

Sarthak Consul

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Education

Indian Institute of Technology Bombay, Mumbai, India 2016 - 2020
Bachelor of Technology (with Honours) in Electrical Engineering and with Minor in Computer Science and Engineering
○ **Overall CPI:** 9.66/10

Publications

- [1] **Compressed Sensing Approach to Group-testing for COVID-19 Detection**
IEEE Open Journal of Signal Processing 2021
S. Ghosh, R. Agarwal, M.A. Rehan, S. Pathak, P. Agarwal, Y. Gupta, **S. Consul**, N. Gupta, R. Goyal, A. Rajwade, M. Gopalkrishnan
- [2] **Lower Bounds for Policy Iteration on Multi-action MDPs**
IEEE Conference on Decision and Control (IEEE CDC) 2020
K. Ashutosh[†], **S. Consul**[†], Bhishma Dedhia[†], P. Khirwadkar[†], S. Shah[†] and S. Kalyanakrishnan

Research Internships & Projects

- Compressed Sensing Approach to Group-testing for COVID-19 Detection** *IIT Bombay*
Guide: Prof. Manoj Gopalakrishnan, EE & Prof. Ajit Rajwade, CSE *Spring 2020*
- Devised a single-round pooled testing approach, called Tapestry, to detect SARS-CoV-2 viral loads using quantitative RT-PCR that shortens testing time and conserves reagents and testing kits
 - Employed a combination of Combinatorial Orthogonal Matching Pursuit and compressed sensing algorithms along with specially designed Kirkman matrices to recover the status and estimated viral load of the samples.
 - An accompanying **Android application** (BYOM) has been made for easy implementation at testing centres
 - Approved by the Indian regulator, DCGI, after extensive clinical trials for commercial deployment.
- Lower Bounds for Policy Iteration on Multi-action MDPs** *IIT Bombay*
Guide: Prof. Shivaram Kalyanakrishnan, Department of Computer Science & Engineering *Spring 2020*
- Devised a family of n-state, k-action MDPs to obtain a strong lower bound of $\Omega(k^{n/2})$ for policy iteration
 - Generalised existing constructions of 2-action MDPs to k-action MDPs to scale lower bounds by a factor of k for some common deterministic variants of PI, and by $\log(k)$ for the corresponding randomised variants
- Leveraging Reinforcement Learning for Semantic Segmentation** *IIT Bombay*
Guide: Prof. Amit Sethi, Department of Electrical Engineering *Fall 2019*
- Developed an hierarchical segmentation agent trained using the REINFORCE policy gradient algorithm.
 - Achieved **53.62%** mIoU on the PASCAL VOC 2012 dataset when sequential labelling
- Segmentation of Lacunar Objects from Ultra High Resolution μ CT Bone Scans** *ETH Zürich*
Guide: Prof. Dr. Ralph Müller, D-HEST, Institute for Biomechanics *Summer 2019*
- Worked on extracting lacunar structures from trabecular bone samples of rare osteoporotic patients
 - Worked on a 2 stage method that extracts regions using adaptive thresholding followed by a classifier to fine-tune results by removing noise structures, achieving an F1 score of **98.4%**
- Semantic Segmentation of Medical Images** *IIT Bombay*
Guide: Prof. Amit Sethi, Department of Electrical Engineering *Summer 2018*
- Implemented Global Convolution using PyTorch for the **segmentation of lungs** from chest x-rays and **nuclei segmentation** from h/he stained histopathological sections of organs
 - Improved the state of the art results of **nuclei segmentation** to a mean F1 score of **85%** and set the baseline for the **MoNuSeg Challenge** at MICCAI 2018
 - Annotated and pre-processed data from ~ 800 patients afflicted with precancerous/cancerous oral lesions

Scholastic Achievements

- Achieved **Advanced Performer** grade (AP) in **4 courses**: *Biology* (15 out of 445), *Introduction to Electrical Systems* (2 out of 149), *Network Theory* (10 out of 143), and *Electronic Devices Lab* (3 out of 139)
- Secured All India Rank 840 (out of around 200,000 candidates) in JEE Advanced [2016]

- Awarded KVPY Fellowship (**AIR 16**) by Department of Science and Technology, Govt. of India [2014]
- Placed in **National Top 1%** in National Standard Examination in Junior Sciences [2012]
- Ranked **4th** in State Science Talent Search Examination (SSTSE), conducted by Govt. of Rajasthan [2014]
- Recipient of NTSE Scholarship by National Council of Educational Research and Training [2012]

Miscellaneous Projects

Digitally Programmable Analog Computer

EE344: Electronics Design Lab
Spring 2019

Prof. Mukul Chandorkar, EE, IIT Bombay

Designed and developed a standalone digitally programmable analog computer, capable of solving non-linear dynamical systems upto the fifth order, demonstrating hardware-in-loop capabilities. The system is capable of working in real-time, is fully programmable, and has an on-board power management system [Technical Report]

Tree based Stereo Matching for Postcapture Refocus

CS663: Digital Image Processing

Prof. Suyash Awate & Prof. Ajit Rajwade, CSE, IIT Bombay

Fall 2018

- Implemented a **hybrid tree based** stereo matching algorithm, constructing MSTs to calculate disparity
- Incorporated CLMF (Cross Local Multipoint filter) to use as an edge preserving smoother for refining the depth map, and used the depth estimates to interactively refocus and generate depth blurring

Multicycled and Pipelined Implementation of IITB-RISC ISA

EE309: Microprocessors

Prof. Virendra Singh, EE, IIT Bombay

Fall 2018

- Designed and implemented a 6-stage pipelined multicycle RISC processor in VHDL, consisting of arithmetic, logical and branching instructions, and tested it on Altera DE0-Nano FPGA board
- Implemented branch predictors, priority encoders and hazard detection units to safely reduce latencies

Mentorship Experience

Section Leader for Code In Place 2021

Apr-May 2021

- Prepared and taught a weekly discussion section of 10 students to supplement professors' lectures in a 6-week introductory online Python programming course based on material from the first half of Stanford's CS106A.

Department Academic Mentor

2019-2020

- Mentored 12 second year students with a view to guide and help them cope academically

Teaching Assistant

MA207: Partial Differential Equations

Prof. Swapneel Mahajan, Department of Mathematics, IIT Bombay

Fall 2018

- Taught a class of approximately 60 students. Involved in the setting and evaluation of examination papers

Instructor of Machine Learning Bootcamp

Summer 2018

- Taught the fundamentals of Machine Learning to a class of approximately **130** students
- Explained the basics of ML and covered the theory and implementation of popular algorithms of supervised and unsupervised learning such as **Random Forest Algorithm, SVMs, CNNs, and k-means Clustering**

Technical Skills

Programming Languages

- C++, MATLAB, Python, Bash, VHDL, Assembly, JavaScript, MySQL

ML Libraries

- PyTorch, TensorFlow, Keras

Design and Simulation Tools

- EAGLE, AutoCAD, SolidWorks NgSpice, L^AT_EX, Simulink, LabVIEW, Wireshark

Hardware

- Arduino, Intel 8081, Intel 8085, Altera DE0-Nano

Relevant Coursework

Advanced Machine Learning, Digital Image Processing, Intelligent & Learning Agents, Automatic Speech Recognition, Computer Vision, Machine Learning, Computer Networks, Data Structures & Algorithms, Operating Systems, Probability & Random Processes, Digital Signal Processing, Convex Optimization, Matrix Computations

Online Courses

- **Advanced MATLAB for Scientific Computing** (Stanford University - Lagunita)
- **Convolutional Neural Network for Computer Vision** (Stanford University - CS231n)
- **Machine Learning** (Stanford University - CS229 and Coursera)
- **Neural Networks for Machine Learning** (University of Toronto - Coursera)
- **Deep Reinforcement Learning** (UC Berkeley - CS285)