Pengfei Gu

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RESEARCH INTERESTS

Artificial Intelligence in Medical and Scientific Data: Medical Image Analysis; Scientific Visualization; Self-supervised Learning

EDUCATION

Ph.D. Candidate, Computer Science (expected graduation: May 2024) Aug 2018 - Present
University of Notre Dame, Notre Dame, IN

M.S., Computer Science Aug 2016 - May 2018
The University of Texas Rio Grande Valley (UTRGV), Edinburg, TX

M.S., Mathematics Aug 2014 - May 2016
The University of Texas Rio Grande Valley, Edinburg, TX

B.S., Mathematics Sep 2010 - Jun 2014
Tianjin University of Technology and Education, Tianjin, China

RESEARCH EXPERIENCE

Research Assistant Aug 2018 - Present
Department of Computer Science and Engineering, University of Notre Dame, Notre Dame, IN

- **Research on medical image analysis**
  - Developed a spatially-aware volumetric representation learning self-supervised method to learn representations from unlabeled medical images for downstream medical image segmentation tasks (published in *IEEE ISBI* 2023)
  - Designed a gate-regularized network training method for improving multi-scale fusion medical image segmentation (published in *IEEE ISBI* 2023)
  - Proposed two state-of-the-art deep learning (DL) architectures for accurate medical image segmentation (published in *IEEE ISBI* 2023 and *MICCAI* 2021)
- **Research on scientific visualization**
  - Proposed an innovative image-wise implicit neural network designed for compressing a large number of high-resolution visualization images (published in *C&G*, 2023)
  - Introduced a novel DL solution that translates scalar fields to velocity vector fields for scientific visualization (published in *IEEE PacificVis* 2022)
  - Presented a new DL framework that performs vector field reconstruction for unsteady flow data from representative streamlines (published in *IEEE CG&A*, 2021)

Research Assistant Aug 2016 - May 2018
College of Engineering and Computer Science, UTRGV, Edinburg, TX

- **Research on approximate algorithms:** Developed a randomized approximation algorithm for the size of set union problem (published in *TCS*, 2021)

Research Assistant May 2017 - Aug 2017
Department of Civil Engineering, UTRGV, Edinburg, TX

- Worked as data analyst for the project "Enhanced Production Rate Establishment to Ascertain Construction Activity Durations", sponsored by Texas Department of Transportation

PUBLICATIONS (* indicates equal contribution)

1. **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

2. **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

3. **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)

4. **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

5. **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)

6. **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

7. **Pengfei Gu**, Yejia Zhang, Hongxiao Wang, Yizhe Zhang, Chaoli Wang, and Danny Z. Chen, "Self Pre-training with Topology- and Spatially-aware Masked Autoencoders for 3D Medical Image Segmentation", *under review at Medical Image Analysis (MedIA)*, 2024

8. 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)

9. 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)

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

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

12. 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

13. 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
14. 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
15. Yizhe Zhang, Tao Zhou, Shuo Wang, Ye Wu, **Pengfei Gu**, and Danny Z. Chen, "SamDSK: Combining Segment Anything Model with Domain-Specific Knowledge for Semi-Supervised Learning in Medical Image Segmentation", *under review at IEEE Transactions on Medical Imaging (TMI)*, 2023
16. 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
17. 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
18. 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", *under revision at Bioinformatics Advances*, 2023

TEACHING EXPERIENCE

Instructor Jan 2016 - May 2016
School of Mathematical and Statistical Science, UTRGV, Edinburg, TX

- College Algebra

Teaching Assistant Aug 2018 - May 2023
Department of Computer Science and Engineering, University of Notre Dame, Notre Dame, IN

- Computer Graphics: Spring 2023, Spring 2022, Spring 2021
- Complexity and Algorithms: Spring 2020
- Design/Analysis of Algorithms: Fall 2018

Teaching Assistant Aug 2016 - May 2018
College of Engineering and Computer Science, UTRGV, Edinburg, TX

- Introduction to Computer Science, Introduction to Programming, OOP in Java, Computer Science II, and Algorithms and Data Structures

Teaching Assistant Aug 2014 - Dec 2015
School of Mathematical and Statistical Science, UTRGV, Edinburg, TX

- Pre-calculus, Intermediate Algebra, and College Algebra

MENTORING EXPERIENCE

1. Zihan Zhao, Tianjin University (Notre Dame iSURE Student) Jul 2023 - Aug 2023

- Mentored Ms. Zhao's research on leveraging foundation DL models for medical image classification (submitted an article to *IEEE ISBI* 2024)

2. Kaiyuan Tang, Xidian University (Notre Dame iSURE Student) Jul 2021 - Aug 2021
   - Mentored Mr. Tang's research on DL-based approaches for compressing scientific visualization images (now a Ph.D. student at University of Notre Dame)

3. Shen Zheng, Wenzhou Kean University (Notre Dame iSURE Student) Jul 2021 - Aug 2021
   - Mentored Mr. Zheng's research on DL-based approaches for compressing scientific visualization images (now a Master student at Carnegie Mellon University)

HONORS AND AWARDS

GSG Conference Presentation Grant, University of Notre Dame	2023
IEEE CG&A 2021 Best Paper Award	2022
Outstanding Student Award, UTRGV	2018
Travel Funds Recipient, UTRGV	2016
Graduate Travel Scholarship, UTRGV	2016

PROFESSIONAL ACTIVITIES

Journal Reviewer: *European Journal of Agronomy*, *Computers in Biology and Medicine*, *Engineering Applications of Artificial Intelligence*, *Neural Networks*, *Journal of Biomedical and Health Informatics*
Conference Reviewer: *ISBI* 2024, *MICCAI* 2023, *EuroVis* 2023, *PacificVis* 2023, 2022, *IJCAI* 2022, *AAAI* 2022

SKILLS

Programming: Python, Matlab, Java, C/C++
Packages: PyTorch, TensorFlow, Scikit-Learn, OpenCV, NumPy, SciPy, Matplotlib, Jupyter
Tools: Github, LaTex, FIJI/ImageJ, Weights & Biases