Natural Language Processing, Blockchain etc.

Sun Yat-Sen University, Guangdong, China *Sep. 2020 ~ Jun. 2021*

M.S in Condensed Matter Physics, School of Physics (not pursuing a degree)

Relevant Courses: Algorithm Design and Complexity, Advanced Quantum Mechanics, Group Theory, etc.

Sun Yat-Sen University, Guangdong, China *Sep. 2016 ~ Jun. 2020*

B.S in Opto-Electronics Information Science and Engineering, School of Physics (GPA: **3.6/4.0**)

Honors: Scholarship of Sun Yat-sen University *2017, 2018, 2019*

Relevant Courses: Linear Algebra, Advanced Mathematics, Signal and Systems, Quantum Mechanics, Thermodynamics and Statistical Physics, Principles of Communication, Information Optics, etc.

RESEARCH INTEREST

Machine Learning *(Domain Generalization, Domain Adaptation, Self-Supervised Learning, Continual Learning, Federated Learning, Machine Learning Security, etc.)*

Applications of Machine Learning *(Computer Vision, Natural Language Processing, Speech Processing, Cyber-Physical Systems, Quantum Systems, etc.)*

PUBLICATIONS

[1] **Chenxi Liu**, Lixu Wang, Lingjuan Lyu, Chen Sun, Xiao Wang, Qi Zhu. **Twofer: Tackling Continual Domain Shift with Simultaneous Domain Generalization and Adaptation**. Submitted to 2023 International Conference on Learning Representations (ICLR), Sep.2022. [Paper]

[2] Zewang Zhang, Shuo Yang, Yihang Wu, **Chenxi Liu**, Yimin Han, Ching Hua Lee, Zheng Sun, Guangjie Li and Xiao Zhang. **Predicting Quantum Many-Body Dynamics with Transferable Neural Networks**. Chinese Physics Letters, Dec. 2019. [Paper]

RESEARCH EXPERIENCE

Data Imbalance in Self-Supervised Federated Learning *Aug. 2022 ~ present*

Advisor: Prof. Qi Zhu Northwestern University

- Aim to address global class imbalance problem in self-supervised federated learning.
- Designing a data selection strategy for semi-supervised downstream tasks.
- Targeting 2023 International Conference on Machine Learning (ICML) as the first author.

Tackling Continual Domain Shift with Simultaneous Domain Generalization and Adaptation *Apr. 2022 ~ Sep. 2022*

Advisor: Prof. Qi Zhu, Prof. Xiao Wang, Publication [1] Northwestern University

- The first work to consider performance before adaptation in continual domain adaptation setting.
- Proposed a training-free data augmentation module for domain generalization, a cluster-based pseudo-labeling method for source-free domain adaptation, and a Prototype Contrastive Alignment loss to simultaneously address domain generalization, adaptation and catastrophic forgetting.
- Extensive experiments on three datasets showed high effectiveness compared to other SOTA methods, especially when target domain is much more complicated than source domain.

Fairness in Continual Learning *Jan. 2022 ~ Mar. 2022*

Advisor: Prof. Qi Zhu Northwestern University

- Explored the accuracy of different sensitive attributes evolve along with continual learning, but we found that the forgetting of the different sensitive attributes appears to be different only in small neural networks.

Generalize to larger Fractional Quantum Hall Effect System using Neural Networks *Mar. 2020 ~ Jun. 2021*

Advisor: Prof. Xiao Zhang, Prof. Ching Hua Lee Sun Yat-Sen University, National University of Singapore

- Developed a feature disentanglement model only trained on low-cost data of small FQHE systems, and aimed to predict the phase condition of larger FQHE systems without any high-cost training data.
- It is a very hard task because it can be seen as a domain generalization task with very limited source domain data. The students in the group are still working on this topic.

Predicting Quantum Many-Body Dynamics with Transferable Neural Networks *Sep. 2017 ~ Dec. 2019*

Advisor: Prof. Xiao Zhang, Publication [2] Sun Yat-Sen University

- A RNN based model is used to autoregressively predict the time sequence evolution of an Ising model from its initial state. Furthermore, the model is trained on sufficient low-cost source data from small Ising systems, and then adapts to larger Ising systems using only a few high-cost data.
- The model achieved very high efficiency (100 times faster on only 7-spin system) and kept high accuracy compared to traditional physical algorithm.

SELECTED PROJECTS

Automatic Music Transcription *Mar. 2022 ~ Jun. 2022*

Advisor: Prof. Thrasyvoulos N. Pappas Northwestern University

- Jointly transcribed arbitrary combinations of musical instruments simultaneously using a general-purpose Transformer model.

Swarm Learning *Jan. 2022 ~ Mar. 2022*

Advisor: Prof. Ermin Wei Northwestern University

- Swarm learning used a blockchain framework to encrypt the parameters aggregation process in federated learning.
- Applied swarm leaning to traffic light classification in connected vehicles scenario. [code]

Conversational Agent *Jan. 2022 ~ Mar. 2022*

Advisor: Prof. David Demeter Northwestern University

- Finetuned GPT2 and T5 model on conversational data, and explored the performance in different conversation scenarios.

Face Mask Images Generation and Recognition *Sep. 2021 ~ Mar. 2022*

Advisor: Prof. Aggelos Katsaggelos Northwestern University

- Used GAN to generate face mask images as a data augmentation technique and trained a CNN to classify if a person wears a mask in the right way.

ML for Medical Images Classification *Sep. 2021 ~ Dec. 2021*

Advisor: Prof. Lee A Cooper Northwestern University

- Applied different data manipulations to improve classification accuracy of breast cancer cellular images.

SKILLS

Programming Languages

Python (Pytorch, Tensorflow), Latex, C++, C, Verilog, Vasp

Techniques

Git, Anaconda, MPI, Docker