Amogh **Hiremath**

Senior AI Scientist

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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*

- Research and development of AI tools on medical images for disease diagnosis, characterization and prognosis.
- Data engineering, processing and building end-end machine learning frameworks for analysing medical images

I-Corps@Ohio *Cleveland, Ohio, US*

Entrepreneurial Lead *Aug. 2020 - Nov. 2020*

- A customer discovery and business model innovation program to assess technologies, enhance the business acumen of research faculty and students and expand their entrepreneurial network relationships.
- Interviewing clinicians to understand the market potential of AI tool for prostate cancer risk stratification

Philips Reasearch, 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 Institue of Technology, Karantaka *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 (>5 years), JAVA (1 year), C# (6 months), LaTeX (2 years)

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

Libraries pytorch, numpy, matplotlib, pandas, sklearn, scipy, pyspark, ITK (C++), simpleITK (Python), openCV (python).

Patents

- Ulman, S, Prasad, RV, **Hiremath, A**; Koninklijke Philips N.V, assignee, **"Nutrition support systems and methods"**, WIPO (PCT), WO2019063762A1, 2019, April.

Journal Publications

- **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., 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 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 28th 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, Frace*
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

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 distension 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

- Segmentaion 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 Coeffients (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**