Gautam Rajendrakumar Gare

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Education

Carnegie Mellon University — Pittsburgh, PA

Doctor of Philosophy in Robotics — (start) Aug 2021

- First-year Ph.D. student at the Robotics Institute of Carnegie Mellon University with a research focus on video understanding targeting both natural and medical image domains.

Master of Science in Electrical and Computer Engineering, GPA: 4.00/4.00 — Dec 2020

- Courses: SLAM, Computer Vision, Convex Optimization, Intro to Deep Learning, Intro to Machine Learning, Image and Video Processing, Machine Learning for Signal Processing, Speech Recognition and Understanding

BMS College of Engineering — Bangalore, India

Bachelor of Engineering in Electronics and Communication Engineering, GPA: 9.4/10.0 — May 2016

Research Experience

Action Recognition in Clinical Setting — Jun 2020–present

Manager: Hadi Kiapour | Advisors: Prof. Fei-Fei Li and Prof. Ehsan Adeli — DawnLight Inc.

- Developing efficient model architecture for action classification on both RGB and IR videos, for classifying patient actions with a focus on detecting 'patient-fall' action.
- Our model achieved 85% accuracy in detecting patient actions for cross-subject validation.

Lung Ultrasound Video Analysis for Assessing Patient Severity — Feb 2021–present

Advisor: Prof. John Galeotti, CMU — Biomedical Image Guidance Lab, CMU

- Developing TSM based spatio-temporal models to grade the presence of bio-markers (A-lines, B-lines and Pleural lines) in lung ultrasound clips.
- Assessing the patient severity using the detected grades of the various bio-markers.

Action Recognition in Untrimmed Videos - NIST ActEV Challenge — May 2020–May 2021

Advisors: Prof. Aswin C. Sankaranarayanan and Prof. Deva Kannan Ramanan, CMU — Image Science Lab, CMU

- Developing efficient model architecture for action classification on untrimmed videos, capable of operating directly on full-res untrimmed video streams with a strong emphasis on inference speed and accuracy.
- Our model processes videos 12.5x faster than real-time with comparable accuracy under set conditions.

Robust Loss functions for Noisy Labels — Feb 2020–Dec 2020

Advisor: Prof. John Galeotti, CMU — Biomedical Image Guidance Lab, CMU

- Introduced a novel projective loss function that exploits class similarity for robust learning, unlike traditional loss functions that work agnostic to such class similarities, under review at ICCV 2021.
- Our approach is able to achieve 88.5% accuracy even with 80% asymmetric noisy labels on the CIFAR10 dataset, and 84.97% accuracy on Food-101N, and 76.92% accuracy on ImageNet, without any training enhancement.

Dense & Diagnostic Semantic Segmentation of Ultrasound — Jun 2020–Sep 2020

Advisor: Prof. John Galeotti, CMU — Biomedical Image Guidance Lab, CMU

- Developed U-Net based CNNs for semantic segmentation of Pneumonia bio-markers (A-lines, B-lines and Pleural lines) for assistive medical care.
- Performed diagnostic classification into Healthy, Pneumonia and COVID-19 by directly operating on segmentation output achieving 84.9% accuracy, accepted at ISBI 2021.

Ultrasound raw RF waveform analyses using CNN Sep 2019–Apr 2020
Advisor: Prof. John Galeotti, CMU Biomedical Image Guidance Lab, CMU

– Developed W-Net, a CNN architecture that analyzes spectral content of raw ultrasound RF waveform, outperforms existing architectures for breast lesion segmentation & diagnosis, providing the first quantitative proof of the utility of RF data in breast cancer detection.

Multi-Person 3D Human Pose Estimation in Occluded Scenarios Dec 2019–Feb 2020
Advisor: Prof. Anthony Rowe, CMU CONIX Research Centre, CMU

– Developed a custom fisheye stereo vision system using the Taylor omnidirectional camera model, to estimate 3D human pose from 2D key points detected using OpenPose deep learning model, for VR & AR applications.

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Publications

[1] **Gare, Gautam Rajendrakumar**, W. Chen, A. L. Y. Hung, E. Chen, H. V. Tran, T. Fox, P. Lowery, K. Zamora, B. P. deBoisblanc, R. L. Rodriguez, and J. M. Galeotti, "The role of pleura and adipose in lung ultrasound ai", accepted for *LL-COVID19 MICCAI 2021 workshop*, 2021.

[2] **Gare, Gautam Rajendrakumar**, B. P. deBoisblanc, R. L. Rodriguez, and J. M. Galeotti, "Weakly supervised contrastive learning for better severity scoring of lung ultrasound", under review at *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2021*, 2021.

[3] **Gare, Gautam Rajendrakumar** and J. M. Galeotti, "Exploiting Class Similarity for Machine Learning with Confidence Labels and Projective Loss Functions", under review at *Neural Information Processing Systems (NeurIPS) Conference*, [**paper-link**], 2021.

[4] **Gare, Gautam Rajendrakumar**, A. Schoenling, V. Philip, H. V. Tran, B. P. deBoisblanc, R. L. Rodriguez, and J. M. Galeotti, "Dense pixel-labeling for reverse-transfer and diagnostic learning on lung ultrasound for covid-19 and pneumonia detection", in *2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI)*, [**paper-link**], 2021, pp. 1406–1410.

[5] **Gare, G.R.**, J. Li, R. Joshi, R. Magar, M. P. Vaze, M. Yousefpour, R. L. Rodriguez, and J. M. Galeotti, "W-Net: Dense and diagnostic semantic segmentation of subcutaneous and breast tissue in ultrasound images by incorporating ultrasound RF waveform data", under review at *Medical Image Analysis (MIA), MICCAI Journal*, [**paper-link**], 2020.

[6] **Gare, G.R.**, J. Li, R. Joshi, M. P. Vaze, R. Magar, M. Yousefpour, R. L. Rodriguez, and J. M. Galeotti, *W-net: Dense semantic segmentation of subcutaneous tissue in ultrasound images by expanding u-net to incorporate ultrasound rf waveform data*, [**paper-link**], 2020. arXiv: 2008.12413 [eess.IV].

[7] R. Chattaraj, S. Khan, A. Dasgupta, **G. Gare**, D. Chatterjee, and S. Bhaumik, "An iteratively optimized resolution to hyper redundancy for dissimilarly doped compliant ipmc actuators", *Mechatronics*, vol. 46, pp. 154–167, 2017, [**paper-link**], ISSN: 0957-4158.

[8] **Gare, G.R.**, K. Peter, and A. L. R, "Custom 8 Bit Microprocessor Designing and Implementation on FPGA Board", in *International Journal of Electrical Electronics Computer Science Engineering, Special Issue – News*, [**paper-link**], 2016.

[9] **Gare, Gautam Rajendrakumar**, "Autonomous Vehicle Technology - A Brief Overview of The Technology and Current Trends in Autonomous Systems", in *International Journal of Modern Trends in Engineering and Research*, [**paper-link**], 2016.

Work Experience

DawnLight, Palo Alto, USA

Computer Vision Research Intern — Jun 2021–Aug 2021

- Computer Vision and Deep Learning researcher working on Human Action recognition in clinical settings.

Carnegie Mellon University, Pittsburgh, USA

Research Associate — Feb 2021–May 2021

- Computer Vision and Deep Learning researcher with a focus on video understanding and tracking.

Sling Media R&D, Bangalore, India

Senior Data Scientist — May 2019–Jul 2019

- Worked on feature modeling to analyze customer trends and predicted the churn rate with an accuracy of 85%.

Senior Software Engineer — Jul 2016–Apr 2019

- Lead the development of the UI interface of Sling TV Android App for AirTV Player platform.

Patents

- Inventor for *"Apparatuses, Systems and Methods for Adding Functionalities to control Buttons on a Remote-Control Device"*, granted on Jan 28, 2020. [**patent-link**]
- Co-inventor for *"System and Method for Labeling Ultrasound Data"*, applied on Jun 12, 2020.
- Inventor for *"Add-On Smart Device for Charging Portable Device"*, applied on Oct 24, 2016. [**patent-link**]
- Co-inventor for *"An Improved Faucet with Automatic Flow Control using Proximity Sensor"*, applied on Feb 26, 2016. [**link**]

Scholarships and Awards

- Awarded co-authored grant application for NSF-funded XSEDE PSC compute resource for 130,500 hours of NVIDIA V100 GPU usage. Dec 2020
- Awarded co-authored grant application for Neocortex EUP, a NSF-funded XSEDE PSC compute resource. Oct 2020
- Awarded summer research fellowship by Indian Academy of Sciences, Indian National Science Academy, and The National Academy of Sciences, India. Jan 2015

Skills

- **Programming Languages:** Python, Java, C++, R, C **IDEs:** Visual Studio, MATLAB, RStudio, Jupyter