Sachin Goyal

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Microsoft Research India
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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 - August '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

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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 *Conference on Computer Vision and Pattern Recognition (**CVPR, 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

Low False Positive Rate (FPR) Classifiers for WakeWord Detection   [ICML 2020]
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri   *Sept '19 - May '20*, **Microsoft Research**

Worked towards developing wake-word systems robust to unseen non wake-word (negative) data distribution. Proposed a *key idea* of modelling positives as lying on a low dimensional manifold and negatives as off the manifold. To make the system robust to very close negatives, generated informative negatives around the manifold via adversarial perturbations. Proposed method, DROCC, gave classifiers with upto 10% better recall at a fixed FPR.
Further, proposed a variant of DROCC for the core ML problem of anomaly detection. Proposed method, which especially is independent of any domain specific knowledge, gave upto 15% increase in AUC over SOTA across domains like timeseries, tabular and image data. ***(Published at ICML '20)***

EdgeML : Phonemes based KeyWord Spotting (KWS) 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 (micro-controllers). Developed **1mB** size phoneme prediction models, used for building robust to noise KWS schemes. Moreover, my approach required minimal train samples for adding new keyword. Deployed the models on an ARM Cortex M7 processor with **only 2MB flash and 1MB RAM**. Models found to be competitive even in non resource constrained settings and are being tested for use in "Hey Cortana" detection on Windows.

Deep Neural Dictionaries : Learning with Reduced Dictionary Size

Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri   *Ongoing,* **Microsoft Research**

Proposed a method to learn inference time adaptable dictionaries 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**

Designed, developed and prototyped a SOTA system to locate an object with high accuracy ($< 10cm$) in indoor environments. Used a LSTM to estimate the relation between strength of received WiFi signals and the distance from a wireless access point. Proposed a setup of 4 static signal receivers to account for indoor topology and signal attenuation effects. Further, designed a bot traversing a predetermined path for train data collection. *(Undergraduate Research Award, India Patent Pending, filed Dec' 2018)*.

PAL : Pretext based Active Learnig   [Preprint]

Advisor: Prof. Amit Sethi   *Jan '19 - July '20,* **IIT Bombay**

Proposed an active learning scheme to select the most informative unlabeled samples to be sent for labelling by an oracle. 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, CVPR '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.

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.

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 images. Proposed to learn a 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