Han Liu

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PROFILE:

- Highly self-motivated graduate student with research experience in medical imaging processing and analysis.
- Computer skills: C++, Python, MATLAB, R, Keras, TensorFlow, OpenCV, PIL, SPSS, etc.

EDUCATION:

Yale University, New Haven, Connecticut
M.S. Biomedical Engineering, May 2017

Rensselaer Polytechnic Institute, Troy, New York
B.S. Biomedical Engineering, dual major Electrical Engineering, May 2016
Concentration: medical imaging

RESEARCH INTERESTS:

- Machine learning
- Computer vision
- Deep learning
- Biomedical image analysis

PUBLICATION:

- **H. Liu**, L. Wang, Y. Nan, F. Jin, and J. Pu, "SDFN: Segmentation-based Deep Fusion Network for Thoracic Disease Classification in Chest X-ray Images", *IEEE Transactions on Medical Imaging*, Aug 2018. (under review)
- L. Wang, **H. Liu**, Y. Lu, H. Chen, J. Zhang, and J. Pu, "A coarse-to-fine deep learning framework for optic disc segmentation in fundus images", *Medical Signal Processing and Control*, July 2018. (under review)
- W. Zhao, **H. Liu**, J. K. Leader, D. Wilson, L. Wang, L. Chen, and J. Pu, "Computerized Identification of the Vasculature Surrounding a Pulmonary Nodule", *IEEE Transactions on Medical Imaging*, July 2018. (under review)

RESEARCH EXPERIENCE:

University of Pittsburgh, Department of Radiology, Imaging Research Lab
Graduate Researcher, Sep 2017-Present

- Pneumonia detection. (ongoing)
- Thoracic disease classification in chest X-ray images

Proposed a novel deep learning framework termed as Segmentation-based Deep Fusion Network (SDFN), which incorporated the features extracted from the local region of chest X-ray images, the lung fields. The lung fields were identified by a segmentation model and several post-processing techniques. The experiment demonstrated that our framework achieved a state-of-art classification accuracy, an AUC of 0.815 on the NIH benchmark testing set and localized the lesion regions more precisely compared to the traditional method.

- Optic disc segmentation in fundus images - II

Developed a coarse-to-fine deep learning framework, which (i) proposed a disc candidate

RESEARCH EXPERIENCE:

region by utilizing the features extracted from the vessel density maps of fundus images, and (ii) trained the network with the identified candidate regions. Evaluated on six public datasets, the developed framework was demonstrated to achieve an average IoU and a DSC of 89.1% and 93.9% respectively, as compared to 87.4% and 92.5% obtained by the traditional U-net model.

- Optic disc segmentation in fundus images - I

Developed a novel computer algorithm that automatically delineates the optic disc (OD) boundary by utilizing multiple characteristics of color fundus images, including vascular architecture, geometric shape, and local contrast. An innovative orientation map was proposed to characterize the retinal vessel architecture. Our experiment showed that this developed method was capable of detecting OD region more accurately than previous methods in the pathological retinal datasets.

Yale University, School of Medicine, Department of Radiology & Biomedical Imaging

Research Assistant, May 2017-Aug 2017

- Segmentation between viable and necrotic liver tumor

(a) Developed and compared the Philips IntelliSpace Discovery built-in unsupervised learning algorithms: (i) Gaussian Mixture Model, (ii) Iterative Self-Organizing Data Analysis Technique and (iii) qEASL. (b) Organized sessions to explain machine learning concepts for resident doctors. Our research showed that a supervised auto-context random forest achieved similar performance as the Philips built-in algorithms in segmentation of viable and necrotic tumor but did not require human annotations of tumor lesions.

Yale University, Department of Biomedical Engineering, Image Processing and Analysis Group (IPAG)

Graduate Research Assistant, Sep 2016-May 2017

- Multi-feature Gaussian Mixture Model for liver tissue segmentation

Developed a multi-feature Gaussian Mixture Model to segment parenchyma, viable tumor, blood vessels and necrotic tumor in post-TACE liver cancer MRI images. Five intensity features and five texture features (i.e., GLCM) were used. Downsampling technique was used to overcome the problem of imbalanced classes. Assessed by a five-fold cross-validation, the model achieved a mean dice similarity coefficient of 0.92, 0.462, 0.63, 0.30 for parenchyma, viable tumor, blood vessels, necrotic tumor respectively.

- Dictionary Learning for Epicardial Boundary Tracking

An implementation of dictionary learning to track epicardial boundary of left ventricle. For an initial frame of echocardiographic images, two dictionaries were created to learn the sparse representations of blood pool and cardiac muscle respectively. Then K-SVD and OMP algorithms were used to reconstruct images and classify the voxels for the next frame.

Wake Forest Baptist Hospital, CT Lab

*Summer Research Intern***,** May 2014-Aug 2014

- Optimization of General Thresholding Algorithm

Developed an alternating iterative general-thresholding method to overcome the non-convex problem for sparse-view CT image reconstruction.

RELATED COURSES:

Graduate

- Data Ming and Machine Learning
- Optimization Techniques
- Biomedical Imaging Processing and Analysis
- Stochastic Process
- Imaging Drugs in Brain

Undergraduate (Dean's list: 2012-2015)

- Modeling of Biomedical Systems
- Computer Components and Operations
- Embedded Control
- Signal and Systems
- Digital Signal Processing
- Intro to Image Processing

ACTIVITIES & VOLUNTEER:

- BME Society, *Secretary*, Rensselaer Polytechnic Institute. 2013-2016
- Mandarin club, *volunteer*, Rensselaer Polytechnic Institute. 2013-2015
- RPI Relief, *volunteer*, Rensselaer Polytechnic Institute. 2012-2014.
- Eddy Memorial Geriatric Center, *volunteer*, Troy, New York. Summer 2015.
- Northeast CSSA Basketball tournament 8^{th} place. 2014.
- CSSA mid-autumn vocal competition 1^{st} place. 2015.