Pengfei Gu Ph.D.

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https://pgu-nd.github.io/

Research Interests

Deep learning for medical image analysis (e.g., image segmentation, classification, and detection, etc.):

- Topology-driven image analysis, Self-supervised learning, Large foundation models/Large language models in medical imaging, Multi-modal data analysis, Data-efficient deep learning

Deep learning for scientific visualization:

- Scientific data generation, Scientific data compression

Working Experience

Assistant Professor in Computer Science | University of Texas Rio Grande Valley, Edinburgh, TX, USA 2024.09 - Now

Education

Department of Computer Science and Engineering, University of Notre Dame Notre Dame, IN, USA

Ph.D. in Computer Science 2018 - 2024

- Advisor: Drs. Danny Z. Chen and Chaoli Wang
- Thesis: New Deep Methods for Medical Image Analysis and Scientific Data Generation and Compression

Department of Computer Science, University of Texas Rio Grande Valley Edinburg, TX, USA

M.S. in Computer Science 2016 - 2018

- Advisor: Dr. Bin Fu
- Thesis: Approximate Set Union via Approximate Randomization

School of Mathematical and Statistical Sciences , University of Texas Rio Grande Valley Edinburg, TX, USA

M.S. in Mathematics 2014 - 2016

- Advisor: Dr. Zhaosheng Feng
- Thesis: Lie Symmetry to Second-order Nonlinear Differential Equations and its First Integrals

Department of Mathematics, Tianjin University of Technology and Education Tianjin, China

B.S. in Mathematics 2010 - 2014

Awards

- **IEEE CG&A 2021 Best Paper Award** 2022
- **Outstanding Student Award**, University of Texas Rio Grande Valley 2018

Grants

1. Institutional Research Enhancement Award (AIREA): Immersive Surgical Planning: An AI-Integrated Virtual Reality Platform for Vascular Procedures (**Co-PI**, $199,994), **AHA-AIREA**, 1/2026 – 12/2027
2. Collaborative Research: CISE Crosscutting Small: SCH: Towards Auto-Prompt Textual Annotations Generation with Domain Knowledge for Multimodal Medical Image Segmentation (**Co-PI**, $600,000), **NSF CISE MSI**, 10/2025-9/2028
3. Cooperative Agreement: Advancing Automation in SIT Programs Using AI Tools: Pathogen Detection and Pupal Age Determination (**Sole PI**, $152,501), **USDA-APHIS**, 9/2025 – 9/2027

Publications

(* indicates equal contribution and # indicates a student I have mentored)

1. Peixian Liang, Jianxu Chen, Yizhe Zhang, Hongxiao Wang, Hao Zheng, **Pengfei Gu**, and Danny Z. Chen, "InTracker: An Integrated Detector-tracker Framework for Cell Detection and Tracking", *in IEEE 33rd International Symposium on Computer-Based Medical Systems (CBMS)*, 2020

2. Bin Fu, **Pengfei Gu** (**Corresponding Author**), and Yuming Zhao, "Polyhedral Circuits and Their Applications", *in Algorithmic Aspects in Information and Management (AAIM)*, 2020

3. **Pengfei Gu**, Hao Zheng, Yizhe Zhang, Chaoli Wang, and Danny Z. Chen, "kCBAC-Net: Deeply Supervised Complete Bipartite Networks with Asymmetric Convolutions for Medical Image Segmentation", *in International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2021

4. **Pengfei Gu**, Jun Han, Danny Z. Chen, and Chaoli Wang, "Reconstructing Unsteady Flow Data from Representative Streamlines via Diffusion and Deep-learning-based Denoising", *IEEE Computer Graphics and Applications (CG&A)*, 2021 (*IEEE CG&A* 2021 Best Paper Award)

5. Bin Fu, **Pengfei Gu** (**Corresponding Author**), and Yuming Zhao, "Approximate Set Union via Approximate Randomization", *Theoretical Computer Science (TCS)*, 2021

6. **Pengfei Gu**, Jun Han, Danny Z. Chen, and Chaoli Wang, "Scalar2Vec: Translating Scalar Fields to Vector Fields via Deep Learning", *in IEEE 15th Pacific Visualization Symposium (PacificVis)*, 2022

7. Yejia Zhang, Nishchal Sapkota, **Pengfei Gu**, Yaopeng Peng, Hao Zheng, and Danny Z. Chen, "Keep Your Friends Close & Enemies Farther: Debiasing Contrastive Learning with Spatial Priors in 3D Radiology Images", *in IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2022

8. Yejia Zhang*, **Pengfei Gu***, Nishchal Sapkota, Hao Zheng, Peixian Liang, and Danny Z. Chen, "A Point in the Right Direction: Vector Prediction for Spatially-aware Self-supervised Volumetric Representation Learning", *in IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, 2023 (Oral Presentation)

9. **Pengfei Gu***, Yejia Zhang*, Chaoli Wang, and Danny Z. Chen, "ConvFormer: Combining CNN and Transformer for Medical Image Segmentation", *in IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, 2023 (Oral Presentation)

10. Yizhe Zhang*, **Pengfei Gu***, Yejia Zhang, Chaoli Wang, and Danny Z. Chen, "GrNT: Gate-regularized Network Training for Improving Multi-scale Fusion in Medical Image Segmentation", *in IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, 2023 (Oral Presentation)

11. Yejia Zhang, **Pengfei Gu**, Nishchal Sapkota, and Danny Z. Chen, "SwIPE: Efficient and Robust Medical Image Segmentation with Implicit Patch Embeddings", *in International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2023

12. Marinka Zitnik, Michelle M. Li, Aydin Wells, Kimberly Glass, Deisy Morselli Gysi, Arjun Krishnan, T. M. Murali, Predrag Radivojac, Sushmita Roy, Anaïs Baudot, Serdar Bozdag, Danny Z. Chen, Lenore Cowen, Kapil Devkota, Anthony Gitter, Sara Gosline, **Pengfei Gu**, Pietro H. Guzzi, Heng Huang, Meng Jiang, et al., "Current and Future Directions in Network Biology", *Bioinformatics Advances*, 2024

13. **Pengfei Gu**, Danny Z. Chen, and Chaoli Wang, "NeRVI: Compressive Neural Representation of Visualization Images for Communicating Volume Visualization Results", *Computers & Graphics (C&G)*, 2023

14. Yizhe Zhang, Tao Zhou, Yuhui Tao, Ye Wu, Benyuan Liu, **Pengfei Gu**, Qiang Chen, and Danny Z. Chen, "TestFit: A Plug-and-Play One-Pass Test Time Method for Medical Image Segmentation", *Medical Image Analysis (MedIA)*, 2024

15. **Pengfei Gu**, Zihan Zhao, Hongxiao Wang, Yaopeng Peng, Yizhe Zhang, Nishchal Sapkota, Chaoli Wang, and Danny Z. Chen, "Boosting Medical Image Classification with Segmentation Foundation Model", *in IEEE 21st International Symposium on Biomedical Imaging (ISBI)*, 2024 (Oral Presentation)

16. Hongxiao Wang, Yang Yang, Zhuo Zhao, **Pengfei Gu**, and Danny Z. Chen, "Path-GPTOmic: A Balanced Multi-modal Learning Framework for Survival Outcome Prediction", *in IEEE 21st International Symposium on Biomedical Imaging (ISBI)*, 2024 (Oral Presentation)

17. Yunfei Lu, **Pengfei Gu**, and Chaoli Wang, "FCNR: Fast Compressive Neural Representation of Visualization Images", *in IEEE VIS Conference (Short Papers)*, 2024

18. Yejia Zhang, Hanqing Chao, Zhongwei Qiu, Wenbin Liu, Yixuan Shen, Nishchal Sapkota, **Pengfei Gu**, Danny Z Chen, Le Lu, Ke Yan, Dakai Jin, Yun Bian, and Hui Jiang "IHCSurv: Effective Immunohistochemistry Priors for Cancer Survival Analysis in Gigapixel Multi-stain Whole Slide Images", *in International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2024

19. Yizhe Zhang, Tao Zhou, Shuo Wang, Ye Wu, **Pengfei Gu**, and Danny Z. Chen, "Combining Segment Anything Model with Domain-Specific Knowledge for Semi-Supervised Learning in Medical Image Segmentation", *in Chinese Conference on Pattern Recognition and Computer Vision*, 2024

20. Delin An*, **Pengfei Gu***, Milan Sonka, Chaoli Wang, and Danny Z. Chen, "Sli2Vol+: Segmenting 3D Medical Images Based on an Object Estimation Guided Correspondence Flow Network", *in IEEE/CVF Winter Conference on Applications of Computer (WACV)*, 2025

21. Fabian Vazquez[#], Jose Nunez, Xiaoyan Fu, **Pengfei Gu**, and Bin Fu, "Exploring Transfer Learning for Deep Learning Polyp Detection in Colonoscopy Images Using YOLOv8", *in SPIE Medical Imaging*, 2025

22. Delin An, Pan Du, **Pengfei Gu**, Jian-xun Wang and Chaoli Wang, "Hierarchical LoG Bayesian Neural Network for Enhanced Aorta Segmentation", *in IEEE 22nd International Symposium on Biomedical Imaging (ISBI)*, 2025 (Oral Presentation)

23. Jose Nunez[#], Fabian Vazquez, Diego Adame, Xiaoyan Fu, **Pengfei Gu**, and Bin Fu, "White Light Specular Reflection Data Augmentation for Deep Learning Polyp Detection", *in IEEE 22nd International Symposium on Biomedical Imaging (ISBI)*, 2025

24. Diego Adame[#], Jose A Nunez, Fabian Vazquez, Nayeli Gurrola, Huimin Li, Haoteng Tang, Bin Fu, and **Pengfei Gu**, "Topo-VM-UNetV2: Encoding Topology into Vision Mamba UNet for Polyp Segmentation", *in IEEE International Symposium on Computer-Based Medical Systems (CBMS)*, 2025 (Oral Presentation)

25. **Pengfei Gu**, Haoteng Tang, Islam A Ebeid, Jose A Nunez, Fabian Vazquez, Diego Adame, Marcus Zhan, Huimin Li, Bin Fu, and Danny Z Chen, "Adapting a Segmentation Foundation Model for Medical Image Classification", *in IEEE International Symposium on Computer-Based Medical Systems (CBMS)*, 2025 (Oral Presentation)

26. Haoteng Tang, Siyuan Dai, Lei Guo, **Pengfei Gu**, Guodong Liu, Alex D Leow, Paul M Thompson, Heng Huang, and Liang Zhan, "Instantaneous Frequency: A New Functional Biomarker for Dynamic Brain Causal Networks", *AI in Neuroscience*, 2025

27. **Pengfei Gu**, Hongxiao Wang, Yejia Zhang, Huimin Li, Chaoli Wang, and Danny Z Chen, "TopoImages: Incorporating Local Topology Encoding into Deep Learning Models for Medical Image Classification", *in the 33rd ACM International Conference on Multimedia (ACM MM)*, 2025

28. Kun Zhao, Yang Du, Rhianna Zhang, Liang Zhan, Dongkuan Xu, **Pengfei Gu**, and Haoteng Tang, "Who Matters More in Radiology Report Generation: Vision Encoders or Language Models?", *in IEEE International Conference on Data Mining Workshop (ICDM Workshop)*, 2025

29. **Pengfei Gu***, Huimin Li*, Yejia Zhang, Chaoli Wang, and Danny Z Chen, "Self Pre-training with Topology-and Spatiality-aware Masked Autoencoders for 3D Medical Image Segmentation", *in IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2025

30. Islam Akef Ebeid, Haoteng Tang, and **Pengfei Gu**, "Inferred Global Dense Residue Transition Graphs from Primary Structure Sequences Enable Protein Interaction Prediction via Directed Graph Convolutional Neural Networks", *Frontiers in Bioinformatics*, 2025

31. **Pengfei Gu***, Huimin Li*, Haoteng Tang, Dongkuan (DK) Xu, Erik Enriquez, DongChul Kim, Bin Fu, and Danny Z Chen, "Integrating Multi-scale and Multi-filtration Topological Features for Medical Image Classification", *in IEEE/CVF Winter Conference on Applications of Computer (WACV)*, 2026

Mentorship Experience

Fabian Vazquez
Ph.D. in Computer Science, UTRGV Fall 2024 - Now

Jose Nunez, (co-advisor: Dr. Bin Fu)
Ph.D. in Computer Science, UTRGV Fall 2024 - Now

Diego Adame
M.S. in Computer Science, UTRGV Fall 2024 - Now

Zihan Zhao
B.S. in Computer Science, Tianjin University Jul 2023 - Aug 2023

Kaiyuan Tang
B.S. in Computer Science, Xidian University Jul 2021 - Aug 2021

Shen Zheng
B.S. in Computer Science, Wenzhou Kean University Jul 2021 - Aug 2021

Daniel Gutierrez
B.S. in Computer Science, UTRGV Jan 2025 - May 2025

John Ross
B.S. in Computer Science, UTRGV Jan 2025 - May 2025

Joe Reyna
B.S. in Computer Science, UTRGV Jan 2025 - May 2025

Esteban Kott
B.S. in Computer Science, UTRGV Jan 2025 - May 2025

Ana Sanchez
B.S. in Computer Science, UTRGV Jan 2025 - May 2025

Teaching Experience

CSCI-3310: Mathmatical Foundation of CS, UTRGV Fall 2024, Spring 2025, Fall 2025

CSCI-4341: Deep Learning Algorithms for Medical Imaging, UTRGV Spring 2025

CSCI-8370: Deep Learning Algorithms for Medical Imaging, UTRGV Fall 2025

University Services

- Faculty Search Committee, Department of Computer Science, UTRGV, 2024 - 2025
- Scientific Committee for STEM Research Conference 2025, UTRGV, 2025

Academic Services

Reviewers for Journals: *Engineering Applications of Artificial Intelligence*,
Computers & Graphics,
Biomedical Signal Processing and Control
Computers in Biology and Medicine
European Journal of Agronomy
Neural Networks
Scientific Reports
Neurocomputing
Medical Image Analysis
Information Fusion

Reviewers for Conferences: *ICDM Workshop 2025*,
MIDL 2026, 2025,
WACV 2026, 2025,
MICCAI 2025, 2024, 2023,
ISBI 2026, 2025, 2024
CVPR 2026