GUANQUN LIU

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RESEARCH INTERESTS

My major research interests lie at the intersection of AI and medical signal processing, particularly in 3D/4D medical imaging, exploring advanced machine learning techniques to interpret and analyze complex imaging data, such as structural segmentation, shape delineation, and lesion diagnosis. Besides, I am also interested in combined modeling between medical signals and large language models in assisting clinical diagnosis and drug discovery. I aim to contribute to the advancement of AI-driven tools that can transform clinical practice and improve patient's quality of life.

EDUCATION

École Polytechnique Fédérale de Lausanne (EPFL), Switzerland *Aug 2024*
MSc in Computer Science

- **Grade**: 5.36/6.0 (Top 15%)
- **Related courses**: Machine Learning, Computer Vision, Image Processing, Applied Biostatistics, Modern Natural Language Processing

The Hong Kong Polytechnic University (HKPU), Hong Kong *Jul 2021*
BEng (Hons) in Electronic and Information Engineering

- **Grade**: 3.71/4.0 (Top 10%)
- **Related courses**: Medical Imaging, Image Processing and Pattern Recognition, Digital Signal Processing

RESEARCH EXPERIENCE

Master Thesis Project Feb 2024 - Jul 2024
Supervisors: Dr. Jiancheng Yang, Prof. Pascal Fua CVLab, EPFL

· ***Title***: **JointAtlas: Deformable Template-Based Implicit Method for Joint Segmentation-Appearance Modeling in Cardiac Images** [Report]
· Explored the feasibility of mapping cardiac structures' segmentation and appearance through generative mapping, simulating the imaging process from the human body to paired task structures.
· Proposed *JointAtlas* - based on Deep Implicit Field (DIF) and deformable latent templates, this model can represent any cardiac structure by deforming the closest latent template in test-time optimization.
· Proposed a 1-1 Supervised Template Learning mechanism in training that expands the representation diversity of latent templates.
· ***Result***: *JointAtlas* performs remarkable visible structural alignment between tasks and showed superior performance compared to other deformable template-based models in segmentation (Dice score enhanced by $\sim 20\%$ and $\sim 5\%$ on MMWHS MRI and CT dataset respectively).

Research Assistant Feb 2023 - Jul 2023
Supervisors: Dr. Pol del Aguila Pla, Prof. Michaël Unser Biomedical Imaging Group, EPFL

· ***Title***: **Deep Neural Networks to Reconstruct Super-Resolution MRI for 3D Modeling** [Report]

- Designed the Single Acquisition Isotropic Resolution (SAIR) MRI acquisition pipeline, including a sample-specific data processing block with a Gaussian-approximated PSF simulating the imaging process and multi-view through-plane rotations for data augmentation, a self-supervised U-Net model for super-resolution.
- Designed a robust generation mechanism using Fourier Burst Accumulation (FBA) synthesis on multiple rotated SAIR predictions.
- Designed a Pydicom-based SAIR data converter to allow DICOM metadata processing and transform SAIR's prediction from tensors to standard DICOM files.
- ***Result***: SAIR model's performance in multi-sample testing on reconstruction metrics (PSNR, SSIM) significantly exceeded (>10%) those of cubic spline interpolation for super-resolution. FBA algorithm enhanced prediction robustness and reduced noise effectively, improving the metrics by ∼1.5% compared to SAIR without FBA.

Computer Vision Intern Aug 2022 - Jan 2023
Supervisors: Zoltan Facius, Dr. Alexander Gatto Stuttgart Technology Center, Sony

- *Title*: **Deep Learning-Based Specular Highlight Removal in Surgical Images** [Link]
- Collected an endoscopic specular highlight dataset of 3,000+ images with surgery frames from the LapGyn dataset and Sony's data center, filtered and normalized by OpenCV and torchvision.
- Proposed an endoscopic specular-free generator composed of a two-stage network: *AttentiveGAN* for specular removal; an *LGNet* for removal inpainting based on *AttentiveGAN*'s result guided with correction mask from a color-distribution specular detection algorithm.
- Collected an endoscopic specular-free dataset according to feedback from medical experts on the generator results. Retrained the *AttentiveGAN* to obtain an endoscopic specular highlight removal model.
- ***Result***: The generator achieved 86% correction rate in medical experts' testing, strongly supporting the visual module. The generator and *AttentiveGAN* are adopted by the Tokyo headquarters.

Bachelor Thesis Project Jan 2021 - June 2021
Supervisor: Prof. Kenneth K.M. LAM HKPU

- *Title*: **Real-time Emotion Recognition System**
- Designed a real-time facial recognition module based on AdaBoost algorithm and OpenCV library and an emotion recognition model based on a residual CNN network.
- Developed an interactive user interface with PyQt library showing real-time emotion recognition results with a multi-face capturing function.
- ***Result***: The emotion recognition model achieved a Top-10 comparable performance in the Kaggle contest on the FER2013 dataset.

ACHIEVEMENTS

HKSAR Government Fund – Reaching Out Award	*2020.06*
Wong Tit-Shing Student Exchange Scholarship	*2019.06*
Dean's Honours List	*2018.10*

SKILLS

Programming Languages	Python, C++, R, Go, Scala, JavaScript, MATLAB
Machine Learning Tools	Pytorch, Tensorflow, Keras, scikit-learn, Hugging Face
Image Processing Tools	OpenCV, Pydicom, scikit-image, Pillow
Software Engineering	Version Control, Docker Packaging, Database Management
Languages	Chinese(Native), English(C2), French(A2), Japanese(Beginner)