Xianfeng Wu

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EDUCATION

B.E. Artificial Intelligence, Jianghan University, Wuhan, China, 2020-present
advisor: Associate Researcher Zhongyuan Lai

RESEARCH EXPERIENCE

Institute for Interdisciplinary Research, Jianghan University Wuhan, China
Undergraduate Researcher Sep 2020 – present

Under the guidance of Associate Researcher Zhongyuan Lai, I have proposed a novel point cloud classification method that excels in extracting efficient global features and demonstrates superior robustness compared to existing point cloud classification models. This innovative research has already been submitted to "Computers & Electrical Engineering" (CAEE) and successfully accepted for publication, with me as the first author.

Currently, I am dedicated to an innovative project that combines Generative Adversarial Networks (GANs) and Transformer architecture to construct a robust point cloud completion model. This model performs exceptionally well, even in extreme scenarios with only 16 partial point clouds. It's worth mentioning that this project is a collaborative effort with Professor Junsong Yuan from the University at Buffalo, State University of New York, who is an authoritative expert in the field of computer vision. We have submitted this pioneering work to CVPR24, with me as the co-first author.

Furthermore, I am in the process of applying for a Chinese national invention patent, which is currently under review. I have also successfully applied for **10** software copyright registrations, all of which have been approved. Among them, **7** software copyrights have been successfully transformed, with a total conversion value of RMB 105,000.

School of Cyber Science and Engineering, Wuhan University Wuhan, China
Intern Jun 2022 – Dec 2022

Under the guidance of Professor Libing Wu, I actively acquired knowledge in the field of artificial intelligence safety, including reinforcement learning, Federated Learning, adversarial learning, and more. Recognizing the current challenges of high communication overhead and vulnerability to Byzantine attacks between edge devices and servers, I participated in the design of a Federated Learning algorithm aimed at improving communication efficiency while ensuring system robustness. This work has been submitted to IEEE Network and has been accepted. Furthermore, I had the privilege of collaborating with Professor Libing Wu's team in co-authoring multiple papers, including contributions to publications such as Security and Communication Networks, BESC'22, and Information.

Institute of Data Science, The University of Hong Kong Pokfulam, Hong Kong
Remote Intern Nov 2022 – May 2023

Under the guidance of Assistant Professor Liangqiong Qu, I conducted in-depth studies on the application of Federated Learning in the field of healthcare artificial intelligence. I actively participated in multiple projects that focused on researching privacy leakage attacks within the realm of Federated Learning. In these projects, my emphasis was on examining privacy leakage issues in the healthcare AI domain under various Federated Learning algorithm frameworks and analyzing different attack methodologies.

I discovered that privacy leakage attack methods based on Generative Adversarial Networks (GANs) or the Diffusion model could still reconstruct input images. However, due to the utilization of prior knowledge of the reconstructed class during attacks, there was a discrepancy between the reconstructed input images and the original ones. This calls for further investigation and research.

School of Information Sciences, University of Illinois Urbana-Champaign IL, USA
Remote Intern Dec 2022 – May 2023

Under the guidance of Assistant Professor Haohan Wang, I am actively engaged in research within the domain of Trustworthy Machine Learning. My research focuses on exploring the incorporation of data-free knowledge distillation techniques into Federated Learning to enhance customer privacy protection, surpassing existing Federated Learning methods.

School of Engineering, Westlake University Hangzhou, China
Summer Research Intern June 2023 – present

Under the expert guidance of Assistant Professor Tailin Wu, I am actively engaged in research within the AI4Science domain. Currently, I am working on the design of a foundational model that has the capability to infer the coefficient of a partial differential equation (PDE) even in the absence of coefficient. This is achieved through the utilization of a coefficient encoder to deduce the coefficient of the time-dependent PDE from the initial state. The coefficient of the PDE, along with the initial state, undergoes processing through an Encode-Process-Decode network to predict the trajectories of time-dependent PDEs. Our research has already yielded results surpassing state-of-the-art (SOTA) models. Additionally, this work involves conducting high-dimensional physical simulation experiments, including 2D Navier-Stokes fluid simulations.

RESEARCH AREAS

Computer Vision: 3D reconstruction, point cloud recognition, completion

Trustworthy Machine Learning

AI4Science

PUBLICATIONS

Under review

2023 Xianzu Wu, **Xianfeng Wu**, Tianyu Luan, Yajing Bai, Zhongyuan Lai*, Junsong Yuan*, FSC: Few-point Shape Completion, Conference on Computer Vision and Pattern Recognition (CVPR24').

Journal Articles

2023 Zhuangzhuang Zhang*, Libing Wu*, Debiao He, Jianxin Li, Shuqin Cao, **Xianfeng Wu**, Communication-Efficient and Byzantine-robust Federated Learning for Mobile Edge

Computing Networks, IEEE Network, Accepted.

2023 Fudong Ding, Libing Wu, Zhuangzhuang Zhang, Xianfeng Wu, Chao Ma, and Qin Liu. "A Low-Overhead Auditing Protocol for Dynamic Cloud Storage Based on Algebra." In: *Security and Communication Networks* 2023 (2023). DOI: https://doi.org/10.1155/2023/5477738. URL: https://www.hindawi.com/journals/scn/2023/5477738/

2023 Jiyan Cai, Libing Wu, Dan Wu, Jianxin Li, and Xianfeng Wu. "Multi-Dimensional Information Alignment in Different Modalities for Generalized Zero-Shot and Few-Shot Learning." In: *Information* 14.3 (2023). ISSN: 2078-2489. DOI: 10.3390/info14030148. URL: https://www.mdpi.com/2078-2489/14/3/148

2022 Xianfeng Wu, Xinyi Liu, Junfei Wang, Zhongyuan Lai, Jing Zhou, and Xia Liu. "Point cloud classification based on transformer." In: *Computers and Electrical Engineering* 104 (2022), p. 108413. ISSN: 0045-7906. DOI: https://doi.org/10.1016/j.compeleceng.2022.108413. URL: https://www.sciencedirect.com/science/article/pii/S0045790622006309

Conference Proceedings

2022 Xianfeng Wu, Xinyi Liu, Junfei Wang, et al. "Transformer-Based Point Cloud Classification." In: *Artificial Intelligence and Robotics*. Ed. by Shuo Yang and Huimin Lu. Singapore: Springer Nature Singapore, 2022, pp. 218–225. ISBN: 978-981-19-7946-0

2022 Jiyan Cai, Libing Wu, Dan Wu, Jianxin Li, and Xianfeng Wu. "Multi-dimensional alignment via Variational Autoencoders for Generalized Zero-Shot and Few-Shot Learning." In: *2022 9th International Conference on Behavioural and Social Computing (BESC)*. 2022, pp. 1–4. DOI: 10.1109/BESC57393.2022.9995148

2022 Junfei Wang, Luxin Hu, Xianfeng Wu, Zhongyuan Lai, and Qian Jia. "Point Cloud Driven Object Classification: A Review." In: *Artificial Intelligence and Robotics*. Ed. by Shuo Yang and Huimin Lu. Singapore: Springer Nature Singapore, 2022, pp. 260–270. ISBN: 978-981-19-7946-0

2022 Junfei Wang, Hui Xiong, Yanli Gong, et al. "Attention-Based Dynamic Graph CNN for Point Cloud Classification." In: *Artificial Intelligence and Robotics*. Ed. by Shuo Yang and Huimin Lu. Singapore: Springer Nature Singapore, 2022, pp. 357–365. ISBN: 978-981-19-7946-0

PATENT

2022 Object classification method based on point cloud and related equipment. China Invention Patent. 202211076689.7, Under review.

SOFTWARE COPYRIGHT

2023 Rate-distortion optimal shape coding and decoding software based on polygon approximation V4.0. 2023SR1184145, October 19th, 2023.

2023 Rate-distortion optimal shape coding and decoding software based on polygon approximation V3.1. 2023SR1286413, October 24th, 2023.

2023 Rate-distortion optimal shape coding and decoding software based on polygon approximation V2.3. 2023SR1184145, October 10th, 2023.

2022 Rate-distortion optimal shape coding and decoding software based on polygon approximation V3.0. 2022SR0373977. March 22, 2022.

2022 2D shape skeleton extraction software V1.1. 2022SR0347060. March 15, 2022.

2022 Rate-distortion optimal shape coding and decoding software based on polygon approximation V2.1. 2022SR0102715. January 17, 2022.

2021 Polygon Evolution Software for Planar Digital Contours V1.0. 2021SR1647057. November 5th, 2021.

2021 Rate-distortion optimal shape coding and decoding software based on curve approximation V1.0. 2021SR1536129. October 20th, 2021.

2021 Rate-distortion optimal shape coding and decoding software based on polygon approximation V2.0. 2021SR1536127. October 20th, 2021.

2021 Rate-distortion optimal shape coding and decoding software based on polygon approximation V1.0. 2021SR0785371. May 28th, 2021.

AWARDS

Awards and Honors

2023 Second Prize in Hubei Contest District in China Undergraduate Mathematical Contest in Modeling

2022 Second Prize in Hubei Contest District in China Undergraduate Mathematical Contest in Modeling

2022 ASC World Student Supercomputer Competition Second Prize

EXTERNAL AND INTERNAL FUNDING

A. MODERATOR

1 Sparse Point Cloud 3D Reconstruction Based on Point-Nerf and Diffusion Model
National College Students' innovation and entrepreneurship training program (No.2023zd111)
2023/05-2024/05 RMB 10000

2 An Encoder-Decoder network-based point cloud completion method
The second batch of student research sub-focus projects of Jianghan University 2021 (No. 2021Bczd006)
2021/10-2022/10 RMB 5000

B. Participation

1 Privacy and security research of point cloud information processing for autonomous vehicles based on federated learning
National College Students' innovation and entrepreneurship training program (No.2023zd111)
2023/05-2024/10 RMB 10000

2 Machine vision-based assessment of infant motor development
Jianghan University School-level Research Project (No. 2022SXZX16)
2022/11-2024/11: RMB 70,000

3 Machine vision-based blast rock detection and trajectory prediction
State Key Laboratory of Precision Blasting 2022 Exploratory Project of Independent Subjects (No. PBSKL2022201)
2022/05-2024/05: RMB 200,000

4 Research on the Detection Method of Weakly Perceived Point Cloud Targets in Complex Scenes
National Natural Science Foundation of China (No. 62106086)
RMB 300,000

5 Research on weak perceptual target detection method based on deep attention-guided completion
Nature Science Foundation of Hubei Province (No. 2021CFB564)
RMB 80,000

6 Machine vision-based recognition of abnormal human postures and rehabilitation movements
Key Research and Development program projects of Hubei Province (No. 2020BCB054)
2020/09-2022/12: RMB 300,000

TEACHING

2023 Teaching Assistant: Digital Image Processing

2021 Teaching Assistant: Object Oriented Programming (C++)

SERVICE

Academic Journal and Conference Reviewer

Computers and Electrical Engineering (CAEE)

International Symposium on Artificial Intelligence and Robotics (ISAIR)

Membership in Professional Societies

China Society of Image and Graphics (CSIG) Student Member

SKILLS

Programming	Python, Matlab, C/C++, Java, LaTex, R
Deep Learning	PyTorch, TensorFlow