Xiwen Chen

School of Computing, Clemson University |Clemson, SC, 29634

xiwenc@g.clemson.edu 864-533-9740

Research Interests

Machine Learning, Deep Learning, Data Mining, Computer Vision, Time Series Analysis, and Information-theoretical Methods in AI.

Education

Clemson University **Clemson, SC**
Doctoral student in computer science GPA: 4.0/4.0 *Aug. 2021 – May. 2025 (Expected)*

Clemson University **Clemson, SC**
Master in computer science GPA: 4.0/4.0 *Aug. 2021 – Dec. 2023*

Northern Arizona University (transfer to Clemson Univ.) **Flagstaff, AZ**
Doctoral student in informatics and cyber systems GPA: 4.0/4.0 *Aug. 2019 – May. 2021*

Northern Arizona University **Flagstaff, AZ**
Bachelor of Electrical Engineering GPA: 3.8/4.0 *Aug. 2018 – May. 2019*

Chongqing University of Posts and Telecommunications **Chongqing, CN**
Bachelor of Electrical Engineering GPA: 4.0/4.0 *Sep. 2015 – Jan. 2018*

- **Highlighted Graduate-level Courses**: Rank Top 10% on *Advanced Machine Learning*, *Deep Learning*, *Pattern Recognition*, *Computer Graphics Images*, and *Image Processing*.

Skills

- Self-motivated and productive. In the last two years, I have published 6 papers as first author and 6 papers as co-first author. Some of them are in top venues, such as **ICML2024**, **MICCAI2024**, and **CVPRW2024**.
- Background in statistical machine learning.
- Background in computational imaging, computational holography, and diffractive optics.
- Background in wireless communication and information theory.
- Programming Languages: Python, C, and MATLAB.
- Deep Learning framework: Pytorch.

Highlighted Research Experience

Multiple Instance Learning

In our work, Multiple Instance Learning (MIL), a powerful approach in weakly supervised learning, is employed in histological whole slide image (WSI) classification for detecting lesions. This task often requires processing some large WSIs with *gigapixel resolution* under limited storage and computation resources. *We propose a novel MIL aggregation method and one novel dropout mechanism to address the overfitting problems in recent MIL frameworks.* Then, we extend the idea to time series analysis, and *formally reformulate multivariate time series classification (MTSC) as a weakly supervised problem, and subsequently, guided by information theory, we propose a time-aware MIL framework.* The outcomes are as follows.

- **Chen, X.**, Qiu, P., Zhu, W., Li, H., Wang, H., Sotiras, A., ... & Razi, A. (2024). TimeMIL: Advancing Multivariate Time Series Classification via a Time-aware Multiple Instance Learning. **ICML2024**.
- Zhu, W., **Chen, X.** (co-first), Qiu, P. (co-first), H., Sotiras, A., ... & Wang, Y. (2024). DGR-MIL: Exploring Diverse Global Representation in Multiple Instance Learning for Whole Slide Image Classification. (In submission to **ECCV2024**).
- Zhu, W., Qiu, P. (co-first), **Chen, X.** (co-first), Dumitrascu, O. M., & Wang, Y. (2023). PDL: Regularizing Multiple Instance Learning with Progressive Dropout Layers. arXiv preprint arXiv:2308.10112. (In submission to **ECCV2024**).

Data Diversification via Determinantal Point Process

Determinantal Point Process (DPP) is commonly used for diversity maximization due to its simple form, high interpretability, and high efficiency. *We are the first to reveal a concrete yet non-trivial relationship between Rate-Distortion theory and DPP under the mild assumption of Gaussianity. Inspired by MIMO techniques, we develop a distribution version of DPP*. Then, *we propose a low-complexity and theoretically guaranteed diversity loss to enforce the orthogonality based on DPP.* The outcomes are as follows.

- **Chen, X.**, Li, H., Amin, R., & Razi, A. (2023). RD-DPP: Rate-Distortion Theory Meets Determinantal Point Process to Diversify Learning Data Samples. arXiv preprint arXiv:2304.04137.
- **Chen, X.**, Li, H., Amin, R., & Razi, A. (2023). Learning on Bandwidth Constrained Multi-Source Data with MIMO-inspired DPP MAP Inference. arXiv preprint arXiv:2306.02497. (In submission to **IEEE TMLCN**).
- Zhu, W., **Chen, X.** (co-first), Qiu, P. (co-first), H., Sotiras, A., ... & Wang, Y. (2024). DGR-MIL: Exploring Diverse Global Representation in Multiple Instance Learning for Whole Slide Image Classification. (In submission to **ECCV2024**).

Physics-driven Computational Imaging

Our work focuses on untrained Physics-based Deep Learning (DL) methods, which have several benefits, such as not requiring an annotated training dataset, and providing interpretability since utilizing the governing laws of hologram formation. *We build the equipment under guidance to obtain real-world digital in-line holograms and propose two physics-driven DL models for digital holography reconstruction.* To tackle the issue that the forward imaging process may be unreliable, *we propose a training framework that can perform reconstruction under uncertain forward model parameters.* We demonstrate its feasibility in applications of both digital holography and compressed sensing. The outcomes are as follows.

- **Chen, X.**, Zhu, W., Qiu, P., & Razi, A. (2024). Imaging Signal Recovery Using Neural Network Priors Under Uncertain Forward Model Parameters. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 1420-1429). (**PBDL@CVPR2024**, Oral).
- **Chen, X.**, Wang, H., Zhang, Z., Li, Z., Li, H., Ye, T., & Razi, A. (2024). Enhancing Digital Hologram Reconstruction Using Reverse-Attention Loss for Untrained Physics-Driven Deep Learning Models with Uncertain Distance. In AI and Optical Data Sciences V (Vol. 12903, pp. 132-141). SPIE. (Oral).
- **Chen, X.**, Wang, H., Razi, A., Kozicki, M., & Mann, C. (2023). DH-GAN: a physics-driven untrained generative adversarial network for holographic imaging. Optics Express, 31(6), 10114-10135.
- Li, H., **Chen, X.**, Chi, Z., Mann, C., & Razi, A. (2020). Deep DIH: Single-Shot Digital In-Line Holography Reconstruction by Deep Learning. IEEE Access, 8, 202648-202659.

Medical Image Analysis

I also want to highlight some works in medical image analysis. The key motivation is designing a model based on the prior of the given data. For example, *we propose a learnable prompt for Segment Anything Model (SAM) based on the geometric distribution of cell data. We also investigate the overfitting problem and undesirable learned pattern of recent popular DL models for medical images.* The outcomes are as follows.

- Zhang, Z., **Chen, X.** (co-first), Richardson, W., Gao, B. Z., Razi, A., & Ye, T. (2023). Quantification of cardiac capillarization in basement-membrane-immunostained myocardial slices using Segment Anything Model. arXiv. https://arxiv.org/pdf/2311.18173v1. (Accepted by Scientific Reports)
- Zhu, W., **Chen, X.** (co-first), Qiu, P. (co-first), Farazi, M., ... & Wang, Y. (2024). SelfReg-UNet: Self-Regularized UNet for Medical Image Segmentation. In International Conference on Medical Image Computing and Computer-Assisted Intervention. (**MICCAI2024**)
- Zhu, W., Qiu, P., **Chen, X.**, Li, X., Lepore, N., Dumitrascu, O. M., & Wang, Y. (2024). nnMobileNet: Rethinking CNN for Retinopathy Research. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 2285-2294). (**DCAMI@CVPR2024**)
- Li, H., Zhu, W., **Chen, X.**, & Wang, Y. (2023, October). Prediction of Spherical Equivalent with Vanilla ResNet. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 66-74). Cham: Springer Nature Switzerland.
- Zhu, W., Qiu, P., **Chen, X.**, Li, H., Wang, H., Lepore, N., ... & Wang, Y. (2023, October). Beyond MobileNet: An Improved MobileNet for Retinal Diseases. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 56-65). Cham: Springer Nature Switzerland.

Collaborations

I have collaborated with several excellent researchers from various places, such as UA, UCI, ASU, MUSC, WUSTL, GaTech, MIT Lincoln Laboratory, and Mayo Clinic.

Awards

- Travel Grant by Clemson University in 2024.
- Travel Grant by SPIE Photonics West 2024.
- Dean's List in Northern Arizona University (2018-2019)
- Twice academic scholarships in Chongqing University of Posts and Telecommunications, CN (2016 & 2017)

Professional Activities

- Technical Program Committees for International Conference on Signal Processing and Machine Learning (SPML 2023 and 2024)
- invited reviewer by CIKM, Neural Processing Letters, IEEE Access.
- Teaching Assistant for undergraduate EE courses.
- Research Assistant in the AI-based Sensing, Networking, and Data Services (AI-SENDS) lab, Clemson University.

Full Publication List

- **Chen, X.**, Qiu, P., Zhu, W., Li, H., Wang, H., Sotiras, A., ... & Razi, A. (2024). TimeMIL: Advancing Multivariate Time Series Classification via a Time-aware Multiple Instance Learning. In International conference on machine learning. PMLR. (ICML2024)
- Zhang, Z., **Chen, X.** (co-first), Richardson, W., Gao, B. Z., Razi, A., & Ye, T. (2023). Quantification of cardiac capillarization in basement-membrane-immunostained myocardial slices using Segment Anything Model. arXiv. https://arxiv.org/pdf/2311.18173v1. (Accepted by Scientific Reports)
- Zhu, W., **Chen, X.** (co-first), Qiu, P. (co-first), Farazi, M., ... & Wang, Y. (2024). SelfReg-UNet: Self-Regularized UNet for Medical Image Segmentation. In International Conference on Medical Image Computing and Computer-Assisted Intervention. (MICCAI2024)
- **Chen, X.**, Zhu, W., Qiu, P., & Razi, A. (2024). Imaging Signal Recovery Using Neural Network Priors Under Uncertain Forward Model Parameters. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 1420-1429). (PBDL@CVPR2024, Oral).
- Zhu, W., Qiu, P., **Chen, X.**, Li, X., Lepore, N., Dumitrascu, O. M., & Wang, Y. (2024). nnMobileNet: Rethinking CNN for Retinopathy Research. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 2285-2294). (DCAMI@CVPR2024).
- Li, H., Carreon-Rascon, A. S., **Chen, X.**, Yuan, G., & Li, A. (2024). MTS-LOF: medical time-series representation learning via occlusion-invariant features. IEEE Journal of Biomedical and Health Informatics.
- **Chen, X.**, Wang, H., Zhang, Z., Li, Z., Li, H., Ye, T., & Razi, A. (2024). Enhancing Digital Hologram Reconstruction Using Reverse-Attention Loss for Untrained Physics-Driven Deep Learning Models with Uncertain Distance. In AI and Optical Data Sciences V (Vol. 12903, pp. 132-141). SPIE.
- Li, H., **Chen, X.**, Ditzler, G., Chang, P., Roveda, J., & Li, A. (2024). Knowledge distillation under ideal joint classifier assumption. Neural Networks, 106160.
- Wang, H., **Chen, X.**, Vital, N., Duffy, E., & Razi, A. (2024). Energy optimization for HVAC systems in multi-VAV open offices: A deep reinforcement learning approach. Applied Energy, 356, 122354.
- **Chen, X.**, Wang, H., Razi, A., Kozicki, M., & Mann, C. (2023). DH-GAN: a physics-driven

untrained generative adversarial network for holographic imaging. Optics Express, 31(6), 10114-10135.

- Sarlak, A., Razi, A., **Chen, X.**, & Amin, R. (2023, October). Diversity Maximized Scheduling in RoadSide Units for Traffic Monitoring Applications. In 2023 IEEE 48th Conference on Local Computer Networks (LCN2023) (pp. 1-4). IEEE.
- Li, H., Zhu, W., **Chen, X.**, & Wang, Y. (2023, October). Prediction of Spherical Equivalent with Vanilla ResNet. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 66-74). Cham: Springer Nature Switzerland.
- Zhu, W., Qiu, P., **Chen, X.**, Li, H., Wang, H., Lepore, N., ... & Wang, Y. (2023, October). Beyond MobileNet: An Improved MobileNet for Retinal Diseases. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 56-65). Cham: Springer Nature Switzerland.
- **Chen, X.**, Hopkins, B., Wang, H., O'Neill, L., Afghah, F., Razi, A., ... & Watts, A. (2022). Wildland Fire Detection and Monitoring Using a Drone-Collected RGB/IR Image Dataset. IEEE Access, 10, 121301-121317.
- Razi, A., **Chen, X. (co-first)**, Li, H., Wang, H., Russo, B., Chen, Y., & Yu, H. (2022). Deep learning serves traffic safety analysis: A forward-looking review. IET Intelligent Transport Systems.
- **Chen, X.**, Wang, H., Razi, A., Russo, B., Pacheco, J., Roberts, J., ... & Baca, A. G. (2022). Network-level Safety Metrics for Overall Traffic Safety Assessment: A Case Study. IEEE Access.
- Wang, H., **Chen, X.**, & Razi, A. (2022). Fast Key Points Detection and Matching for Tree-Structured Images. In 2022 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 2022, pp. 1381-1387.
- Wang, H., **Chen, X.**, Razi, A., Kozicki, M., Amin, R., & Manfredo, M. (2022). Nano-Resolution Visual Identifiers Enable Secure Monitoring in Next-Generation Cyber-Physical Systems. In 2022 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 2022, pp. 856-861.
- **Chen, X.**, Li, H., Qu, J., & Razi, A. (2021, January). Boosting Belief Propagation for LDPC Codes with Deep Convolutional Neural Network Predictors. In 2021 IEEE 18th Annual Consumer Communications & Networking Conference (CCNC) (pp. 1-6). IEEE.
- Li, H., Wu, H., **Chen, X.**, Wang, H., & Razi, A. (2021, August). Towards boosting channel attention for real image denoising: Sub-band pyramid attention. In International Conference on Image and Graphics (pp. 303-314). Springer, Cham. (Oral)
- Li, H., **Chen, X.**, Chi, Z., Mann, C., & Razi, A. (2020). Deep DIH: Single-Shot Digital In-Line Holography Reconstruction by Deep Learning. IEEE Access, 8, 202648-202659.

Preprints

- **Chen, X.**, Li, H., Amin, R., & Razi, A. (2023). RD-DPP: Rate-Distortion Theory Meets Determinantal Point Process to Diversify Learning Data Samples. arXiv preprint arXiv:2304.04137.
- **Chen, X.**, Li, H., Amin, R., & Razi, A. (2023). Learning on Bandwidth Constrained Multi-Source Data with MIMO-inspired DPP MAP Inference. arXiv preprint arXiv:2306.02497.
- Li, H., **Chen, X.**, Ditzler, G., Killgore, W. D., Quan, S. F., Roveda, J., & Li, A. (2023). Sleep Stage Classification with Learning from Evolving Datasets.
- Wang, H., Qin, J., Bastola, A., **Chen, X.**, Suchanek, J., Gong, Z., & Razi, A. (2024). VisionGPT: LLM-Assisted Real-Time Anomaly Detection for Safe Visual Navigation. arXiv preprint arXiv:2403.12415.