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Pranav Kulkarni

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EDUCATION

2018 – 2022	University of Maryland, College Park	BS in Computer Science BS in Mathematics *(Dual Degree)*	• Completed *Capstone Research in Machine Learning* with Dr. Tom Goldstein on adversarial attacks on LLM for detecting AI-generated news. • Completed the *First-Year Innovation and Research Experience* with Dr. Müge Karagöz.

EMPLOYMENT

Apr 2024 –	Bioinformatics Software Engineer I	University of Maryland Institute for Health Computing (UM-IHC), University of Maryland School of Medicine	• Developing web-based informatics tools for clinical data analysis and visualization using VueJS and Flask.
Aug 2022 – Apr 2024	Bioinformatics Software Engineer I	University of Maryland Medical Intelligent Imaging (UM2ii) Center, University of Maryland School of Medicine	• Research focused on cross-domain federated learning, resource-efficient AI, and AI fairness and bias. • Developed tools for processing and analyzing medical images from radiological PACS/VNA.
Jan 2021 – May 2022	Head Teaching Assistant	Department of Computer Science, University of Maryland	• Held weekly recitations for over 200 students, facilitated review sessions for over 2000 students, planned and restructured course material, managed over 50 TAs, and held office hours.
Sep 2019 – Mar 2020	MATLAB Tutor	Department of Mathematics, University of Maryland	• Provided one-on-one tutoring to students in MATLAB programming, tailored to their course and proficiency.
May 2019 – Aug 2019	Summer Research Fellow	The First-Year Innovation and Research Experience, University of Maryland	• Applied unsupervised RNN to reconstruct particle splitting for the Compact Muon Solenoid experiment at CERN's Large Hadron Collider.

RELEVANT COURSEWORK AND SKILLS

Computational Coursework:	Geometric Computer Vision (*Graduate-Level*), Computer Vision, Deep Learning, Machine Learning, Artificial Intelligence, Algorithms, Data Structures, Data Science, Functional Programming, Object-Oriented Programming
Mathematics Coursework:	Linear Algebra, Multivariate Calculus, Advanced Calculus, Differential Equations, Partial Differential Equations, Fourier Transforms, Statistical Analysis
Technical Skills:	Python, TensorFlow, PyTorch, Git, Linux, C/C++, C#, Java, MATLAB, SQL
Other Skills:	Data Visualization, Data Analysis, Scientific Writing, Public Speaking

RESEARCH INTERESTS

My research focuses on the overarching goal of bringing AI from bench to bedside for clinical decision-making support, across three distinct areas: **1)** Federated lifelong learning frameworks to collaboratively train cross-domain models that continue to learn and adapt to new imaging protocols and tasks. **2)** Resource-efficient AI by reducing burden of data curation using coresets, data annotation using weakly-supervised learning, and training/inference using intelligent streaming of medical images. **3)** Algorithmic bias and adversarial bias attacks in medical imaging AI and their implication in the clinical environment.

PUBLICATIONS

**** First/Co-first author. # Corresponding author.***

Peer-Reviewed Journal Publications

1. **Kulkarni, P.***, Kanhere, A., Siegel, E., Yi, P. H., & Parekh, V. S.# (2024). ISLE: An Intelligent Streaming Framework for High-Throughput AI Inference in Medical Imaging. *Journal of Imaging Informatics in Medicine* (In Press).
2. Kamel, P.*, Kanhere, A., **Kulkarni, P.**, Kahlid, M., Steger, R., Bodanapally, U., Gandhi, D., Parekh, V. S., & Yi, P. H.# (2023). Optimizing Acute Stroke Segmentation on MRI using Deep Learning: Self-configuring Neural Networks Provide High Performance using only DWI Sequences. *Journal of Imaging Informatics in Medicine* (In Press).
3. Doo, F. X.*#, **Kulkarni, P.**, Siegel, E., Toland, M., Yi, P. H., Carlos, R. C., & Parekh, V. S. (2023). Economic and environmental costs of cloud for medical imaging and radiology artificial intelligence. *Journal of the American College of Radiology, 21*(2), 248-256.
4. Bachina, P.*, Garin, S. P., **Kulkarni, P.**, Kanhere, A., Sulam, J., Parekh, V. S., & Yi, P. H.# (2023). Coarse Race and Ethnicity Labels Mask Granular Underdiagnosis Disparities in Deep Learning Models for Chest Radiograph Diagnosis. *Radiology, 309*(2), e231693.

Peer-Reviewed Conference Publications

1. Chan, S.*, **Kulkarni, P.**, Yi, P. H., & Parekh, V. S.# (2024). Expanding the Horizon: Enabling Hybrid Quantum Transfer Learning for Long-Tailed Chest X-Ray Classification. In *Proceedings of the 2024 IEEE International Conference on Quantum Computing and Engineering (QCE)*. IEEE (In Press).
2. **Kulkarni, P.***, Chan, A., Navarathna, N., Chan, S., Yi, P. H., & Parekh, V. S.# (2024). Hidden in Plain Sight: Undetectable Adversarial Bias Attacks on Vulnerable Patient Populations. In *Proceedings of the 2024 Conference on Medical Imaging with Deep Learning*. PMLR (In Press).
3. Kanhere, A.*, **Kulkarni, P.**, Yi, P. H., & Parekh, V. S.# (2024). Privacy-Preserving Collaboration for Multi-Organ Segmentation via Federated Learning from Sites with Partial Labels. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops* (pp. 2380-2387).

Book Chapters

1. Parekh, V. S.*#, **Kulkarni, P.**, Kanhere, A., & Jacobs, M. A. (2024). Expanding the Federated Horizon: Cross-Domain Techniques for Collective Intelligence. *In Federated Learning for Medical Imaging: Principles, Algorithms and Applications* (In Press).

Under Review

1. Yi, P. H., Bachina, P., Bharti, B., Garin, S. P., Kanhere, A., **Kulkarni, P.**, Li, D., Parekh, V. S., Santomartino, S. M., Moy, L., & Sulam, J. (2024). Pitfalls and Best Practices in Evaluation of Algorithmic Biases in Radiology. *Radiology*.
2. Kavandi, H., **Kulkarni, P.**, Garin, S. P., Bachina, P., Parekh, V. S., & Yi, P. H. (2024). Radiomics-Based Prediction of Demographics on Chest Radiographs: Looking Beyond Deep Learning for Risk of Bias. *Radiology*.
3. Kamel, P., Khalid, M., Steger, R., Kanhere, A., **Kulkarni, P.**, Parekh, V. S., Yi, P. H., Bodanapally, U., & Gandhi, D. (2024). Dual Energy CT for Deep Learning-Based Segmentation and Volumetric Estimation of Early Ischemic Infarcts. *Journal of Imaging Informatics in Medicine*.
4. Chatterjee, D., Kanhere, A., Doo, F. X., Zhao, J., Chan, A., Welsh, A., **Kulkarni, P.**, Trang, A., Parekh, V. S., & Yi, P. H. (2024) Children Are Not Small Adults: Addressing Limited Generalizability of an Adult Deep Learning Organ Segmentation Model to the Pediatric Population. *Journal of Imaging Informatics in Medicine*.
5. Kargilis, D., **Kulkarni, P.**, Kanhere, A., Garin, S., Murphy, Z., Hafey, C., Parekh, V. S., & Yi, P. H. (2024). The Impact of Standard Image Preprocessing on Deep Learning Models' Predictions for Chest Radiographs: An Overlooked Source of Performance Variability. *Journal of Imaging Informatics in Medicine*.

Preprints

1. **Kulkarni, P.**, Kanhere, A., Yi, P. H., & Parekh, V. S. (2024). Surgical Aggregation: Federated Class-Heterogeneous Learning. *arXiv preprint arXiv:2301.06683*.
2. **Kulkarni, P.**, Kanhere, A., Yi, P. H., & Parekh, V. S. (2023). Text2Cohort: Facilitating Intuitive Access to Biomedical Data with Natural Language Cohort Discovery. *arXiv preprint arXiv:2305.07637*.

3. **Kulkarni, P.**, Kanhere, A., Siegel, E., Yi, P. H., & Parekh, V. S. (2023). One Copy Is All You Need: Resource-Efficient Streaming of Medical Imaging Data at Scale. *arXiv preprint arXiv:2307.00438*.
4. **Kulkarni, P.**, Kanhere, A., Yi, P. H., & Parekh, V. S. (2023). Optimizing Federated Learning for Medical Image Classification on Distributed Non-IID Datasets with Partial Labels. *arXiv preprint arXiv:2303.06180*.

INVENTIONS, PATENTS, AND COPYRIGHTS

1. Parekh, V. S., **Kulkarni, P.**, Kanhere, A., Yi, P. H., & Siegel, E. Systems and Methods for High-Throughput Analysis for Graphical Data. US Patent Application No. 63/501,552 – Filed May 11, 2023. PCT International Patent Application No. PCT/US2024/028956 – Filed May 10, 2024.

PRESENTATIONS AND ABSTRACTS

**** Presenting author.***

1. Chan, S.*, **Kulkarni, P.**, Yi, P. H., & Parekh, V. S. (2024). Expanding the Horizon: Enabling Hybrid Quantum Transfer Learning for Long-Tailed Chest X-Ray Classification. Spotlight Talk, 2024 *IEEE International Conference on Quantum Computing and Engineering (QCE)*.
2. **Kulkarni, P.***, Chan, A., Navarathna, N., Chan, S., Yi, P. H., & Parekh, V. S. (2024). Hidden in Plain Sight: Undetectable Adversarial Bias Attacks on Vulnerable Patient Populations. Spotlight Talk, *Medical Imaging with Deep Learning*.
3. **Kulkarni, P.***, Kanhere, A., Kukreja, H., Zhang, V., Yi, P. H., & Parekh, V. S. (2024). Improving Multi-Center Generalizability of GAN-Based Fat Suppression using Federated Learning. Poster Presentation, *Medical Imaging with Deep Learning*.
4. **Kulkarni, P.***, Kanhere, A., Savani, D., Chan, A., Chatterjee, D., Yi, P. H., & Parekh, V. S. (2024). Anytime, Anywhere, Anyone: Investigating the Feasibility of Segment Anything Model for Crowd-Sourcing Medical Image Annotations. Poster Presentation, *Medical Imaging with Deep Learning*.
5. Kanhere, A.*, **Kulkarni, P.**, Yi, P. H., & Parekh, V. S. (2024). Privacy-Preserving Collaboration for Multi-Organ Segmentation via Federated Learning from Sites with Partial Labels. Poster Presentation, *Data Curation and Augmentation in Medical Imaging Workshop, IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)* – **Won Best Poster Award**
6. Zhao, J.*, Kanhere, A., **Kulkarni, P.**, Chatterjee, D., Parekh, V. S., & Yi, P. H. (2024). Using Deep Learning to Predict Knee Osteoarthritis. Poster Presentation, *Undergraduate Research Day 2024*, University of Maryland.
7. Kamel, P.*, Khalid, M., Steger, R., Kanhere, A., **Kulkarni, P.**, Parekh, V. S., Yi, P. H, Bodanapally, U., & Gandhi, D. (2024). Is Dual-Energy CT Better for Deep Learning-Based Detection and Segmentation of Early Ischemic Infarcts on CT? *2024 American Society of Neuroradiology Annual Meeting*.
8. Kamel, P.*, Kanhere, A., **Kulkarni, P.**, Khalid, M., Steger, R., Bodanapally, U., Gandhi, D., Parekh, V. S., & Yi, P. H. (2024). Assessing the Generalizability of Acute Stroke Segmentation using a Self-Configuring Neural Network Trained on Public Data. *2024 American Society of Neuroradiology Annual Meeting*.
9. Kamel, P.*, Khalid, M., Steger, R., Kanhere, A., **Kulkarni, P.**, Parekh, V. S., Yi, P. H., Bodanapally, U., & Gandhi, D. (2024). Cross-Modality Stroke Segmentation using Deep Convolutional Neural Networks for Detection of Acute Ischemic Infarcts on Non-Contrast Head CT. *2024 American Society of Neuroradiology Annual Meeting*.
10. **Kulkarni, P.**, Hafey, C., Siegel, E., Yi, P. H.*, & Parekh, V. S. (2024). Medical Images On-Demand: Intelligent Streaming of Medical Images for High-Throughput AI Inference. Spotlight Talk, *2024 Society for Imaging Informatics in Medicine Annual Meeting*.
11. Chan, A., **Kulkarni P.**, Garin, S., Parekh, V. S., & Yi, P. H.* (2024). More pixels, more bias? Comparing fairness of chest x-ray deep learning models trained with image vs. pixel-level annotations. Spotlight Talk, *2024 Society for Imaging Informatics in Medicine Annual Meeting*.
12. Navarathna, N.*, Chatterjee, D., Chan, A., **Kulkarni, P.**, Kanhere, A., Parekh, V. S., & Yi, P. H. (2024). From Download to ML: Challenges in Directly Using the MIDRC Dataset for Machine Learning and Enhancing its Usability. Spotlight Talk, *2024 Society for Imaging Informatics in Medicine Annual Meeting*.
13. Chan, S.*, **Kulkarni, P.**, Navarathna, N., Murphy, Z., Venkatesh, K., Sulam, J., Parekh, V. S., & Yi, P. H. (2024). Vision Transformers are More Robust to Real-World Medical Image Variations than Convolutional Neural Networks. Poster Presentation, *2024 Society for Imaging Informatics in Medicine Annual Meeting*.
14. Kim, J.*, **Kulkarni, P.**, Welsh, A., Garin, S., Chatterjee, D., Kanhere, A., Parekh, V. S, & Yi, P. H. (2023). Sex Bias in Pediatric Deep Learning Chest Radiograph Classifier Model. Spotlight Talk, *Medical Student Research Day 2023*, University of Maryland-Baltimore.

15. Kavandi, H.*, **Kulkarni, P.**, Garin, S., Bachina, P., Parekh, V. S., & Yi, P. H. (2023). Risk of Bias in Chest X-Ray Radiomics Models: Looking Beyond Neural Networks. Spotlight Talk, *Radiological Society of North America 109th Scientific Assembly and Annual Meeting*.
16. Kamel, P.*, Kanhere, A., **Kulkarni, P.**, Khalid, M., Steger, R., Bodanapally, U., Gandhi, D., Parekh, V. S., & Yi, P. H. (2023). Quantifying the Technical Challenges and DICOM Metadata Variability in Stroke Machine Learning Data Curation. Spotlight Talk, *Radiological Society of North America 109th Scientific Assembly and Annual Meeting*.
17. **Kulkarni, P.***, Kanhere, A., Yi, P. H., & Parekh, V. S. (2023). From Isolation to Collaboration: Harmonizing Heterogeneous Medical Imaging Datasets with Partial Annotations. Spotlight Talk, *2023 Conference on Machine Intelligence in Medical Imaging, Society for Imaging Informatics in Medicine*.
18. Bachina, P.*, Garin, S., **Kulkarni, P.**, Kanhere, A., Sulam, J., Parekh, V. S., & Yi, P. H. (2023). Coarse Race and Ethnicity Labels Mask Granular Underdiagnosis Disparities in Deep Learning Models for Chest Radiograph Diagnosis. Spotlight Talk, *2023 Conference on Machine Intelligence in Medical Imaging, Society for Imaging Informatics in Medicine*.
19. **Kulkarni, P.***, Kanhere, A., Siegel, E., Yi, P. H., & Parekh, V. S. (2023). One Copy Is All You Need: Resource-Efficient Streaming of Medical Imaging Data at Scale. Poster Presentation, *2023 Conference on Machine Intelligence in Medical Imaging, Society for Imaging Informatics in Medicine*.
20. **Kulkarni, P.***, Kanhere, A., Yi, P. H., & Parekh, V. S. (2023). Text2Cohort: Democratizing the NCI Imaging Data Commons with Natural Language Cohort Discovery. Poster Presentation, *2023 Conference on Machine Intelligence in Medical Imaging, Society for Imaging Informatics in Medicine*.
21. Kanhere, A.*, **Kulkarni, P.**, Yi, P. H., & Parekh, V. S. (2023). SegViz: A Federated Learning Framework to Train Multi-task Segmentation Models from Partially Annotated and Distributed Datasets. Poster Presentation, *2023 Conference on Machine Intelligence in Medical Imaging, Society for Imaging Informatics in Medicine*.
22. Bachina, P.*, Garin, S., **Kulkarni, P.**, Kanhere, A., Kargilis, D., Parekh, V. S., & Yi, P. H. (2023). Not So Black and White: Confounders Mediate AI Prediction of Race on Chest X-Rays. Poster Presentation, *Machine Learning for Healthcare 2023*.
23. Kamel, P.*, Kanhere, A., **Kulkarni, P.**, Parekh, V. S., & Yi, P. H. (2023). Optimizing Acute Stroke Segmentation: Do Additional Sequences Matter for Deep Learning Algorithms? Poster Presentation, *2023 Society for Imaging Informatics in Medicine Annual Meeting*.
24. **Kulkarni, P.***, Kanhere, A., Yi, P. H., & Parekh, V. S. (2022). From Competition to Collaboration: Making Toy Datasets on Kaggle Clinically Useful for Chest X-Ray Diagnosis Using Federated Learning. *Medical Imaging meets NeurIPS Workshop, 2022 Conference on Neural Information Processing Systems*.

GRANTS

Active Grants

Jul 2024 – Jun 2027 **(Key Personnel, 20%)** Subcontract PI: Vishwa S. Parekh
"Enabling Intuitive Access to Biomedical Data with Natural Language Queries"
ARPA-H Biomedical Data Fabric Toolbox
Total Direct Costs: $384,140

Completed Grants

Apr 2023 – Dec 2023 **(Key Personnel)** PIs: Vishwa S. Parekh, Paul H. Yi
"Amazon Experimental Credits"
Total Direct Costs: $9,998 (AWS Credits)

Oct 2022 – Sep 2023 **(Key Personnel)** PI: Vishwa S. Parekh
"CheXViz: A collaborative learning medical imaging platform for chest x-ray diagnosis"
Total Direct Costs: $5,000 (GCP Credits)

MENTORING AND TEACHING

Teaching

2021 – 2022	Head Teaching Assistant	• CMSC 330: Programming language paradigms • CMSC 132: Object-oriented programming	Department of Computer Science, University of Maryland
2019 – 2020	MATLAB Tutor	• MATH 240: Linear algebra • MATH 241: Multivariate calculus	Department of Mathematics, University of Maryland

• MATH 246: Differential equations

Mentoring

Staff

2023 – 2024	Andrew Chan	Research Assistant	Research and project mentor for Andrew during his gap year. He contributed to multiple studies on AI fairness and bias presented at conferences like *MIDL 2024*.	University of Maryland School of Medicine
2023 – 2024	Nithya Navarathna	Research Program Coordinator	Research and project mentor for Nithya during her gap year. Her work in imaging informatics resulted in a spotlight talk at *2024 SIIM Annual Meeting*.	University of Maryland School of Medicine
2023 – 2024	Skylar Chan	Research Assistant	Research and project mentor for Skylar during his gap year. His work resulted in a first-author publication and spotlight talk on quantum ML for medical imaging at *IEEE QCE 2024*.	University of Maryland School of Medicine

MD Students

2023 – 2024	Devina Chatterjee	Research and statistical mentor for her work on AI and informatics.	University of Maryland School of Medicine
2023 – 2024	Jake Kim	Research and project mentor for his work on AI fairness and bias in pediatric patients.	University of Maryland School of Medicine
2023 – 2024	Annie Trang	Statistical mentor for her work on AI fairness and bias in FDA-approved tools.	University of Maryland School of Medicine
2023	Alexander Welsh	Research mentor for his work on AI interpretability and explainability using saliency maps.	University of Maryland School of Medicine
2023	Niket Patel	Research and project mentor on his work on the impact of image compression on medical imaging AI.	Drexel University
2023	Sam Santomartino	Research mentor for her work on AI fairness and bias. Sam's work resulted in several first-author publications in journals.	Drexel University
2022 – 2023	Daniel Kargilis	Research and project mentor for his work on AI interpretability and explainability using saliency maps.	Johns Hopkins University

Undergraduate Students

2023	Jerry Zhao	Bioengineering	Summer Intern. Research mentor for his work on using DL to predict knee osteoarthritis.	University of Maryland
2023	Noam Fox	Bioengineering	Summer Intern. Research mentor for her work on DL segmentation of knee bone and cartilage for osteoarthritis.	University of Maryland
2021 – 2022	Aasritha Sanikommu	Computer Science	Peer mentor as part of the Iribe Initiative for Inclusion and Diversity in Computing (I4C).	University of Maryland

RECOGNITION

Awards and Honors

2024	Best Poster Award (Co-Author)	Data Curation and Augmentation in Medical Imaging Workshop, CVPR
2021 – 2022	OMSE Academic Excellence Award	Office of Multi-Ethnic Student Education, University of Maryland
2019	Summer Fellowship Award	The First-Year Innovation and Research Experience Program, University of Maryland
2019	125 Mile E-Bike Challenge Preliminary Design Competition Award	A. James Clark School of Engineering, University of Maryland
2018 – 2022	Semester Academic Honors (Dean's List)	Department of Computer Science, University of Maryland

LEADERSHIP AND ORGANIZATIONAL ACTIVITIES

Leadership Activities

2019 – 2022	President	CompuTerps	Student Organization
2019	Committee Member	Student (Under)graduate Directing Organization	Student Organization

Journal Peer-Review Activities

2023 Invited Reviewer, *Frontiers in Medicine (1)*