

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] Yinchu 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 a periodical moving average clustering guided module to reduce the number of false negatives in image contrastive learning. Develop a high-speed content-based image retrieval system based on the 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. The 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 reports. 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:** The proposed method is one of the first CLIP models specifically designed for mammography and beats existing baselines by 4%. Our pre-trained model ranked in the top-3 in the MICCAI 2024 CXR-LT challenge (until August).

Controlled and Self-supervised Diffusion MRI Denoising via Diffusion

Yale University

Advised by Andre Wibisono

Jan. 2023 – May 2023

- **Objective:** Reduce the uncontrolled deformation of diffusion model-based MRI image denoising process.
- **Responsibility:** Introduce a controlled frozen encoder and decoder with zero-convolution to attention-based diffusion UNet. Use the DDIM diffusion process to reduce the uncertainty during the 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

IPAG @ Yale

Advised by John Onofrey

Sept. 2022 – Present

- **Objective:** Develop an efficient rotation & reflection equivariant convolution layer to serve as a vision encoder for images without specific orientation, e.g., pathological images and remote-sensing images.
- **Method:** Design a smoothed symmetric convolution kernel to extract local rotation & reflection invariant features. 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:** The proposed method shows SOTA performance on multiple classification benchmarks from pathological images to remote sensing data. The model also shows the best consistency under rotation and reflection augmentation compared with group-based methods.

Conditional Foley Audio Generation

Vision @ UMich Research Group

Advised by Andrew Owens

May 2021 – June 2023

- **Objective:** Research & development of a novel condition-based method of audio foley generation with a given silent video clip. Conditional visual-sound pair helps to generate different styles of output.
- **Method:** Use the VQ-GAN spectrogram encoder and auto-regressive transformer to generate foley spectrograms. Use 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 demonstrated 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

Hold weekly Office Hour & Homework Grading & Hold Review Session

Prof. James Duncan & Prof. Lawrence Staib

Sept. 2023 – Dec. 2023

EECS 442: Computer Vision, IA | UMich

Hold weekly Office Hour & Design homework and projects & Manage Piazza

Prof. David Fouhey

Jan. 2022 – April. 2022

VR 246: Intro to Comics & Graphic Novels, TA | SJTU

Hold weekly Office Hour & Grading

Prof. Joelle Tybon

May. 2021 – Aug. 2021

VE101: Intro to Computer & Programming, TA | SJTU

Leading Review Class & Office Hour & Grading & Design Lab Questions

Prof. Jigang Wu

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

Reviewer of CVPR, MICCAI, NeurIPS, AAAI, ICLR, IEEE T-MM

New Haven, USA

Dec. 2023 – Present

Joint Institute Student Union

Leader of Organization Department

Shanghai, China

May. 2019 – June. 2020

Yunnan Kuang Chang Primary School

Leader of Volunteer Teaching Group

Yunnan, China

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.