Gregory Holste

website: gholste.me | **email**: gholste@utexas.edu | **github**: github.com/gholste

Research Interests

In my research, I develop and apply **deep learning** and **computer vision** techniques to solve clinical decision-making and medical image analysis problems. To do this, I collaborate with clinicians to develop systems for automated **medical image interpretation**, **computer-aided diagnosis**, and delivery of **precision healthcare**.

Education

The University of Texas at Austin, Austin, TX
Ph.D. in Electrical Engineering **Aug. 2021-present**

- 4th-year Ph.D. Candidate
- NSF Graduate Research Fellow (2023-present)
- Advisor: Zhangyang (Atlas) Wang

M.S.E. in Electrical Engineering **Aug. 2021-May 2024**

- GPA: 3.87 / 4.00

Kenyon College, Gambier, OH
B.A. in Mathematics & Statistics **Aug. 2016-May 2020**

- GPA: 3.91 / 4.00 (*summa cum laude*)
- Concentration in Scientific Computing; Minor in Biology

Research Experience

The University of Texas at Austin, Austin, TX
Visual Informatics @ UT Austin (VITA) **Jul. 2021-present**

- Developing externally validated, video-based deep learning methods for fully automated interpretation of echocardiogram videos [2,5,8,13,p1-2]
- Advancing long-tailed learning of thorax diseases on chest X-rays [6,15]
- Organized the CVAMD 2023 workshop at ICCV 2023 and CXR-LT challenges in 2023 and 2024 for long-tailed and zero-shot chest X-ray classification
- Advisor: Zhangyang (Atlas) Wang

Weill Cornell Medicine, New York City, NY
Peng Lab, Population Health Sciences **May. 2023-Oct. 2023**

- Developed method for eye disease prognosis from longitudinal fundus imaging [4]
- Led an open challenge for rare thorax disease detection with >500 submissions [6]
- Advisor: Yifan Peng

Artera Inc, Mountain View, CA
Artificial Intelligence Team **May. 2022-Oct.2022**

- Implemented methods for multimodal fusion of histopathology images and clinical data for automated prostate cancer detection [12]
- Improved upon productionalized biomarker by 0.02 mean cross-validation AUROC
- Advisors: Akinori Mitani, Andre Esteva

Michigan State University, East Lansing, MI
Medical Imaging & Data Integration Lab **Aug. 2019-Jul. 2021**

- Developed and compared multimodal fusion models that learn jointly from breast MRI images and associated non-image clinical data [17]
- Applied novel ensemble methods to pediatric rib fracture detection in X-rays [7,16]
- Submitted solutions to RSNA Pulmonary Embolism Detection Challenge and MICCAI 2020 RibFrac Challenge (top 8-performing solution) [1]
- Advisor: Adam Alessio

Preprints

[p1] **PanEcho: Complete AI-enabled echocardiography interpretation with multi-task deep learning**
G. Holste, E.K. Oikonomou, M. Tokodi, A. Kovács, Z. Wang, R. Khera
medRxiv preprint 6 Apr. 2025

[p2] **Artificial intelligence-enabled echocardiography as a surrogate for multi-modality aortic stenosis imaging: post-hoc analysis of a clinical trial**
E.K. Oikonomou, N.J. Craig, **G. Holste**, S.V. Shankar, A. White, M. Mahendran, D.E. Newby, M.R. Dweck, R. Khera
medRxiv preprint 27 Mar. 2025

Publications

[1] **Deep Rib Fracture Instance Segmentation and Classification from CT on the RibFrac Challenge**
J. Yang, R. Shi, L. Jin, X. Huang, K. Kuang, D. Wei, S. Gu, J. Liu, P. Liu, Z. Chai, Y. Xiao, H. Chen, L. Xu, B. Du, X. Yan, H. Tang, A. Alessio, **G. Holste**, J. Zhang, X. Wang, J. He, L. Che, H. Pfister, M. Li, B. Ni
IEEE Transactions on Medical Imaging 30 Apr. 2025

[2] **Artificial intelligence-guided detection of under-recognised cardiomyopathies on point-of-care cardiac ultrasonography: a multicentre study**
E.K. Oikonomou, A. Vaid, **G. Holste**, A. Coppi, R.L. McNamara, G. Nadkarni, C. Baloescu, H. Krumholz, Z. Wang, R. Khera
The Lancet Digital Health 1 Feb. 2025

[3] **Improving Fairness of Automated Chest X-ray Diagnosis by Contrastive Learning**
M. Lin, T. Li, Z. Sun, **G. Holste**, Y. Ding, F. Wang, G. Shih, Y. Peng
Radiology: Artificial Intelligence 21 Aug. 2024

[4] **Harnessing the power of longitudinal medical imaging for eye disease prognosis using Transformer-based sequence modeling**
G. Holste, M. Lin, R. Zhou, F. Wang, L. Liu, Q. Yan, S.H. Van Tassel, K. Kovacs, E.Y. Chew, Z. Lu, Z. Wang, Y. Peng
npj Digital Medicine 16 Aug. 2024

[5] **Efficient deep learning-based automated diagnosis from echocardiography with contrastive self-supervised learning**
G. Holste, E.K. Oikonomou, B.J. Mortazavi, Z. Wang, R. Khera
Communications Medicine 6 Jul. 2024

[6] **Towards long-tailed, multi-label disease classification from chest X-ray: Overview of the CXR-LT challenge**
G. Holste, Y. Zhou, S. Wang, A. Jaiswal, M. Lin, S. Zhuge, Y. Yang, D. Kim, T. Nguyen-Mau, M. Tran, J. Jeong, W. Park, J. Ryu, F. Hong, A. Verma, Y. Yamagishi, C. Kim, H. Seo, M. Kang, L.A. Celi, Z. Lu, R.M. Summers, G. Shih, Z. Wang, Y. Peng
Medical Image Analysis 31 May 2024

[7] **High sensitivity methods for automated rib fracture detection in pediatric radiographs**
J. Burkow, **G. Holste**, J. Otjen, F. Perez, J. Junewick, A. Zbojniewicz, E. Romberg, S. Menashe, J. Frost, A. Alessio
Scientific Reports 10 Apr. 2024

[8] **A Multimodal Video-Based AI Biomarker for Aortic Stenosis Development and Progression**
E.K. Oikonomou, **G. Holste**, N. Yuan, A. Coppi, R.L. McNamara, N.A. Haynes, A.N. Vora, E.J. Velazquez, F. Li, V. Menon, S.R. Kapadia, T.M. Gill, G.N. Nadkarni, H.M. Krumholz, Z. Wang, D. Ouyang, R. Khera
JAMA Cardiology 6 Apr. 2024

[9] **Biometric contrastive learning for data-efficient deep learning from electrocardiographic images**
V. Sangha, A. Khunte, **G. Holste**, B.J. Mortazavi, Z. Wang, E.K. Oikonomou, R. Khera
Journal of the American Medical Informatics Association 24 Jan. 2024

[10] **Improving model fairness in image-based computer-aided diagnosis**
M. Lin, T. Li, Y. Yang, **G. Holste**, Y. Ding, S.H. Van Tassel, K. Kovacs, G. Shih, Z. Wang, Z. Lu, F. Wang, Y. Peng
Nature Communications 6 Oct. 2023

[11] **How Does Pruning Impact Long-Tailed Multi-Label Medical Image Classifiers?**
G. Holste, Z. Jiang, A. Jaiswal, M. Hanna, S. Minkowitz, A.C. Legasto, J.G. Escalon, S. Steinberger, M. Bittman, T.C. Shen, Y. Ding, R.M. Summers, G. Shih, Y. Peng, Z. Wang
Proc. Medical Image Computing and Computer-Assisted Intervention (MICCAI) 1 Oct. 2023

[12] **Improved Multimodal Fusion for Small Datasets with Auxiliary Supervision**
G. Holste, D. van der Wal, H. Pinckaers, R. Yamashita, A. Mitani, A. Esteva
Proc. IEEE International Symposium on Biomedical Imaging (ISBI) 1 Sep. 2023

[13] **Severe aortic stenosis detection by deep learning applied to echocardiography**
G. Holste, E.K. Oikonomou, B.J. Mortazavi, A. Coppi, K.F. Faridi, E.J. Miller, J.K. Forrest, R.L. McNamara, L. Ohno-Machado, N. Yuan, A. Gupta, D. Ouyang, H.M. Krumholz, Z. Wang, R. Khera
European Heart Journal 23 Aug. 2023

[14] **Radiomics-Guided Global-Local Transformer for Weakly Supervised Pathology Localization in Chest X-Rays**
Y. Han, **G. Holste**, Y. Ding, A. Tewfik, Y. Peng, Z. Wang
IEEE Transactions on Medical Imaging 26 Oct. 2022

[15] **Long-Tailed Classification of Thorax Diseases on Chest X-Ray: A New Benchmark Study**
G. Holste, S. Wang, Z. Jiang, T.C. Shen, G. Shih, R.M. Summers, Y. Peng, Z. Wang
Proc. MICCAI Workshop on Data Augmentation, Labelling, & Imperfections 16 Sep. 2022

[16] **Avalanche decision schemes to improve pediatric rib fracture detection**
J. Burkow, **G. Holste**, J. Otjen, F. Perez, J. Junewick, A. Alessio
Proc. SPIE Medical Imaging 2022: Computer-Aided Diagnosis 4 Apr. 2022

[17] **End-to-End Learning of Fused Image and Non-Image Features for Improved Breast Cancer Classification from MRI**

G. Holste, S. Partridge, H. Rahbar, D. Biswas, C. Lee, A. Alessio
Proc. International Conference on Computer Vision (ICCV) Workshops 31 Oct. 2021

[18] **Multi-class semantic segmentation of pediatric chest radiographs**
G. Holste, R. Sullivan, M. Bindschadler, N. Nagy, A. Alessio
Proc. SPIE Medical Imaging 2020: Image Processing 10 Mar. 2020

[19] **Deep learning methods for segmentation of lines in pediatric chest radiographs**
R. Sullivan, **G. Holste**, J. Burkow, A. Alessio
Proc. SPIE Medical Imaging 2020: Computer-Aided Diagnosis 16 Mar. 2020

Honors/ Awards

NSF Graduate Research Fellowship (GRFP) **Mar. 2023-2026**
National Science Foundation fellowship for outstanding STEM graduate students

MICCAI 2024 Oustanding Reviewer Honorable Mention **Sep. 2024**
One of 92 reviewers (top 5%) who consistently exceeded expectations

Dean's Prestigious Fellowship Supplement (3x) **Sep. 2023-2025**
UT Austin award for graduate students receiving prestigious external scholarships

Ram's Horn Best Project Award **Apr. 2023**
Best student project in Alan Bovik's EE 381K: Digital Video

Charles W. & Margaret A. Tolbert Endowed Scholarship **Aug. 2021**
UT Austin Cockrell School of Engineering scholarship for top incoming engineering students

Phi Beta Kappa **May 2020**
Elected to Kenyon College's chapter of the national honor society

Sigma Xi **Feb. 2020**
Inducted into the Kenyon-Denison chapter of the national science research honor society

Pi Mu Epsilon **Apr. 2018**
Elected to the Ohio Pi chapter of the national mathematics society

Wendell D. Lindstrom Memorial Prize **Apr. 2018**
One of 12 students given prize for outstanding mathematics students at Kenyon College

Kenyon College Merit List (8x) **every semester**

Oral Presentations

PanEcho: Complete echocardiography interpretration with multi-task deep learning [Late-Breaking Science]
American Heart Association (AHA) Scientific Sessions **Nov. 2024**

Universal echocardiography interpretation with multi-task deep learning
AI in Health Conference (AIHC) **Sep. 2024**

Long-Tailed Classification of Thorax Diseases on Chest X-Ray: A New

Benchmark Study
MICCAI Workshop on Data Augmentation, Labelling, & Imperfections **Sep. 2022**

Multi-class semantic segmentation of pediatric radiographs
SPIE Medical Imaging: Image Processing **Feb. 2020**

Scientific Abstracts

An AI-Echo Strategy to Define a Personalized Aortic Stenosis Progression Profile and its Pathophysiological Correlates in the SALTIRE-2 Trial
E.K. Oikonomou, N. Craig, **G. Holste**, S.V. Shankar, A. White, T. Pawade, D.E. Newby, M. Dweck, R. Khera
American College of Cardiology (ACC) Scientific Session **Mar. 2025**

PanEcho: Complete echocardiography interpretration with multi-task deep learning
G. Holste, E.K. Oikonomou, Z. Wang, R. Khera
American Heart Association (AHA) Scientific Sessions **Nov. 2024**

Artificial intelligence-enabled detection and phenotyping of left ventricular hypertrophy on real-world point-of-care cardiac ultrasonography and its implications for patient outcomes
E.K. Oikonomou, **G. Holste**, A. Coppi, C. Baloescu, R. McNamara, R. Khera
American Heart Association (AHA) Scientific Sessions **Nov. 2024**

Universal echocardiography interpretation with multi-task deep learning
G. Holste, E.K. Oikonomou, Z. Wang, R. Khera
AI in Health Conference (AIHC) **Sep. 2024**

Artificial intelligence-guided screening of under-recognized cardiomyopathies adapted for point-of-care echocardiography
E.K. Oikonomou, **G. Holste**, A. Coppi, R.L. Mcnamara, G.N. Nadkarni, H.M. Krumholz, Z. Wang, E.J. Miller, R. Khera
European Society of Cardiology (ESC) Congress **Sep. 2024**

Cross-modal validation of an artificial intelligence video-based approach for the automated risk stratification of aortic stenosis
E.K. Oikonomou, **G. Holste**, G. Nadkarni, Z. Wang, R. Khera
American College of Cardiology (ACC) Scientific Session **Apr. 2024**

ECG-GPT: Automated Complete Diagnosis Generation From ECG Images Using Novel Vision-Text Transformer Model
A. Khunte, V. Sangha, **G. Holste**, L.S. Dhingra, A. Aminorroaya, Z. Wang, R. Khera
American Heart Association (AHA) Scientific Sessions **Nov. 2023**

Predicting aortic stenosis progression using a video-based deep learning model of aortic stenosis built for single-view two-dimensional echocardiography
E.K. Oikonomou, **G. Holste**, R.L. Mcnamara, E.J. Velazquez, G.N. Nadkarni, D. Ouyang, H.M. Krumholz, Z. Wang, R. Khera

European Society of Cardiology (ESC) Congress **Aug. 2023**

Biometric Contrastive Modeling for Data-Efficient Deep Learning from Electrocardiographic Images
V. Sangha, A. Khunte, **G. Holste**, B. Mortazavi, Z. Wang, E.K. Oikonomou, R. Khera
American College of Cardiology (ACC) Scientific Session **Mar. 2023**

Long-Tailed Classification of Thorax Diseases on Chest X-Ray
G. Holste, S. Wang, Z. Jiang, T.C. Shen, G. Shih, R.M. Summers, Y. Peng, Z. Wang
Radiological Society of North America (RSNA) Annual Meeting **Nov. 2022**

Automated Detection of Aortic Stenosis From Single-View 2-Dimensional Echocardiography Using a Semi-Supervised, Contrastive Learning Approach
E.K. Oikonomou, **G. Holste**, B. Mortazavi, Z. Wang, R. Khera
American Heart Association (AHA) Scientific Sessions **Nov. 2022**

Self-Supervised Learning of Echocardiogram Videos Enables Data-Efficient Clinical Diagnosis
G. Holste, E.K. Oikonomou, B. Mortazavi, Z. Wang, R. Khera
ICML Workshop on Interpretable Machine Learning in Healthcare **Jul. 2022**

Rib fracture detection in pediatric radiographs via deep convolutional neural networks
J. Burkow, **G. Holste**, F. Perez, J. Junewick, A. Zbojniewicz, J. Frost, E. Romberg, S. Menashe, J. Otjen, A. Alessio
International Pediatric Radiology Congress **Oct. 2021**

Automatic segmentation of chest radiographs with deep learning
G. Holste, R. Sullivan, N. Nagy, M. Bindschadler, A. Alessio
Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE) **Jul. 2019**

Deep learning methods for automatic evaluation of lines in chest radiographs
R. Sullivan, **G. Holste**, A. Alessio
Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE) **Jul. 2019**

Invited Talks

PanEcho: Complete AI-enabled echocardiography interpretation with multitask deep learning
Laboratory for Computational Physiology (LCP) @ MIT **Feb. 2025**

Self-supervised learning for echocardiography
Cardiovascular Data Science (CarDS) Lab @ Yale University **Jul. 2023**

Fusing imaging and clinical information for improved automatic breast cancer detection
Virtual Imaging Research Symposium @ Michigan State University **Feb. 2021**

Automatic segmentation of pediatric chest radiographs
Math Monday @ Kenyon College **Nov. 2019**

SERVICE

Organizer: CXR-LT 2024 Challenge, ICCV 2023 CVAMD Workshop, CXR-LT 2023 Challenge

Conference Reviewer: CVPR (2024,2025), ICML (2023-2025), NeurIPS (2023-2025), MICCAI (2024,2025), ISBI (2024,2025), AAAI 2025, ECCV 2024, GenAI4Health Workshop (NeurIPS 2024), FM4Science Workshop (NeurIPS 2024), CVAMD Workshop (ICCV 2023)

Journal Reviewer: JAMA, JAMA Cardiology, European Heart Journal, IEEE Transactions on Medical Imaging, Medical Physics, IEEE Journal of Biomedical and Health Informatics, Computer Methods and Programs in Biomedicine, Artificial Intelligence in Medicine, Scientific Reports, PLoS One, ACM Transactions on Computing for Healthcare

Mentorship: Anthony Wang (UT Austin), Yuehao Wang (UT Austin)