

ZUWEI GUO

Machine Learning | Computer Vision | Medical Imaging | Data Science

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 <https://github.com/jlianglab/StepwisePretraining>

PROFILE

- Passionate, self-motivated and versatile software engineer with extensive experience in medical imaging classification/segmentation, anomaly detection, image action recognition, and objection detection.
- Demonstrated deep neural networks experience, including CNN, RNN, U-Net, GAN, and transformer. Possesses inherent ability and technical understanding in multiple technologies to provide new insights and procedures.
- Forward thinking with focus on new and leading-edge technologies, collaborating across multiple teams and organizations, providing superior service efficiency while maintaining goals.

AWARDS AND HONORS

- President's Awards for Innovation, Arizona State University | Oct. 2024
- 1st place in CXR-LT 2024 challenge task 1 | Sep. 2024

EDUCATION

Ph.D. in Computer Engineering
Arizona State University
 Jan. 2017 – current

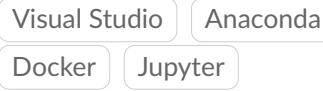
M.Sc. in Computer Engineering
Arizona State University
 Jan. 2014 – Dec. 2015

SKILLS

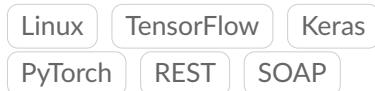
Languages



Software



Technologies



PROJECTS

Debiasing Machine Learning Models for Skin Lesion Detection Using Contrastive Debiasing

- Proposed a method to debias machine learning models using skin color contrast, ensuring consistent performance across all skin tones.
 - Designed a supervised contrastive debiasing algorithm that pulls images of different skin colors with the same lesion label closer in the feature space while pushing them apart if their lesion labels differ.
 - Innovatively utilized a student-teacher network framework to preserve the performance of a pretrained lesion classification model while alleviating performance gaps across different skin tones.
- Designed experiments to demonstrate the effectiveness of the proposed method across different datasets and adoption strategies.
 - Collected a diverse set of skin lesion datasets from different organizations, collection methods, and demographic groups, covering a wide range of disease labels.
 - Achieved an average AUC of 84.53% on the Fitzpatrick17k dataset, outperforming the supervised pretrained method (78.65%) and the adversarial debiasing counterpart (81.54%).
 - Improved the average AUC on the challenging DDI dataset from 67% to 71%, with performance across different skin tones (T12, T34, and T56) being 71.28%, 71.42%, and 70.53%, respectively, successfully alleviating the performance gap between different skin tones.

Uniting Self-Supervised Learning with Stepwise Incremental Pretraining

- Proposed a unified self-supervised learning model that integrates discriminative, restorative, and adversarial learning.
 - Designed a stepwise incremental pretraining strategy to stabilize training and enhance the synergistic effects of the three self-supervised learning components.
 - Collected pretrained unified models that incorporate discriminative, restorative, and adversarial learning into a single framework for 3D medical imaging tasks, including both classification and segmentation.
- Designed experiments to demonstrate the superiority of stepwise incremental pretraining for the unified model.
 - Achieved an average IoU of 70% on the brain tumor segmentation task, which is 11.1% better than the baseline random initialization method and 1.2% better than the unified model trained without stepwise incremental pretraining.
 - Achieved an average AUC of 87% on the pulmonary embolism false positive reduction task, 7% better than the baseline random initialization method and 2.8% better than the unified model trained without stepwise incremental pretraining.

Lung Disease Classification with Distance Learning

- Proposed a novel self-supervised technique to train a **generative adversarial network (GAN)** for pathology classification on chest X-rays.
 - Designed a method to define a pretext task using patch classification and reconstruction.
 - Trained a network to classify the distance between two patches extracted from the same X-ray image.
 - Trained a network for image-to-image translation.
- Developed a new algorithm that does not require labeled data for training.
 - Achieved an average **AUC of 81%** on classification with the newly proposed network.
 - Provided a clear direction for solving challenging problems.
 - Improved the discriminator component of the GAN for pathology classification.

Brain Lesion Detection Using GAN

- Developed signal processing and machine learning algorithms for computer vision.
- Enhanced traditional machine learning algorithms that do not generalize well to MRI images.
- Trained a **DCGAN** for patch-based detection and localization of brain lesions.
- Achieved a **whole tumor Dice score of 0.69**, outperforming the previous score of **0.647**.

Polyp Detection for Colonoscopy

- Collaborated with a team to develop an **automatic polyp detection** system for colonoscopy images.
- Extracted features using the **Daisy algorithm**, clustered and categorized them using **K-means clustering** and **Bag of Visual Words**, and used a **Random Forest model** for classification.
- Trained a three-layer **CNN model** for polyp detection, achieving an **AUC of 95.72%** with an **accuracy of 93.87%**.
- Designed and developed a **MATLAB GUI application** to integrate the models and visualize results.

PUBLICATIONS

- Guo, Zuwei, Nahid UI Islam, and Jianming Liang (Jan. 2025). *Systems, methods, and apparatuses for implementing stepwise incremental pre-training for integrating discriminative, restorative, and adversarial learning into an ai model*. US Patent App. 18/776,010.
- Lin, Mingquan, Gregory Holste, Song Wang, Yiliang Zhou, Yishu Wei, Imon Banerjee, Pengyi Chen, Tianjie Dai, Yuexi Du, Nicha C Dvornek, et al. (2025). "CXR-LT 2024: A MICCAI challenge on long-tailed, multi-label, and zero-shot disease classification from chest X-ray". In: *Medical Image Analysis*, p. 103739.
- Guo, Zuwei, Nahid UI Islam, Michael B Gotway, and Jianming Liang (2024). "Stepwise incremental pretraining for integrating discriminative, restorative, and adversarial learning". In: *Medical Image Analysis* 95, p. 103159.
- Guo, Zuwei, Nahid UI Islam, Michael B Gotway, and Jianming Liang (2022). "Discriminative, restorative, and adversarial learning: Stepwise incremental pretraining". In: *MICCAI Workshop on Domain Adaptation and Representation Transfer*. Springer, pp. 66–76.
- Tu, Zhigang, Zuwei Guo, Wei Xie, Mengjia Yan, Remco C Veltkamp, Baoxin Li, and Junsong Yuan (2017). "Fusing disparate object signatures for salient object detection in video". In: *Pattern Recognition* 72, pp. 285–299.