Varun Sundar

Indian Institute of Technology Madras

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Education

Indian Institute of Technology Madras — **Chennai, India**
B. Tech (Hons.) Electrical Engineering — *2016–Present*
Department Rank: 4 of 131 — CGPA: 9.62/10.0

Awards & Honours

- **One of 15 selected for the IUSSTF[1]-Viterbi REU** (out of 1,000+ applicants). Guided during summer 2019 by Prof. Ram Nevatia, IRIS Lab, USC.
- **Regional finalist at the HULT Prize 2018**, dubbed as the "*Nobel Prize for Students*" for work on *Waste Segregation and Management* in Chennai, India.
- **Invited to Global Entrepreneurship Summit 2018**, Hyderabad, India, under the "*young innovators*" category.
- **Secured All India Rank of 501** in the Joint Entrance Examination (JEE) - Mains 2016 (out of 13,00,000+ candidates) and All India Rank of 2917 in JEE-Advanced 2016 (out of 1,50,000+ candidates).
- **Awarded KVPY Scholarship** (top-1% out of 10,000 applicants) and offered provisional admission to the Indian Institute of Science (IISc) with fellowship in 2016.
- **Top-100 (out of 35,000 students)** in the National Chemistry Olympiad **(NSEC)** 2016 and National Physics Olympiad **(NSEP)** 2016. Qualified for the Indian National Chemistry Olympiad **(INChO)** and Indian National Physics Olympiad **(INPhO)** 2016.
- **Special Mention** at the Indian National Mathematical Olympiad **(INMO)** 2015 (among the top 33 in the country).
- **Selected for the Infosys Catch them Young** Programme, 2014 (one of 30 out of 3000+).

Manuscripts

- **V Sundar**, SS Khan, K Mitra, "A Unified Framework for Lensless Image Recovery", to be submitted to *IEEE Transactions on Computational Imaging (TCI), 2020.*
- **V Sundar**, A Sadhu, R Nevatia, "FARCNN: Decoupling Attributes from Object Detection", Technical Report, July 2019, pdf.

Relevant Coursework

All taken at the graduate level.

- Computational Photography
- Reinforcement learning
- Deep learning
- Advances in the Theory of Deep Learning
- Simultaneous Localisation and Mapping
- Multi-Armed Bandits
- Estimation Theory
- Convex Optimisation

Research Experience

Image Recovery for FlatCam — *Guide:* Prof. Kaushik Mitra
Computational Imaging Lab, IIT Madras — *May 2019 - Present*

- Formulated a unified image recovery model for phase and amplitude mask based *FlatCam*: a lensless based imaging system which uses a thin mask to control sensor illumination. This mask either alters amplitude or phase of incident light.
- Proposed simple layer based on circular convolution to undistort raw measurements and produce high-resolution images. Showed easy adaptability to a range of datasets and lensless cameras. *To be submitted to the IEEE Transactions on Computational Imaging (TCI) 2020.*

MRAS Bandits — *Guide:* Prof. LA Prashanth
DON Lab, IIT Madras — *Oct 2019 - Present*

- Formulated novel bandit algorithms inspired by Model Reference Adaptive Search (MRAS) optimisation methods in control theory under the scenarios of Regret Minimisation and Best Arm Identification.
- Demonstrated superior empirical performance compared to Upper Confidence Bound (UCB) based strategies. Currently proving finite-time bounds for both scenarios.

Attribute Transfer in GANs — *Guide:* Prof. AN Rajagopalan
Image Processing and Computer Vision Lab, IIT Madras — *Feb 2019 - Nov 2019*

- Developing a Generative Adversarial Network (GAN) based approach for transferring unseen attributes from a source to a target dataset. Working in the context of image manipulation using natural language, while preserving faithfulness.
- Examined role of text and spatial attention in text-guided image manipulation. Proposed ranking loss based discriminators which can effectively decouple attributes and subjects.

[1] Indo-US Science and Technology Forum

Decoupling Attributes from Object features *Guide:* Prof. Ram Nevatia
IRIS Lab, University of Southern California *May 2019 - July 2019*
- Studied role of object features in attribute detection. Analysed properties of composition and contextuality. Showed the importance of object features in sparse and noisy datasets such as the Genome Question Answering dataset.
- *Work has been presented at the Viterbi-IUSSTF REU Seminar.*

Projects

Automatic Waste Segregator News Article
Chennai, India *Aug 2017 - Jan 2019*
- Designed the deep learning backend and fabricated electronics for creating a low-cost, fast response segregator at source. Piloted prototypes and a service-based model in two housing societies.
- Won the campus round of the 9^{th} *HULT Prize*, 2018. Shortlisted for the regional round at *Nanyang Technological University (NTU), Singapore*.

Simulating LiDARs from OpenDRIVE Layouts Blog Post
Dailmer, Bangalore, India *Dec 2018 - Jan 2019*
- Worked on simulating LiDAR Point clouds given a specific *OpenDRIVE* file, comprising of road layouts, present objects and reflectivity coefficients. Utilised the *CARLA simulator* as the physics engine.
- Demonstrated utility of segmentation and detection in order to improve simulation outputs. Technical report may be found here. Final presentation at MBRDI may be found here, with visualisations here.

Survey of Deep RL Algorithms for Realistic Scenarios Report
Guide: Prof. LA Prashanth, IIT Madras *Oct 2018 - Nov 2018*
- Defined contexts for evaluating performance of multiple RL Agents under various state-space formulations: *MuJoCo* based physics simulation, car steering in *CARLA* and drone navigation in *AirSim*.
- Showed that control pipelines can outdo RL agents, especially with correct prior assumptions or when dealing with large state spaces.

Fiducial Localisation in MRI Scans GitLab
Chennai, India *Oct 2017 - Jan 2018*
- Worked on unsupervised detection of fiducials implanted for brain surgery. Utilised *mayavi* to perform 3-D rendering of skull images, followed by 3-D template matching, local clustering and fiducial isolation.
- Part of the *Bhabha Atomic Research Centre (BARC)* problem statement during the 6^{th} *Inter IIT Tech Meet*.

Professional Experience

Remote Deep Learning Engineer, Valeo Inc.
Valeo, Germany *Nov 2018 - Feb 2019*
- Developed self-supervised depth estimation models for fisheye images. Formulated Euclidean distance-based depth estimation compared to previous disparity based methods and benchmarked on the KITTI dataset.
- Incorporated multiple distortion models: polynomial *radial distortion* model, Scaramuzza model and *OCAM* model.

Deep Learning Engineer, Hyperverge Inc.
Bangalore, India *May 2018 - July 2018*
- Built an end-to-end framework for training small scale object detectors on over 13 architectures for the specific case of satellite imagery. Achieved an mAP of 67.4 using atrous convolutions and *nasnet* feature-extractors.
- Formulated *TensorRT* based pipeline to work on parallel ETL (Extract Transform Load) for training and interleaved synchronous evaluation. Designed visualisation tools for large scale satellite data in order to facilitate scalable annotation.

Leadership

Head, KAIST-IITM student collaboration
IIT Madras *Nov 2018 - Present*
- Leading a task force of 14 students to draft goals and contextual research agenda for undergraduate research collaboration with the *Korean Advanced Institute of Science and Technology (KAIST)*.

Head, Computer Vision and Intelligence Group Webpage
IIT Madras *Mar 2018 - Feb 2019*
- Led an undergraduate community of 40 students working enthusiastically towards impacting real-world problems by harnessing Computer Vision. Have conducted open sessions for an audience of 200+ strong multiple times in IIT Madras and elsewhere. Frequently interact with startups, companies, NGOs and professors.

Additional Activities

- Conducted an introductory session on *Git* and version control at the 5G Testbed, IIT Madras headed by Prof. R Ganti. Content used may be found here.
- Delivered a workshop lecture at PySangamam 2018 on *data-driven computer vision*. Slides may be found here. Associated blog post maybe found here.