SUDARSHAN A R

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EDUCATION

B.E, Madras Institute of Technology (1 of the 4 constituent government colleges of Anna University) 2019-*Present*
Chennai, India
CGPA 9.59/10 (till 6th Semester) Currently in 7th semester

Class XII, P.S.Senior Secondary School, Chennai, India
Scored 95.6% marks *May 2019*

SCHOLASTIC ACHIEVEMENTS

- Awarded the **DAAD WISE scholarship 2022** for a fully funded research internship at the **Technical University of Munich, Germany**
- Selected for the **Summer Fellowship Programme 2022** for a fully funded research internship at the **Indian Institute of Technology Madras** (could not avail as I had accepted the DAAD WISE scholarship)
- In **top 5** of my batch of 161 students at MIT
- Won the **Prof. S.R.V Iyer Amita** prize for highest marks in **Engineering Mechanics** from among **161 students**
- Won the **Thiru P.M.S Ayyar Memorial** prize for highest marks in **Engineering Mathematics, Academic Proficiency Award** for **GPA of 10** in 1st Semester and the **Amita Prize in honor of Prof. T. Krishnan** for highest marks in **Computer Practices**, among **300+ students**
- Qualified in the Joint Entrance Examination Advanced (**JEE Advanced**) 2019, amongst **1,50,000+** candidates

AREAS OF INTEREST

- Deep Learning for Computer Vision
- Image and Signal Processing

PUBLICATIONS

P1. Kitty Varghese, **Sudarshan Rajagopalan**, Mohit Lamba, Kaushik Mitra - *Spectrum-inspired Low-light Image Translation for Saliency Detection* at Proc. of the Thirteenth Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP'22), December 8–10, 2022, Gandhinagar, India (Spotlight)

P2. Furkan Kaynar*, **Sudarshan Rajagopalan***, Shaobo Zhou, Eckehard Steinbach - *Remote Task-oriented Grasp Area Teaching By Non-Experts through Interactive Segmentation and Few-Shot Learning*, AAAI Workshop on 'User-Centric Artificial Intelligence for Assistance in At-Home Tasks' (2023). (* - These authors contributed equally.)

PROJECTS

- **Internship at Chair of Media Technology, Prof. Eckehard Steinbach, Tech. Univ. of Munich** *July 2022 – Present*
  - Developed a few-shot **robotic grasp-area learning** U-Net framework trained using the Reptile meta-learning algorithm to **segment** required areas for grasping tasks [P2]
  - For **few-shot training**, we created a Grasp Area Segmentation (**GAS**) dataset of 1121 tasks consisting of graspable and non-graspable regions from the publicly available GraspNet-1Billion dataset-CVPR 2020
  - Tested the framework on a robotic setup with a **7 DOF FE Panda** manipulator. To generate 6 DOF grasps, we used Contact-graspnet-ICRA 2021 and used our predicted masks to execute grasps on specific regions
- **Internship at Computational Imaging Lab under Prof. Kaushik Mitra, IIT Madras:** *May 2021 – Nov. 2022*
  - Spectrum-inspired Low-Light Image Translation for Saliency Detection [P1]:
    - Developed a **novel pipeline** for transforming well-lit images to **proxy low-light images** by using **band-pass filtering** to fuse frequency domain characteristics of low-light and well-lit images
    - To suppress ringing artifacts which arise during fusion, we also used **2D windowing**

- Outperformed existing image translation and domain adaptation methods for **real low-light saliency detection** and **depth estimation** when networks were trained on our proxy low-light images

- Explored **Neural Architecture Search (NAS)** for low light restoration:
  - Extended the NAS framework proposed by 'Hierarchical Neural Architecture Search for Semantic Image Segmentation'-CVPR 2019, for low-light restoration on See-in-the-Dark (SID)-CVPR 2018 dataset
  - Fixed the network-level architecture as a U-Net and searched for optimal cell-level architecture
  - Achieved results comparable to that of state-of-the-art methods on the SID dataset
- Ran inference calls for the networks proposed by 'Unsupervised Monocular Depth Estimation with Left-Right Consistency'-CVPR 2017 and 'GA-Net: Guided Aggregation Net for End-to-end Stereo Matching'-CVPR 2019, on the KITTI dataset to compare the performance of monocular and stereo depth estimation networks. This was for a project being explored by the lab on low-light ADAS systems.

♦ **Pre-final year project-Robust Automatic Classroom Attendance System using Deep Learning:** *Sept. 2022 – Present*

- Implemented a robust detection and recognition framework which can run on a **single** image of the classroom
- We fine-tuned **Yolo-v5 face** for face detection and **FaceNet** for face recognition on images captured in our classrooms (annotated using **MakeSense** software)

♦ **IPCV Lab IIT Madras:** *Jan. 2021 – Feb. 2021*

Implemented the paper 'Degradation Aware Approach to Image Restoration using Knowledge Distillation' (IEEE Journal of Selected Topics in Signal Processing, vol. 15, pages: 162-173, 2021) by interacting with a PhD student from IPCV Lab who is co-author of the above paper. The implementation details are as follows:

- Performed deep network-based de-hazing and raindrop removal and got similar results as mentioned in the above paper
- Mask prediction network, an encoder-decoder network, would produce a **binary mask** for degraded and non-degraded regions in the image for guided restoration
- Restoration network, an encoder-decoder with **knowledge distillation** between encoders and **attention** mechanism, uses the mask to restore degraded areas of the image and produces a clean image

♦ **Reinforcement Learning** *Feb. 2021 – Mar. 2021*

- Trained an RL agent to learn to play SpaceInvaders, LunarLander using **DQN** for 500 episodes
- Trained an RL agent to learn to play InvertedPendulum using **actor-critic** algorithm.

♦ **Image Processing Projects** *Nov. 2020 – Dec. 2020*

- Computed **homographies** to transform images or to align them with a set of images for purpose of **mosaicing**
- Implemented **space variant blurring** and **shape from focus**

CODING SKILLS

♦ **Languages:** Python, C++, MATLAB, Octave

♦ **Packages:** NumPy, PyTorch, TensorFlow, Keras, Gym, Bullet, OpenCV, rawpy, pillow

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RELEVANT COURSEWORK

Signals and Systems	Communication Theory	Deep Learning
Linear Algebra and Numerical Methods	Python Programming and Data Structures	Image Signal Processing
Discrete Time Signal Processing	Machine Learning	

POSITIONS OF RESPONSIBILITY

♦ Was class representative for two courses at MIT

♦ Team leader for project on RF transmitter and receiver

♦ Team leader for ongoing final-year project
