

Amogh Hiremath

SENIOR AI SCIENTIST

Pittsburgh, Pennsylvania

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Education

Case Western Reserve University

Cleveland, Ohio, US

PH.D. IN BIOMEDICAL ENGINEERING

Aug. 2018 - May. 2022

- Research primarily focused on applications of deep learning/machine learning on medical images for diagnosis and prognosis of various diseases.

National Institute of Technology, Karnataka

Surathkal, Karnataka, India

M.TECH IN COMMUNICATION ENGINEERING

Jun. 2014 - May 2016

- CGPA: 8.31/10.
- Coursework primarily focused on advanced signal and image processing.

SDMCET, Dharwad

Dharwad, Karnataka, India

B.E IN ELECTRONICS AND COMMUNICATION ENGINEERING

Jul. 2010 - Jun. 2014

- CGPA: 9.23/10
- Coursework primarily focused on fundamentals of signal and image processing, engineering mathematics and telecommunication.

Experience

Picture Health

Pittsburgh, Pennsylvania, US

SENIOR AI SCIENTIST

May. 2022 - Present

- Primarily focused on building AI models for prediction of response to immunotherapy among lung cancer patients.
- First authored publications in top tier conferences such as American Society of Clinical Oncology (ASCO), World Conference on Lung Cancer (WCLC)
- Automated segmentation of lung nodules on CT scans.
- Building end to end feature extraction frameworks, end-end machine learning pipelines for analysing medical images.

Philips Research, India

Bangalore, Karnataka, India

SENIOR RESEARCH ENGINEER

Jun. 2016 - Jul. 2018

- Data engineering (ETL (Extract, Transfer, Load)) of massive ICU databases
- Early prediction of different Hospital Acquired Infections acquired by patients in the ICUs

Philips Research, India

Bangalore, Karnataka, India

PROJECT TRAINEE (INTERN)

May. 2015 - Jun. 2016

- Building quick prototypes in applications of healthcare using concepts of machine learning, image processing, and natural language processing.
- Software development: GUI based annotation tools for Chest X-rays

Indian Institute of Technology, (IIT) Kharagpur

Kolkata, West Bengal, India

DEEP LEARNING FOR VISUAL COMPUTING (DLVC) SUMMER SCHOOL, 2017

Jul. 2017

- A summer school conducted by IIT Kharagpur, India covering different deep learning techniques applied on images with an overview of convolutional neural networks.
- Earned 1st Place in DLVC 2017 Challenge (Bengali Language Digit Recognition).

Carnegie Mellon University - National Institute of Technology, Karnataka

Surathkal, Karnataka, India

NITK - CMU WINTER SCHOOL, 2014

Dec. 2014

- Developing a machine learning model to classify environmental sounds - "An Approach Towards Never Ending Learning of Sound".

Skills

Programming

Language (Experience): Python (>8 years), JAVA (1 year), LaTeX (5 years)

Tools

Matlab, R, ITK Snap, Slicer 3D, MySQL, PySpark, Python Flask.

Libraries

pytorch, hydra, numpy, matplotlib, pandas, scikit-learn, scikit-image, scikit-survival, scipy, pyspark, ITK (C++), simpleITK (Python), openCV (python).

Patents

- Madabhushi, A, Asaeikheybari, G, **Hiremath, A**, Chung, M.K, Barnard, K; Cleveland Clinic Foundation Case Western Reserve University, assignee, **“Atlas construction of branched structure for identification of shape differences among different cohorts”**, WIPO (PCT), US20230146428A1, 2022, November (Pending).
- Ulman, S, Prasad, RV, **Hiremath, A**; Koninklijke Philips N.V, assignee, **“Nutrition support systems and methods”**, WIPO (PCT), WO2019063762A1, 2019, April.

Journal Publications

- Vaidya, P, Alilou, M, Hiremath, A, Gupta, A, Bera, K, Furin, J, Armitage, K, Gilkeson, R, Yuan, L, Fu, P, Lu, C, Ji, M, Madabhushi, A., 2022. **An End-to-End Integrated Clinical and CT-Based Radiomics Nomogram for Predicting Disease Severity and Need for Ventilator Support in COVID-19 Patients: A Large Multisite Retrospective Study**, Frontiers in Radiology 2, Jan 2022.
- **Hiremath, A.**, Bera, K., Yuan, L., Vaidya, P., Alilou, M., Furin, J., Armitage, K., Gilkeson, R., Ji, M., Fu P., Gupta, A., Lu, C., and Madabhushi, A., 2021. **Integrated Clinical and CT based Artificial Intelligence nomogram for predicting severity and need for ventilator support in COVID-19 patients: A multi-site study**, IEEE Journal of Biomedical and Health Informatics, Aug, 2021.
- **Hiremath, A.**, Shiradkar, R., Fu, P., Mahran, A., Rastinehad, A.R., Tewari, A., Tirumani, S.H., Purysko, A., Ponsky, L. and Madabhushi, A., 2021. **An integrated nomogram combining deep learning, Prostate Imaging-Reporting and Data System (PI-RADS) scoring, and clinical variables for identification of clinically significant prostate cancer on biparametric MRI: a retrospective multicentre study**. The Lancet Digital Health, 3(7), pp.e445-e454.
- **Hiremath, A.**, Shiradkar, R., Merisaari, H., Prasanna, P., Ettala, O., Taimen, P., Aronen, H.J., Boström, P.J., Jambor, I. and Madabhushi, A., 2021. **Test-retest repeatability of a deep learning architecture in detecting and segmenting clinically significant prostate cancer on apparent diffusion coefficient (ADC) maps**. European radiology, 31(1), pp.379-391.
- Mahadevaiah, G, **Hiremath, A**, Agarwal, V, Kumaraguru, P, and Dekker, A **“Automating data mining of medical reports”**, International Journal of Computer Science and Technology (IJCST) Vol.01, No.2, March 2019.

Conference Publications

- Roge, A, **Hiremath, A.**, Sobota, M., Tirumani SH., Bittencourt LK., Ream J., Ward R., Olaniyan H., Verma S., Purysko A, Madabhushi A., Shiradkar R., 2022, March. **Evaluating the sensitivity of deep learning to human reader based lesion delineations in identifying clinically significant prostate cancer on MRI**, In Medical Imaging 2022: Computer-Aided Diagnosis. International Society for Optics and Photonics.
- **Hiremath, A.**, Yuan, L., Shiradkar, R., Bera, K., Viswanathan V.S., Vaidya, P., Furin, J., Armitage, K., Gilkeson, R., Ji, M., Fu P., Gupta, A., Lu, C., and Madabhushi, A., 2021. **LuMiRa: An Integrated Lung Deformation Atlas and 3D-CNN model of Infiltrates for COVID-19 Prognosis..** The Medical Image Computing and Computer Assisted Intervention (MICCAI) (Accepted).
- **Hiremath, A.**, Shiradkar, R., Braman, N., Prasanna, P., Rastinehad, A., Purysko, A. and Madabhushi, A., 2020, March. **A combination of intra-and peri-tumoral deep features from prostate bi-parametric MRI can distinguish clinically significant and insignificant prostate cancer**. In Medical Imaging 2020: Computer-Aided Diagnosis (Vol. 11314, p. 113140M). International Society for Optics and Photonics.

Peer-reviewed Abstracts/Posters

- **Hiremath, A**, Bera, K, Gupta, A, Velcheti, V, Madabhushi, A, and Braman, N, **“Radiomic signature of identifies outcome and prognosis to immune checkpoint inhibitors (ICI) in PD-L1 low non-small cell lung cancer (NSCLC)”**, 2023 World Conference on Lung Cancer (WCLC), Singapore, September 9-12, 2023.
- **Hiremath, A**, Li, H, Clement, A, Gupta, A, Velcheti, V, Madabhushi, A, and Braman, N, **“Single-click radiomic classifier is associated with response and prognosis in non-small cell lung cancers (NSCLC) treated with immune checkpoint inhibitors”**, American Society of Clinical Oncology (ASCO), Chicago, June 2-6th, 2023.
- Sompalle, P., Roge, A., Sobota, M., **Hiremath, A.**, Tirumani, S.H., Kayat Bittencourt, L., Purysko, A., Viswanath, S., Madabhushi, A., and Shiradkar, R., **“Association of MR image quality measures with diagnostic accuracy and inter-reader agreement of PI-RADS for detection of prostate cancer”**, 32nd Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Toronto, June 3-8, 2023.
- Asaeikheybari, G., **Hiremath, A.**, Shiradkar, R., El-Harasis, M., Shoemaker, B., Barnard, J., Gupta, A., Chung, M., Madabhushi, A., Anant, **“Computationally identified shape differences in the Left Atrium on pre-ablation CT scans appear to be associated with recurrence of atrial fibrillation”**, American Heart Association (AHA), Boston, Nov 13-15th, 2021.
- Shiradkar R, Sobota M, Bittencourt LK, Tirumani SH, Ream J, Ward R, **Hiremath, A**, Roge A, Mahran A, Purysko A, Ponsky L, Madabhushi, **“Sensitivity of radiomics to inter-reader variations in prostate cancer delineation on MRI should be**

considered to improve generalizability", 29th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), May 15-20, 2021.

- **Hiremath, A**, Shiradkar, R, Merisaari, H, Prasanna, P, Ettala, O, Taimen, P, Aronen, H, Boström, P, Pierce, J, Tirumani, S, Rastinehad, A, Jambor, I, Purysko, A, and Madabhushi, A, **"A deep learning network along with PIRADS can distinguish clinically significant and insignificant prostate cancer on bi-parametric MRI: A multi-center study"**, American Urological Association (AUA), Washington DC, May 15-16th, 2020.
- **Hiremath, A**, Shiradkar, R, Merisaari, H, Prasanna, P, Ettala, O, Taimen, P, Aronen, H, Boström, P, A, Jambor, I, and Madabhushi, A, **"Test-retest repeatability of convolutional neural networks in detecting prostate cancer regions on diffusion weighted imaging in 112 patients"**, 28th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Sydney, Australia, April 18-23, 2020.
- Merisaari, H, Shiradkar, R, Toivonen, J, **Hiremath, A**, Khorrami, M, Montoya Perez, I, Pahikkala, T, Taimen, P, Verho, J, Boström, P, Aronen H, Madabhushi, A, and Jambor, I, **"Repeatability of radiomics features for prostate cancer diffusion weighted imaging obtained using b-values up to 2000 s/mm²"**, 27th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Montreal, Canada, May 11-16, 2019
- Merisaari, H, **Hiremath, A**, Shiradkar, R, Montoya Perez, I, Toivonen, J, Taimen, P et al., **"Repeatability of Machine Learning Classification of Prostate Cancer Using Diffusion Weighted Imaging: Short-term Repeatability Study of 112 Men Who Underwent Two Prostate MR Examinations Before Prostatectomy"**, Annual Meeting of the Radiologic Society of North America (RSNA), Chicago, U.S.A, November 29 - December 4, 2019

Honors & Awards

2021	MICCAI Student Travel Award , The Medical Image Computing and Computer Assisted Intervention	Strasbourg, France
2021	Excellence in Graduate Teaching , Case Western Reserve University	Cleveland, U.S.A
2020	I-Corps, Ohio Grant Funding , Case Western Reserve University	Cleveland, U.S.A
2020	Runner up, Trainee competition , ISMRM MR of cancer study group	Sydney, Australia
2020	Educational Stipend , International Society for Magnetic Resonance in Medicine (ISMRM)	Sydney, Australia
2020	Professional Development Travel Funding , Case Western Reserve University	Cleveland, U.S.A
2020	Trainee Travel Award , Case Comprehensive Cancer Center	Cleveland, U.S.A
2020	Runner up , Art of STEM Competition, Case Western Reserve University	Cleveland, U.S.A
2018	1st Place , Cleveland Medical Hackathon, 2018	Cleveland, U.S.A
2017	1st Place , Deep Learning for Visual Computing Challenge, 2017	Kolkata, India

Projects

Response prediction and prognosis of non-small cell lung cancer patients treated with immune checkpoint inhibitors

Picture Health, USA

- Single click semi automated segmentation of lung cancer lesions
- Radiomic feature extraction, pre-processing, feature selection and training of machine learning models to predict response to immunotherapy across multiple end-points (best overall response, overall survival and progression free survival)

An Integrated Lung Deformation Atlas and 3D-CNN model of Infiltrates for COVID-19 Prognosis

Case Western Reserve University, USA

- A new imaging biomarker using population atlas-based approach to analyze regions of lung shape distortion differences between COVID-19 patients with mild and severe disease.
- Integrating 3D-CNN characterization of lung deformation regions and lung infiltrate regions on lung CT into a novel framework (LuMiRa) for better identifying patients with severe disease requiring mechanical ventilation.

Integrated deep learning and a clinical nomogram to identify which COVID-19 patients would end up needing a mechanical ventilation

Case Western Reserve University, USA

- Segmentation of lung lesions such as ground-glass opacities and consolidations using U-Net on baseline Chest CT scans.
- Direct attention based convolutional neural network for identifying COVID-19 patients who might need mechanical ventilation
- Univariate and multivariate analysis of various routinely collected lab parameters and integration with deep learning to construct and integrated nomogram.

Distinguishing clinically significant and insignificant prostate cancer on bi-parametric MRI

Case Western Reserve University, USA

- Using multiple instance learning based convolutional neural networks to aggregate patch level decisions to lesion level decisions.
- Extracting deep features from intra- and peri- tumoral region and training a machine learning model to distinguish clinically significant and insignificant prostate cancer on MRI

Test-retest repeatability of convolutional neural networks in segmenting and detecting clinically significant prostate cancer regions on apparent diffusion coefficient maps

Case Western Reserve University, USA

- Evaluating the repeatability of convolutional neural networks in segmenting and detecting clinically significant prostate cancer regions by training two models on test-retest scans of ADC maps.
- Analyzing the effect of inter- scan ground-truth segmentation repeatability with network's segmentation repeatability.

Patient Analytics Query Engine (PAQE)

Philips Research, India

- Designing ETL (Extract, Transform, Load) for large publicly available relational medical databases like MIMIC, ERI.
- Designing interfaces for performing complex queries from the Elasticsearch database.
- Designing a machine Learning interface to query and obtain the desired training and test data.

Inverse Planning and Optimization of Dwell position and Time in HDR Brachytherapy using Linear and Quadratic Programming, Mixed Integer Programming

Philips Research, India

- Optimization of parameters like dwell positions and dwell time for giving exact dosage of radiation to cancer tissues while minimizing radiation to healthy tissues surrounding the cancer tissues.

Never Ending Learning of Sound

CMU - NITK Winterschool, India

- Collecting different categories of sound by using a web crawler.
- Extracting different features related to the sound, cleaning up and generation of training and test data set.
- Training a classifier model using bag-of-frames approach using K-means to generate a codebook of different sounds and evaluating with different classifiers like SVM, KNN and Random Forests.

Environmental Sound Classification using Acoustic Features and Texture Features from Spectrogram Image

NITK Surathkal, India

- Audio denoising using wavelets, silence removal and segmentation using K-means on spectrogram image.
- Extracting acoustic features like Mel-Frequency Cepstrum Coefficients (MFCCs), Root Mean Square Error (RMSE), Zero Crossing Rate (ZCR), spectral features and Gray-Level Co-occurrence Matrix (GLCM) features from spectrogram image of an audio.
- Evaluating the approach with publicly available datasets ESC-10, ESC-50, Freiburg-106 dataset.

Recognition

- **Bioethics in the Age of COVID-19: Laundering bias and saving lives through**
- **Indian-Origin Engineer Builds AI To Predict If A Covid Patient Will Need Ventilator**
- **Case Western Reserve University lab using digital images of chest scans from coronavirus patients from Wuhan, China, to teach its computers to triage patients**
- **Test-Retest Repeatability of a Deep Learning Architecture in Detecting and Segmenting Clinically Significant Prostate Cancer on Apparent Diffusion Coefficient (ADC) Maps - Beyond the Abstract- Featured in UroToday**
- **BME Graduate Students Win Top Prizes at the Cleveland Medical Hackathon Event**
- **44 students prepare 10 projects at Winter School**