Yu Zhang

Personal Information

Ph.D. Candidate (ABD)
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Google Scholar

Education

University of Kentucky — Lexington, KY, USA
Department of Computer Science — *Aug. 2017 - Dec. 2022 (expected)*
Ph.D. in Computer Science
Advisor : Nathan Jacobs
GPA : 3.9/4.0

Northeastern University — Shenyang, China
School of Computer Science and Engineering — *Sept. 2013 - June 2017*
B.E. in Telecommunications

Appointments

Siemens Healthineers — Malvern, PA, USA
Image Analytic Intern — *May 2022 - Aug. 2022*

- Developed a self-supervised learning framework for point matching on 3D CT scans.
- Upgraded the landmark-based detector by matching any points from varying follow-ups.
- Applied the framework to multiple CT datasets and reduced 97% training time while maintaining the performance.

University of Kentucky — Lexington, KY, USA
Research Assistant — *May 2019 - Present*

- Multi-domain semantic segmentation and depth estimation for unmanned aerial systems.
- Solved astrophysics problems using deep learning with imbalanced multi-modal data.
- Classification, detection, segmentation, and calibration on 2D and 3D medical images.

Teaching Assistant — *Jan. 2018 - May 2021*

- CS215 : Introduction to Program Design, Abstraction and Problem Solving
- CS216 : Introduction to Software Engineering Techniques
- CS371 : Introduction to Computer Networking

Skills

Experience : deep learning, computer vision, domain adaptation, depth estimation, multi-modal data modeling, 2D/3D medical image analysis
Programming : Python, PyTorch, MATLAB, C, C++

Research Summary

Multi-Domain Classification, Semantic Segmentation, and Depth Estimation

- Designed a dynamic feature alignment framework the semi-supervised domain adaptation problem by minimizing divergence and pseudo-labeling [2].
- Addressed the problem of multi-target domain adaptation for depth estimation and improved the performance by using uncertainty estimation and knowledge distillation.
- Proposed a unified model for semantic segmentation for aerial imagery by learning a universal representation shared across multiple datasets with different label-spaces.

Medical Imaging Understanding with Limited Datasets

- Addressed the inconsistent performance of deep networks on mammogram classification [12]. Proposed a novel method for network calibration which addresses the problem of model overconfidence [5][15]. Bridged the domain gap by using a CycleGAN-based method [17].
- Adapted a self-training approach for the task of breast cancer localization using only image-level labels [6]. Improved the image interpretation performance by designing an image-text matching network using textual medical reports as a weakly-supervision signal [10].
- Made numerous improvements and our current architecture is now able to use the full 2D and 3D mammograms, significantly improving performance over the previous method which subsampled the 3D volume [18][8][7]. Applied both CNN-based [3] and transformer-based [1] architectures on multi-modal PET images for Alzheimer disease diagnosis.

Identifying Galaxy Clusters using Deep Learning

- Identified cool core, weak cool core, and noncool core clusters of galaxies that are defined by their central cooling times using CNNs [11], interpreted the results by using class activation maps, and further improved the performance by using a multi-branch attention network [4].
- Proposed a self-supervised approach for estimating galaxy cluster masses from multi-band optical images using transfer learning [14][9].

Conference Publications

(See Google Scholar for the full list.)

[1] X. Xing, G. Liang, **Yu Zhang**, S. Khanal, A. Lin, N. Jacobs. "ADVIT : Vision Transformer on Multi-modality PET Images for Alzheimer Disease Diagnosis". In *IEEE International Symposium on Biomedical Imaging (ISBI)*, 2022.

[2] **Yu Zhang**, G. Liang, N. Jacobs. "Dynamic Feature Alignment for Semi-supervised Domain Adaptation". In *British Machine Vision Conference (BMVC)*, 2021. arXiv

[3] G. Liang, X. Xing, L. Liu, **Yu Zhang**, Q. Ying, A. Lin, and N. Jacobs. "Alzheimer's Disease Classification Using 2D Convolutional Neural Networks". In *IEEE Engineering in Medicine & Biology Society (EMBC)*, 2021. Link

[4] **Yu Zhang**, G. Liang, Y. Su, N. Jacobs. "Multi-Branch Attention Networks for Classifying Galaxy Clusters". In *International Conference on Pattern Recognition (ICPR)*, 2020. Link

[5] G. Liang, **Yu Zhang**, X. Wang, N. Jacobs. "Improved Trainable Calibration Method for Neural Networks on Medical Imaging Classification". In to *British Machine Vision Conference (BMVC)*, 2020. arXiv

[6] G. Liang, X. Wang, **Yu Zhang**, N. Jacobs. "Weakly-Supervised Self-Training for Breast Cancer Localization". In *IEEE Engineering in Medicine & Biology Society (EMBC)*, 2020. Link

[7] **Yu Zhang**, X. Wang, H. Blanton, G. Liang, X. Xing, N. Jacobs. "2D Convolutional Neural Networks for 3D Digital Breast Tomosynthesis Classification". In *IEEE International Conference of Bioinformatics and Biomedicine (BIBM)*, 2019. arXiv

[8] G. Liang, X. Wang, **Yu Zhang**, X. Xing, H. Blanton, T. Salem, N. Jacobs. "Joint 2D-3D Breast Cancer Classification". In *IEEE International Conference of Bioinformatics and Biomedicine (BIBM)*, 2019. arXiv

Journal Publications

[9] S. Lin, Y. Su, G. Liang, Y. Zhang, N. Jacobs, **Yu Zhang**. "Estimating Cluster Masses from SDSS Multi-band Images with Transfer Learning". In *Monthly Notices of the Royal Astronomical Society (MNRAS)*, 2022.

[10] G. Liang, C. Greenwell, **Yu Zhang**, X. Wang, R. Kavuluru, N. Jacobs. "Contrastive Cross-Modal Pre-Training : A General Strategy for Small Sample Medical Imaging". In *IEEE Journal of Biomedical and Health Informatics (JBHI)*, 2021. arXiv

[11] Y. Su, **Yu Zhang**, G. Liang, J. A. ZuHone, D. J. Barnes, N. B. Jacobs, M. Ntampaka, W. R. Forman, R. P. Kraft, P. E. J. Nulsen, C. Jones, E. Roediger. "A deep learning view of the census of galaxy clusters in IllustrisTNG". In *Monthly Notices of the Royal Astronomical Society (MNRAS)*, 2020. arXiv

[12] X. Wang, G. Liang, **Yu Zhang**, H. Blanton, Z. Bessinger, N. Jacobs. "Inconsistent Performance of Deep Learning Models on Mammogram Classification". In *Journal of the American College of Radiology (JACR)*, 2020. Link

Workshop Publications

[13] U. Rafique, **Yu Zhang**, B. Brodie, N. Jacobs. "Unifying Guided and Unguided Outdoor Image Synthesis". In *CVPR Workshop* : NTIRE 2021. Link

[14] G. Liang, S. Lin, **Yu Zhang**, Y. Su, Nathan Jacobs. "Optical Wavelength Guided Self-Supervised Feature Learning For Galaxy Cluster Richness Estimate". In *NeurIPS Workshop : Machine Learning and Physical Sciences*, 2020. arXiv

[15] G. Liang, **Yu Zhang**, N. Jacobs. "Neural Network Calibration for Medical Imaging Classification Using DCA Regularization". In *ICML Workshop : Uncertainty and Robustness in Deep Learning*, 2020. Link

[16] **Yu Zhang**, G. Liang, T. Salem, N. Jacobs. "Defense-PointNet : Protecting PointNet Against Adversarial Attacks". In *IEEE BigData Workshop : The Next Frontier of Big Data From LiDAR*, 2019. arXiv

Abstracts

[17] **Yu Zhang**, G. Liang, N. Jacobs, X. Wang. "Unsupervised Domain Adaptation for Mammogram Image Classification : A Promising Tool for Model Generalization". In *Conference on Machine Intelligence in Medical Imaging*, 2019. arXiv

[18] G. Liang, **Yu Zhang**, J. Liu, N. Jacobs, X. Wang. "Training Deep Learning Models as Radiologists : Breast Cancer Classification Using Combined Whole 2D Mammography and Full Volume Digital Breast Tomosynthesis". In *Radiological Society of North America 105th Scientific Assembly and Annual Meeting*, 2019.

Talks

- "Defense-PointNet : Protecting PointNet Against Adversarial Attacks", Dec. 2019, IEEE BigData LiDAR Workshop, Los Angeles, CA
- "Unsupervised Domain Adaptation for Mammogram Image Classification : A Promising Tool for Model Generalization", Sep. 2019, C-MIMI, Austin, TX

Media Coverage

- HealthExec: Inconsistent AI for breast cancer fail to deliver after closer inspection. *2020*
- UKNow: UK Physics, Engineering Team uses AI to study galaxy clusters. *2020*

Awards

- Conference Travel Grant, University of Kentucky, 2019
- ATS Fellowship, University of Kentucky, 2017-2018

Service

- Reviewer for IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- Reviewer for IEEE Transactions on Circuits and Systems for Video Technology (TCSVT)
- Reviewer for IEEE Winter Conference on Applications of Computer Vision 2020, 2022
- Reviewer for The British Machine Vision Conference 2020, 2021
- Reviewer for Imaging Science Journal 2022

Memberships

- Institute of Electrical and Electronics Engineers (IEEE), Student Member
- Society for Imaging Informatics in Medicine (SIIM), Student Member