Sachin Goyal

Research Fellow, Machine Learning & Optimization Group
Microsoft Research India
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri

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Education

Indian Institute of Technology Bombay *India*
B.Tech in Electrical Engineering with Minors in Computer Science and Engineering *July '15 - May '19*
GPA: 9.11/10
Advisor: Prof. Subhasis Chaudhuri

Research Interests

Theoretical and Applied Aspects of Resource/Systems Aware Machine Learning,
Robust Representation Learning, Domain Generalization and Compressed Sensing

Publications

DROCC: Deep Robust One-Class Classification.
Sachin Goyal, Aditi Raghunathan, Moksh Jain, Harsha Simhadri and Prateek Jain.
In *International Conference on Machine Learning (**ICML, 2020**).* [Paper]

Improving Self Super Resolution in Magnetic Resonance Images.
Sachin Goyal, Can Zhao, Amod Jog, Jerry L. Prince, Aaron Carass.
In ***SPIE** Conference on Medical Imaging and Biomedical Applications, **2018**.* [Paper]

PAL: Pretext-based Active Learning.
Shubhang Bhatnagar, **Sachin Goyal**, Darshan Tank, Amit Sethi.
In submission at ***AAAI** Conference on Artificial Intelligence, **2021**.* [Paper]

Patent

Indoor Distance Estimation using LSTMs over WLAN Network
Pranav Sankhe, Saqib Azim, **Sachin Goyal** , Tanya Choudhary, Kumar Appaiah , Sukumar Srikant
India Patent Application 201821047043, filed Dec' 2018. Patent Pending.
In *IEEE Workshop on Positioning, Navigation and Communications (WPNC), 2019.* [Paper]

Research Experience

Robust Anomaly Detection and LowFPR Classifiers for WakeWord Detection [ICML 2020]
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri *Sept '19 - May '20, **Microsoft Research***

Developed a robust anomaly detection method, DROCC, which exploits a low dimensional manifold assumption on normal data to generate informative "abnormal" examples via adversarial perturbation. Proposed method is domain knowledge independent, offering upto **20%** increase in accuracy over SOTA.

Further studied a more practical problem of wake-word detection on smartphones using lowFPR classifiers (less misfires), robust to arbitrary distribution of negatives. Proposed a *novel experimental setup*, achieving upto **10%** more accuracy using our theoretically sound approach. ***(Published at ICML '20)***

EdgeML : Phonemes based Keyword Spotting on Resource Constrained Devices [Project]
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri *Ongoing, **Microsoft Research***

Edge Machine **L**earning aims to develop ML algorithms deployable on resource constrained devices (microcontrollers). I developed **1mB** size phoneme prediction models, used for building flexible and robust to extreme noise keyword spotting schemes. *Currently*, I am building a *prototype*, deploying the models on a Cortex M4 processor and also testing them for possible use in Microsoft's "Hey Cortana" prediction pipeline on Windows kernel. ML codes, pipeline and C reference files have all been open sourced.

Deep Neural Dictionaries : Learning with Reduced Dictionary Size
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri *Ongoing,* ***Microsoft Research***

Proposed inference time adaptable dictionary learning method using convolutions and RNN based updates, for sparse data representation and compression. Achieved a **10x** reduction in the learnt dictionary sizes compared to standard classical approaches, easing out the deployment on resource constrained device.

Indoor Positioning System Using WiFi [Paper]
Advisors: Prof. Kumar Appaiah and Prof. Sukumar Srikant *Jan '17 - Jan '19,* ***IIT Bombay***

Design, developed and prototyped a SOTA system to locate an object with high accuracy ($\sim 3cm$) in indoor environments. Used WiFi signal features like RSSI and TDoA, with LSTM as the time-series model. Designed a bot traversing a predetermined path for data collection and location based fine-tuning. ***(India Patent Pending, filed Dec' 2018)***.

PAL : Pretext based Active Learnig [Preprint]
Advisors: Prof. Amit Sethi *Jan '19 - July '20,* ***IIT Bombay***

Proposed an active learning scheme to select the most informative unlabeled samples. Used the difficulty of solving an auxiliary self-supervised task on an unlabeled sample as a proxy measure of the sample's informativeness for neural network training. ***(In submission, AAAI '21)***

DPAC: Digitally Programmable Analog Computer [Prototype]
Advisor: Prof. Mukul Chandorkar *Jan '18 - April '18,* ***IIT Bombay***

Designed, developed and prototyped a real time high frequency linear differential equation solver, based on hardware-in-loop systems. Fabricated the entire circuit on a stand-alone two-layer PCB with on-board power management. Achieved faster and more accurate results compared to digital simulations.

Tomographic Reconstruction from Unknown Random Projections
Advisor: Prof. Ajit Rajwade *Jan '19 - April '19,* ***IIT Bombay***

Used graph laplacian based techniques to sort the unknown angle projections and consequently reconstruct the image. Proposed the use of simulated annealing for sorting the projections.

Internship Experience

Super Resolution of MRI Images [Paper]
Advisor: Prof. Jerry L. Prince *Summer Internship '17,* ***Johns Hopkins University***

Worked on unsupervised super resolution of MRI. Proposed to learn regression between the fourier space of input and it's downsampled counterpart, subsequently using it to super resolve the input image. ***(Published at SPIE '18)***

MirrorLink for Car Infotainment System
Advisor: Praveen Sisodia *Summer Internship '18,* ***Qualcomm, India***

Developed framework for voice transmission from car dashboard microphone to driver's mobile. Enhanced the car's command engine to extract commands from voice and processed it for necessary android actions

Miscellaneous

Awards and Honors

- Undergraduate Research Award, IIT Bombay. 2019
- Among Top 300 in Chemistry (INChO) and Astronomy(INAO) Olympiads. 2015
- Awarded KVPY Fellowship from Government of India - All India Rank 90. 2015
- Awarded NTSE Scholarship from Government of India - All India Rank 6. 2011

Service

- Undergraduate Teaching Assistant : Biology 101 2017
- Hostel System Administrator , IIT Bombay 2019
- National Cadet Corps (NCC), Indian Air Force '15-'17