

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

B.Tech in Electrical Engineering with Minors in Computer Science and Engineering

India

July '15 - May '19

GPA: 9.11/10

Advisor: [Prof. Subhasis Chaudhuri](#)

RESEARCH INTERESTS

Primary: Theoretical and Applied Aspects of Resource/Systems Aware Machine Learning

Others: Machine Learning on Devices (Embedded Devices, IoT Devices, Autonomous Systems),
ML Algorithms Co-designed with and for Efficient Devices and Systems, Machine Perception

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 Learning 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 various products. 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.

INTERSHIP 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
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OTHER PROJECTS

TV Audience Evaluation System

[\[Talk\]](#)

Advisor: BARC India — Inter IIT Tech Meet

*Jan '19 - July '20, **IIT Bombay***

Proposed computer vision based solutions to Broadcast Audience Research Council (BARC), India, for automating TV channel TRP measurement. Implemented real-time commercial recognition system using audio fingerprinting technique.

Human Muscle and Flesh Simulation

[\[Talk\]](#)

Advisor: Prof. Parag Chaudhari

*Jan '19 - April '19, **IIT Bombay***

Proposed a two-way approach of simulating muscles and flesh using different energy formulations and their interaction. Simulated muscles and flesh as a hyper-elastic material with Stable Neo-Hookean Energy formulation. Utilized Newton Solver to solve weak formulation of the problem by implementing finite element method.