

# Rajalaxmi Rajagopalan

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## Education

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**University of Illinois, Urbana-Champaign**

*PhD, ECE. Expected Graduation: May 2026*

Relevant Coursework - Optimization, vector space signal processing/optimization, Random processes, Machine Learning for Signal Processing, Information Theory, Statistical Inference

Fall 2021 - Present

GPA 4.0

**National university of Singapore**

*Master of Science*

Department of Electrical & Computer Engineering

Fall 2018 - Spring 2020

GPA 4.45/5

**CEG, Anna University, India**

*Bachelors in Engineering*

Department of Electrical & Computer Engineering

Fall 2012 - Spring 2016

GPA 9.75/10

## Publications

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- [1] **R. Rajagopalan**, Y.L. Wei, and R.R. Choudhury, "Sample-Constrained Black Box Optimization for Audio Personalization", *AAAI*, February 2024.
- [2] **R. Rajagopalan**, Y.L. Wei, and R.R. Choudhury, "Audio Personalization through Human-in-the-loop Optimization", *NeurIPS Workshop on ML for Audio*, December 2023.
- [3] Y.L. Wei, **R. Rajagopalan**, B. Islam, and R.R. Choudhury, "Self-supervised Speech Enhancement using Multi-Modal Data", *NeurIPS Workshop on ML for Audio*, December 2023.
- [4] **R. Rajagopalan** and C. K. Tham, "Active Learning for IoT Data Prioritization in Edge Nodes Over Wireless Networks", *IECON 2020 The 46th Annual Conference of the IEEE Industrial Electronics Society*, Singapore, 2020.

## Honors and Awards

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Exceptional Academics Award

Silver Medal- Department second rank award

Gold Medal- Excellence in Mathematics

National University of Singapore

CEG, Anna University

CEG, Anna University

Spring 2020

Spring 2016

Spring 2013

## Research Experience

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**Graduate Student Researcher**

*Signals & Inference Research Group (SiNRG)*

○ Sample Constrained Black-Box Optimization using techniques like **Bayesian Optimization Gaussian Process Regression** for Human-in-the-loop personalization of content: audio, images, etc.

○ Multi-modal universal speech enhancement through self-supervised learning.

○ Other projects in acoustic signal processing and earable computing.

Fall 2021 - Present

UIUC

**Graduate Student Researcher**

*Wireless Networking Group*

○ **Distributed modeling and Bayesian statistical inference** in resource-constrained large-scale distributed parallel computing areas: wireless sensor networks and IoT.

Fall 2018 - Spring 2021

NUS, Singapore

**Undergraduate Student Researcher**

*Integrated Systems Lab (ISL)*

○ ANUSAT-2 satellite (QB50 European Research Mission)

<https://www.qb50.eu/index.php/news.html>

Spring 2014 - Spring 2016

CEG, India

## Work Experience

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**Applied Scientist Intern**

*AWS AI Labs*

○ Speech and audio-related problems in Transcribe AWS team.

○ Self-Supervised Universal Speech Enhancement.

Summer 2024

**Teaching Assistant**

*UIUC*

○ Teaching assistant of Mobile Computing and Algorithms for IoT courses.

○ Design and grade lab assignments and tutorial sessions.

Spring 2023

**Research Assistant**  
*SiNRG, UIUC*

Fall 2021 - Present

- Conducting research in acoustic signal processing and earables.

**Teaching Instructor**  
*NUS*

Spring 2020 - Spring 2021  
Singapore

- Curated lecture content and conducted lectures for introductory courses in the Department of ECE: Signals & Systems, Introduction to Probability & Statistics, Machine Learning, and Introduction to Communication Networks.
- Conducted workshops on AWS DeepRacer and mentored teams participating in AWS DeepRacer challenges in 2020 and 2021.

**Network Planner - Assistant manager**  
*Airtel*

June 2016 - July 2018  
Gurgaon, India

- Implementation of IMS (IP Multimedia Subsystem) architecture like VoLTE and basic SDN structures for IP/MPLS backhaul networks.
- Planning and expansion of 4G LTE/LTE-A BTS sites with MIMO, OFDM, and carrier aggregation for ubiquitous 4G coverage.

## Skills

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- **Languages :** Python, R, C, C++, VHDL, MATLAB, VBA
- **Hardware Platforms :** USRP, Raspberry PI, BlackFin BF609, BladeRF, SDR, Cyclone -II FPGA, Stratix-III FPGA, TIVA.
- **Certifications:** Cisco Network Master
- **Languages:** English, Tamil, Hindi, French, Japanese
- **Extracurriculars:** Trained Indian classical violinist

## Selected Projects

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**Self-supervised Universal Speech Enhancement**

*Summer 2024*

Ritwik Giri, Zhiqiang Tang - AWS AI Labs

- Speech is often corrupted by many distortions like ambient noise, reverberation, limited bandwidth, codec artifacts, interfering speakers etc. In practical scenarios, there is lack of high-quality clean speech references. Thus, we developed a universal speech enhancer that (1) can tackle a broad range of distortions simultaneously, (2) trained without access to large-scale clean speech corpus, (4) trained in a self-supervised manner, and (3) offers robust performance for enhancement downstream tasks.
- We use a pre-training-finetuning framework. A Masked Spectrogram Autoencoder based on Vision transformers is pre-trained on a large amount of unlabeled noisy data. An augmentation stack adds further distortions to the noisy input data like reverberation, multi-speaker mixtures, codec artifacts, etc. The masked autoencoder model learns to remove the added distortions along with reconstructing the masked regions of the spectrogram during pre-training. The pre-trained embeddings are then used by fine-tuning models trained on a small amount of paired data for specific downstream tasks like denoising, dereverberation, source separation, and bandwidth extension.

**Sample Constrained Black-Box Optimization for Personalization**

*2021-Present*

Prof Dr. Romit Roy Choudhury - SiNRG, UIUC

- We consider the problem of personalizing content to a user's taste. Content could be audio signals in a hearing aid, customized images, etc. Given the content, we intend to adjust it with a linear filter  $h$ . Our goal is to find the optimal filter  $h$  that will maximize the user's personal satisfaction  $f(h)$ . Finding  $h$  is difficult as the function  $f(h)$  is unknown. Optimizing  $f(h)$  using the human in the loop, while constrained by the number of samples is a sample-efficient black-box optimization problem. We build on the Bayesian Optimization framework. Our techniques are extended to other black-box problems in many areas beyond personalization.
- We achieve sample efficiency by developing kernel learning techniques that learn a unique kernel that models function structure.

**Self Supervised IMU-based Speech Enhancement**

*2021-Present*

Prof Dr. Romit Roy Choudhury - SiNRG, UIUC

- Extracting compact representations of personalized speech features like base frequencies using representation models like autoencoders from captured surface vibrations over the face from the speakers' throat by IMUs in earphones, to perform personalized denoising of speech corrupted by over-the-air interference.

**Master's Thesis: Active Learning for IoT Data Prioritization in Edge nodes over Wireless Networks**

*2019*

Prof Dr. Chen-Khong Tham - WICOMM, NUS

- Developed Active learning-based and Bayesian ML-based techniques to improve the robustness of distributed deep learning models in the presence of practical wireless communication channel issues for the application of predictive maintenance of industrial machines.
- Setup a distributed predictive maintenance testbed with the goal of inferring a global parameter like machine state using distributed machine learning models with message passing strategies.

**Design of Anusat-2 Nano-Satellite (QB50 European Research Mission)**

*2015*

Prof Dr. P. V. Ramakrishna - ISL, CEG

- Designed end-to-end protocol stack including the telecommand and telemetry packet structure for communication with the OBC (On-Board Computer) and FIPEX payload of the satellite and ground station.
- Designed the MCD (Mission control data center) that creates a repository of all payload data, periodic housekeeping data, and Whole Orbit Data, runs scheduled scripts to send periodic commands to the satellite for monitoring the status of various modules.
- Calibration and testing of the ADCS (Attitude Detection and Control System) responsible for stabilizing the satellite in its orbit. Coding the OBC to control the various modules like ADCS, FIPEX payload, solar panels, comms system, etc., and error handling procedures.