Gautam Rajendrakumar Gare

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EDUCATION

Carnegie Mellon University   Pittsburgh, PA
Doctor of Philosophy in Robotics   (start) Aug 2021

- Second-year Ph.D. student at the Robotics Institute, advised by Prof. John Galeotti and Prof. Deva Ramanan, with a research focus on applying causal techniques to help improve interpretability and reliability of neural networks for medical image analysis.
- Courses: Probabilistic Graphical Models, Advance Intro to Machine Learning

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

Causal Synthetic Data Generation   Sep 2022–present
Advisor: Nan Rosemary Ke, Prof. John Galeotti and Prof. Deva Kannan Ramanan, CMU   CMU

- Generating synthetic samples by sampling from a discovered casual graph using ENCO model.
- Boosts downstream model performance by 3% on using synthetic data on UCI Heart disease dataset.

Generic Human-Interpretable Lung Ultrasound Biomarkers   Oct 2021–present
Advisor: Prof. John Galeotti and Prof. Deva Kannan Ramanan, CMU   Biomedical Image Guidance Lab, CMU

- Developed generic lung-ultrasound biomarker features in collaboration with clinicians which enables the use of causal learning techniques on lung-ultrasound.
- Downstream model performance on human-interpretable biomarkers is on-par with deep learning based features.

Action Recognition in Clinical Setting   Jun 2021–Aug 2021
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–Sep 2021
Advisor: Prof. John Galeotti and Prof. Deva Kannan Ramanan, 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.

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.

PUBLICATIONS

[1] **Gare, Gautam Rajendrakumar**, J. M. Galeotti, D. K. Ramanan, and N. R. Ke, "Synthetic data generation by sampling from learnt causal graph", under review at *NeurIPS 2022 Workshop on Causality for Real-world Impact*, 2022.

[2] **Gare, Gautam Rajendrakumar**, T. Fox, P. Lowery, K. Zamora, H. V. Tran, L. Hutchins, D. Montgomery, A. Krishnan, D. K. Ramanan, R. L. Rodriguez, and et al., "Learning generic lung ultrasound biomarkers for decoupling feature extraction from downstream tasks", 2022, [**paper-link**].

[3] **Gare, Gautam Rajendrakumar**, 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", *Medical Image Analysis*, vol. 76, p. 102 326, Feb. 2022, [**paper-link**], ISSN: 1361-8415.

[4] **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", *Clinical Image-Based Procedures, Distributed and Collaborative Learning, Artificial Intelligence for Combating COVID-19 and Secure and Privacy-Preserving Machine Learning*, pp. 141–149, 2021, [**paper-link**], ISSN: 1611-3349.

[5] **Gare, Gautam Rajendrakumar**, H. V. Tran, B. P. deBoisblanc, R. L. Rodriguez, and J. M. Galeotti, "Weakly supervised contrastive learning for better severity scoring of lung ultrasound", preprint on arXiv [**paper-link**], 2022.

[6] **Gare, Gautam Rajendrakumar** and J. M. Galeotti, "Exploiting class similarity for machine learning with confidence labels and projective loss functions", *CoRR*, vol. abs/2103.13607, 2021, preprint on arXiv [**paper-link**]. arXiv: 2103.13607.

[7] **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.

[8] 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.

[9] **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.

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

Academic/Teaching Experience

- Teaching assistant for *"16-720B - Computer Vision"* course under Prof. Deva Ramanan during Spring, 2022.
- Invited panel speaker for the LLCOVID19 MICCAI 2022 workshop during Aug, 2021.
- Teaching assistant for *"16-720A - Computer Vision"* course under Prof. Srinivasa Narasimhan during Fall, 2021.
- Reviewer for MICCAI 2022 conference.
- Mentored undergraduate student as part of CMU AI Mentoring Program 2021.
- Media Coverage - Megan Harris "Seeing Beneath The Surface", LINK magazine of CMU's School of Computer Science, Summer 2022 Issue. [article]

Skills

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