Xiaoyuan Guo

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Research Interests

Computer Vision, Biomedical Image Processing

Education

Emory University — Georgia, USA
Ph.D. Computer Science — Sep. 2017 – **May. 2022 (Expected)**
Advisor: Prof. Imon Banerjee
Co-Advisor: Prof. Ashish Sharma

- 2020 Grace Hopper Conference Scholarship
- Student Travel Scholarship, CRA-W Grad Cohort Workshop 2021
- Schoettle Graduate Research Award, 2021

University of Chinese Academy of Sciences — Beijing, China
M.S. Computer Engineering — Sep. 2014 – Jun. 2017
Advisor: Prof. Jun Xiao

- 2016 National Scholarship of University of Chinese Academy of Sciences

Publications

- **Xiaoyuan Guo**, Judy Wawira Gichoya, Saptarshi Purkayastha, Imon Banerjee. "CVAD: A Novel Anomaly Detector for Medical Images Based on Cascade VAE". IEEE Transactions on Medical Imaging 2021. (Under Review)
- **Xiaoyuan Guo,** Judy Wawira Gichoya, Saptarshi Purkayastha, Imon Banerjee. "Margin-Aware Intra-Class Novelty Identification for Medical Images". Journal of Medical Imaging 2021. (Under Review)
- Monjoy Saha, **Xiaoyuan Guo**, Ashish Sharma. "TilGAN: GAN for Facilitating Tumor-Infiltrating Lymphocyte Pathology Image Synthesis with Improved Image Classification". IEEE Access 2021
- **Xiaoyuan Guo**, William C O'Neill, Brianna Vey, Tianen Christopher Yang, Thomas J Kim, Maryzeh Ghassemi, Ian Pan, Judy Wawira Gichoya, Hari Trivedi, Imon Banerjee. "SCU-Net: A Deep Learning Method for Segmentation and Quantification of Breast Arterial Calcifications on Mammograms". Journal of Medical Physics, 2021.
- Hari Trivedi, Imon Banerjee, William C O'Neill, **Xiaoyuan Guo.** Automated Breast Arterial Calcifications Segmentation and Quantification on Mammograms using Deep Learning. United States Patent Application No. 21005
- **Xiaoyuan Guo**, Judy Wawira Gichoya, Hari Trivedi, William C O'Neill, Rhakur Priya, Weijia Sun, Manisha Singh, Kathiravelu Pradeeban, Kim Thomas, Chris Yang, Imon Banerjee. "Deeper Thinner UNet (DT-UNet) for Fine Vessel Segmentation of Breast Arterial Calcification (BAC)". CMIMI 2020. (Oral)
- Jiali Duan, **Xiaoyuan Guo,** C.-C. Jay Kuo "PortraitGAN for Flexible Portrait Manipulation". APSIPA 2020.
- Jiali Duan, **Xiaoyuan Guo,** Son Tran, C.-C. Jay Kuo "Fashion Compatibility Recommendation via Unsupervised Metric Graph Learning". SCMLS 2020
- **Xiaoyuan Guo,** Fusheng Wang, George Teodoro, Alton B. Farris, and Jun Kong. "Liver Steatosis Segmentation with Deep Learning Methods". ISBI 2019 (Poster)
- **Xiaoyuan Guo,** Hanyi Yu, Blair Rossetti, George Teodoro, Daniel Brat, Jun Kong. "Clumped Nuclei Segmentation with Adjacent Point Match and Local Shape-Based Intensity Analysis in Fluorescence Microscopy Images". EMBC 2018 (Oral)
- Jiali Duan, Shuai Zhou, Jun Wan, **Xiaoyuan Guo,** Stan Z.Li. A Unified Framework for Multi-modal Isolated Gesture Recognition. ACM-TOMM, 2017
- **Xiaoyuan Guo,** Jun Xiao, Ying Wang. "A Survey on Algorithms of Hole Filling in 3D Surface Reconstruction" . The Visual Computer, 2016.
- Jiali Duan, Shuai Zhou, Jun Wan, **Xiaoyuan Guo,** Stan Z.Li. Multi-Modality Fusion based on Consensus-Voting and 3D Convolution for Isolated Gesture Recognition. Arxiv, 2016
- Jiali Duan, Shengcai Liao, **Xiaoyuan Guo,** Stan Z. Li. Face Detection by Aggregating Visible Components. ACCVW (Oral), 2016

Internship

Aurora Innovation Remote, USA
May. 2021 – Aug. 2021

3D perception for autonomous driving, Software Engineering Intern

Mentor: Praveen Srinivasan

Experience

Accurate Anomaly Detection for Medical Images Atlanta, USA
Oct. 2020 – May.2021

Designed an efficient anomaly detector TEND for medical images based on the autoencoder architecture and in-distribution image transformations. The detection aims to filter the out-of-distribution data and ensure the safety of deploying medical AI models. The performance of TEND has surpassed GAN-based and Classifier-based anomaly detector with 5~15% accuracy improvement in identifying intra-class out-of-distribution data on IVC-Filter, RSNA and ISIC datasets.
An extended out-of-distribution detection model CVAD was also developed for more generic anomaly identification, which utilized a cascade variational autoencoder to formulate in-distribution features and a following binary discriminator to distinguish the in-distribution samples from the generated ones. The detector can work on both medical images and natural images, and achieves state-of-the-art performance in detecting both intra-class and inter-class out-of-distribution data.

Mentor: Prof. Judy Wawira Gichoya, Prof. Imon Banerjee, Prof. Saptarshi Purkayastha

Breast Arterial Calcification Segmentation and Quantification in Mammograms Atlanta, USA
May. 2020 – Sep.2020

Developed a quick and accurate semantic segmentation model SCU-Net for separating breast vessel calcifications in mammograms, which was a tough task as calcified vessels are relatively narrow and discontinuous. SCU-Net still outperforms existing segmentation methods in a lightweight and efficient manner. The segmentation results are then used to quantify calcium mass with five proposed quantification metric. SCU-Net also performs well in detecting BAC progression with a cohort of patients' data.

Mentor: Prof. Hari Trivedi, Prof. Judy Wawira Gichoya, Prof. William C O'Neill, Prof. Imon Banerjee

Content-based Image Retrieval for Medical Images Atlanta, USA
Mar. 2020 – May.2020

Developed a deep ranking model to retrieve similar images in image database given a query image. The retrieving model is then used for helping generate target pathology images in database.

Mentor: Prof. Ashish Sharma, Prof. Eugene Agichtein

Lung Nodule Detection in CT Scans Atlanta, USA
Oct. 2018 – Feb.2020

Detected lung nodules in 3D lung cancer screening data using deep learning methods. By converting 2D DICOM images to 3D volumes, a 3D YOLO model was developed for predicting bounding box of nodules. Different from slice-wise detection, 3D detection was able to capture spatial information and also thus can improve the detection accuracy. The prediction can be applied to tracking nodule development and then evaluating lung cancer risks.

Mentor: Prof. Ashish Sharma

Fibrosis Detection and Segmentation in Histological Images Atlanta, USA
Jul. 2018 – Sep.2018

Separating fibrosis from the histological image was challenging due to high variability and complexity of structural features of such images. I developed a U-Net version segmentation model for accurately detecting fibrosis to help quantify the tissue type.

Mentor: Prof. Jun Kong

Liver Steatosis Detection and Segmentation with Large-scale Microscopy Imagery Atlanta, USA

Apr. 2018 – Jun.2018

Generated initial segmentations for overlapped liver steatosis in whole-slide images, which were then used as degraded ground truth for a following deep learning model to segment the clumped steatosis. With transfer learning of Mask-RCNN, the resulting model was able to segment overlapped steatosis regions at 75.87% by Average Precision, 60.66% by Recall, 65.88% by F1-score and 76.97% by Jaccard index. The segmentation model can facilitate the steatosis number counting and acquirement of the average size information, which can be used to support disease diagnosis in future clinical practice.

Mentor: Prof. Jun Kong

Clumped Nuclei Segmentation in Fluorescence Microscopy Images Atlanta, USA

Oct. 2017 – Feb.2018

Developed an unsupervised segmentation method to separate the clustered nuclei occurred in the fluorescence microscopy images, which can solve the under-segmentation problem with nearly 20~40% improvements for Jaccard Index, Recall, F1-score and Hausdorff distance metrics compared with the classic watershed segmentation method. This unsupervised segmentation approach can help separate overlapped nuclei automatically without human intervention.

Mentor: Prof. Jun Kong