Yuexi Du

Biomedical Engineering :: Computer Vision :: Medical Image Analysis

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EDUCATION

Yale University, New Haven, U.S. *Sept. 2022 – Present*
- **Ph.D.**, Biomedical Engineering, Medical Image Analysis
- **M.S. w/ Honor** (En Route) Obtained in *Dec. 2023*
- Advised by *Prof. Nicha C. Dvornek*.

University of Michigan, Ann Arbor, U.S. *Sept. 2020 – May. 2022*
- **B.S.**, Computer Science, w/ Mathematics Minor, **GPA: 3.97/4.00**
- Course Work: *Intro. to Computer Organization* (**A+**), *Computer Vision* (**A+**), *Adv. Topic in CV* (**A+**)

Shanghai Jiao Tong University, Shanghai, China *Sept. 2018 – Aug. 2022*
- **B.S.**, Electrical Computer Engineering, **GPA: 3.70/4.00 (Top 10%)**
- Course Work: *Programming and Data Structures* (**A+**), *Honors Mathematics IV* (**A+**)

PUBLICATIONS

[1] **Yuexi Du**, John Onofrey, Nicha C. Dvornek. *"Multi-View and Multi-Scale Alignment for Contrastive Language-Image Pre-training in Mammography." Submitted to **NeurIPS 2024**.*

[2] **Yuexi Du**, Nicha C. Dvornek, John Onofrey. *"R2E2-Conv: Rotation and Reflection Equivariant Efficient Convolution Kernel." (In submission)*

[3] **Yuexi Du**, Brian Chang, Nicha C. Dvornek. *"CLEFT: Language-Image Contrastive Learning with Efficient Large Language Model and Prompt Fine-Tuning."* **MICCAI 2024**. [Paper]

[4] Yinchi Zhou, Peiyu Duan, **Yuexi Du**, Nicha C. Dvornek. *"Self-Supervised Pre-training Tasks for an fMRI Time-series Transformer in Autism Detection."* **MLCN @ MICCAI 2024**.

[5] **Yuexi Du**, Regina J. Hooley, John Lewin, Nicha C. Dvornek. *"SIFT-DBT: Self-supervised Initialization and Fine-Tuning for Imbalanced Digital Breast Tomosynthesis Image Classification."* **ISBI 2024**. [Paper]

[6] Peiyu Duan, Nicha C. Dvornek, Jiyao Wang, Jeffrey Eilbott, **Yuexi Du**, Denis G Sukhodolsky, James S Duncan. *"Spectral Brain Graph Neural Network for Prediction of Anxiety in Children with Autism Spectrum Disorder."* **ISBI 2024**. [Paper]

[7] **Yuexi Du**, Ziyang Chen, Justin Salamon, Bryan Russell, Andrew Owens. *"Conditional Generation of Audio from Video via Foley Analogies."* **CVPR 2023**. [Project page][Paper]

[8] Xiyue Wang, **Yuexi Du**, Sen Yang, Jun Zhang, Minghui Wang, Jing Zhang, Wei Yang, Junzhou Huang, Xiao Han, *"RetCCL: Clustering-guided contrastive learning for whole-slide image retrieval".* **Medical Image Analysis**, *Volume 83, 2023, 102645, ISSN 1361-8415.* [Paper]

INDUSTRY EXPERIENCE

Content Based Pathological Image Retrieval System *Mentored by Dr. Xiao Han & M.S. Sen Yang*
AI Health Care Group @ Tencent AI Lab *May 2021 – Sept. 2021*
- ***Objective:*** Research on unsupervised contrastive learning and CBIR system for pathological WSI.
- ***Method:*** Introduce periodical moving average clustering guided module to reduce the number of false negatives in the image contrastive learning. Develop a high-speed content-based image retrieval system based on most representative WSI patches selected according to feature clustering. Applying the pre-trained image encoder to different downstream classification tasks.
- ***Outcome:*** On TCGA WSI retrieval task for primary site of disease and patient level diagnoses test, beats Yottixel & FISH by more than 10% in terms of average mean Majority Vote score. Pre-trained model outperforms baselines by more than 5% on TCGA lung cancer patch classification.

RESEARCH EXPERIENCE

Multi-Modal Representation Learning for Medical Image *Advised by Nicha C. Dvornek*
IPAG @ Yale *June. 2023 – Present*
- ***Objective:*** Enhance medical image representation learning using multi-modal information and LLM.
- ***Method:*** Introduce multi-view and multi-scale contrastive language-image pre-training to medical image representation learning using corresponding tabular data or free text report. Using multi-view contrastive learning to adapt the multi-view nature of chest X-ray and Mammography. Proposed a local alignment module to improve the fine-grained understanding of the image and provide interpretability to the model output.
- ***Outcome:*** Proposed method is one of the first CLIP model specifically designed for mammography and beats existing baselines by 4%. Pre-trained model ranked top-3 in the MICCAI CXR-LT challenge (until August).

Controlled and Self-supervised Diffusion MRI Denoising via Diffusion *Advised by Andre Wibisono*
Yale University *Jan. 2023 – May 2023*
- ***Objective:*** Reduce the un-controlled deformation of diffusion model-based MRI image denoising process.
- ***Responsibility:*** Introduce controlled frozen encoder and decoder with zero-convolution to attention-based diffusion UNet. Use DDIM diffusion process to reduce the uncertainty during long diffusion process. Implement the model and experiment with multiple real-world diffusion MRI datasets.
- ***Outcome:*** Greatly improve the SSIM of denoised MRI by more than 10% on both datasets. Also improves the downstream task performance for CSD modeling and DTI modeling. [Report]

Rotation & Reflection Equivariant CNN Architecture *Advised by John Onofrey*
IPAG @ Yale *Sept. 2022 – Present*
- ***Objective:*** Develop an efficient rotation & reflection equivariant convolution layer to serve as vision encoder for images without specific orientation, e.g., pathological image, remote-sensing images.
- ***Method:*** Design a smoothed symmetric convolution kernel to extract local rotation & reflection invariant feature. Due to the translation invariance of convolution operation, the global feature map will be rotation & reflection equivariant. We also proposed a time & space efficient implementation that reduces the computational complexity and parameter number of the R2E2 convolutional layers.
- ***Outcome:*** Proposed method shows SOTA performance on multiple classification benchmarks from pathological image to remote sensing data. The model also shows the best consistency under rotation and reflection augmentation comparing with group-based methods.

Conditional Foley Audio Generation *Advised by Andrew Owens*
Vision @ UMich Research Group *May 2021 – June 2023*
- ***Objective:*** Research & development of a novel condition-based method of audio foley generation with given silent video clip. Conditional visual-sound pair helps to generate different style of output.
- ***Method:*** Use the VQ-GAN spectrogram encoder and auto-regressive transformer to generate foley spectrograms. Using the conditional image-audio pair to guide the timbre of generated audio and use the corresponding video clip to help align the visual action and audio onsets.
- ***Outcome:*** The project proposed a novel task and demonstrates a convincing generation quality. Our method outperforms all the baselines on both qualitative and human quantitative evaluation by a considerable margin.

TEACHING EXPERIENCE

ENAS 912: Biomedical Image Processing, TF | Yale *Prof. James Duncan & Prof. Lawrence Staib*
Hold weekly Office Hour & Homework Grading & Hold Review Session *Sept. 2023 – Dec. 2023*
EECS 442: Computer Vision, IA | UMich *Prof. David Fouhey*
Hold weekly Office Hour & Design homework and projects & Manage Piazza *Jan. 2022 – April. 2022*
VR 246: Intro to Comics & Graphic Novels, TA | SJTU *Prof. Joelle Tybon*
Hold weekly Office Hour & Grading *May. 2021 – Aug. 2021*
VE101: Intro to Computer & Programming, TA | SJTU *Prof. Jigang Wu*
Leading Review Class & Office Hour & Grading & Design Lab Questions *Aug. 2020 – Dec. 2020*

SELECTED AWARDS & HONORS

Yale University Fellowship, Yale *2022, 2023, 2024*
Outstanding Graduates of Shanghai, SJTU *2022*
James B. Angell Scholar, UMich *2022*
Dean's Honor List & University Honor, UMich *2020, 2021, 2022*
Undergraduate Volunteer Scholarship, JI, SJTU *2020*
Undergraduate Scholarship of Excellence, SJTU *2019, 2020*
John Wu & Jane Sun Scholarship of Excellence, SJTU *2018, 2019, 2020*

SERVICES

Conference Paper Review *New Haven, USA*
Reviewer of CVPR, MICCAI, NeurIPS, AAAI, ICLR, IEEE T-MM *Dec. 2023 – Present*
Joint Institute Student Union *Shanghai, China*
Leader of Organization Department *May. 2019 – June. 2020*
Yunnan Kuang Chang Primary School *Yunnan, China*
Leader of Volunteer Teaching Group *Dec. 2019 – Feb. 2020*

SKILLS

- Language: **C/C++, Python, JavaScript, MATLAB, Tex, Bash, R, Go, Verilog, Arduino.**
- Framework: **PyTorch, Torch lightning, TensorFlow, HuggingFace, OpenCV, Faiss, SQLite, Hadoop.**