

# Amogh Hiremath

GRADUATE RESEARCH ASSISTANT

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## Education

### Case Western Reserve University

Cleveland, Ohio, US

PH.D. IN BIOMEDICAL ENGINEERING

Aug. 2018 - PRESENT

- 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

### 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.
- Team ProstaCAD (prostate cancer computer aided diagnosis tool): Interviewing clinicians to understand the market potential of the research we do. In our case, an AI tool for prostate cancer risk stratification

### 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

- Jointly conducted by CMU and NITK focusing on multimedia analysis, neural networks for data analysis and computational models for civic problems.
- In a team of five, built a machine learning model to classify different environmental sounds - "An Approach Towards Never Ending Learning of Sound".

## Skills

**Programming** Language (Experience): Python (5 years), JAVA (1 year), C# (6 months), LaTeX (1 year)

**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

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

## Journal Publications

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- **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 (Under Review).
- Vaidya, P., Alilou, M., **Hiremath, A.**, Gupta, A., Bera, K., Fu P., Gilkeson, R., Armitage, K., Furin, J., Yuan, L., Lu, C., Ji, M., and Madabhushi, A., 2021. **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 multi-site retrospective study**, EBioMedicine (Under Review).
- **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

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- **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

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- 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

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

## Projects

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### **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**

- 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**

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- **Case Western Reserve University lab using digital images of chest scans from coronavirus patients from Wuhan, China, to teach its computers to triage patients**  
<https://thedaily.case.edu/researchers-using-artificial-intelligence-to-find-out-which-covid-19-patients-are-most-likely-to-need-ventilators>
- **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**  
<https://www.urotoday.com/recent-abstracts/urologic-oncology/prostate-cancer/123594-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.html>
- **CCIPD PhD student receives three travel awards**  
<https://engineering.case.edu/centers/ccipd/content/ccipd-phd-student-receives-three-travel-awards>
- **BME Graduate Students Win Top Prizes at the Cleveland Medical Hackathon Event**  
<https://engineering.case.edu/ebme/Cleveland-Medical-Hackathon-Event>
- **44 students prepare 10 projects at Winter School**  
<https://www.deccanherald.com/content/449978/44-students-prepare-10-projects.html>