Anshul Shah

Indian Institute of Technology Madras

+91 9884180693 • anshulbshah@gmail.com

Education

Indian Institute of Technology Madras, Chennai — **CGPA : 9.32/10**

Dual Degree B.Tech.(Honors) & M.Tech. in Electrical Engineering — *2013–2018*

Minor in Robotics

Navrachana School, Vadodara — **95.6%**

Class XII CBSE — *2013*

Coursework

Computer Science & Signal Processing: Image Signal Processing[1], Deep Learning[1], 3D Computer Vision[1] [2], Machine Learning for Computer Vision[1], Data Structures and Algorithms, Computer Organization, DSP Architectures for Embedded Systems[1] ,Microprocessor Laboratory, Digital Signal Processing

Photonics and Optics: Optical Signal Processing[1], Electronic and Photonic Nanoscale devices[1], Introduction to Photonics[1]

Robotics and Control: Introduction to Robotics, Non Linear Control Systems[1],Flight Control Systems[1] [2],Control Engineering

Mathematics: Probability, Statistics and Stochastic Processes, Linear Algebra and Numerical Analysis, Functions of one Variable, Functions of several variables, Mathematical Finance

Skills

Languages: C, C++, Python, MATLAB, Lua, Verilog

Libraries & Tools: TensorFlow, Torch, PyTorch, SciLab, OpenCV, PIL, OpenNI, Kinect SDK, Unity 3D, LaTeX

Hardware: Raspberry Pi, Arduino, Microsoft Kinect, Xilinx Spartan-3E

Academic Research and Course Projects

Blurred Image to Video Generation — **Jun'17-Present**

Guide : Prof. A.N. Rajagopalan — *IIT Madras*

- Developed an approach to extract a temporally consistent sequence of clean frames from a single motion blurred image and set a baseline for the novel task
- Extensively studied areas of deblurring, future frame prediction, optical flow estimation and experimented with Generative Adversarial Networks, Spatial Transformer Networks and Recurrent Neural Networks
- Proposed a novel approach to train a Video AutoEncoder using a modified version of Convolutional LSTMs and trained a blurred image encoder to match feature generated by video encoder
- Trained the network on GoPro dataset which has both camera motion and independent object motion. Tested the network on standard deblurring datasets and blurred images obtained from the internet
- Manuscript is currently under review in IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2018

Defocus Map Generation — **Jul'17**

Guide : Prof. A.N. Rajagopalan — *IIT Madras*

- Addressed the problem of obtaining an optical blur based binary segmentation map of a 3D scene
- Trained a CNN to classify blur in overlapping patches and used a refinement module to get final segmentation map
- Experimented with methods like Markov Random Fields and superpixel based grouping to refine the map
- Obtained performance which was comparable to state-of-the-art techniques, without any hand designed filters

3D Reconstruction System — **Oct'16-Jan'17**

Guide : Prof. Radim Šára — *Czech Technical University in Prague*

- Developed a system to reconstruct 3D scenes using images captured from an internally calibrated camera
- Estimated the Essential Matrix for each pair of images using the five point algorithm and refined it by minimizing Sampson reprojection error ; The optimal matrix was obtained using RANSAC
- Performed stepwise gluing to obtain camera positions and obtained the point cloud

[1] Graduate Level Course

[2] Done at Czech Technical University in Prague, Czech Republic

Enhanced Scaling free CORDIC **Apr'17-May'17**
Guide : Prof. K. Sridharan *IIT Madras*

- Did literature survey on Coordinate Rotation Digital Computer (CORDIC) which is used to implement rotations and vector operations for graphics and signal processing applications and implemented a variant on an FGPA
- Simulated an approach which used radix-4 Booth Recoding with domain folding and adaptive iterations to avoid scale compensation; Obtained a 30% decrease in number of occupied slices

All Optical Digital to Analog Convertor **Oct'17-Nov'17**
Guide : Prof. Deepa Venkitesh *IIT Madras*

- Simulated a 2-bit and 3-bit all optical digital to analog converter using non linear optical loop mirrors (NOLM)

Industrial Research Experience

Virtual Cognitive Mirror **May'16-Jul'16**
IBM Research Lab, India

- Developed innovative algorithms using machine learning and image processing techniques to detect neck feature points in a face image and overlay a necklace image accurately without use of expensive depth sensors
- Project was part of a product to give suggestions and improvise the jewellery buying experience. Was named a co-inventor in a patent filed at US PTO

Surveillance Camera Video Enhancement **May'15-Jul'15**
Matrix ComSec R&D, India

- Extensively studied various image enhancement techniques like edge enhancement, gamma correction, lens distortion correction and implemented algorithms on the TI DM388 media processor for security camera video enhancement
- Obtained quality enhancement on 3MP stream, improved the motion detection functionality and implemented a TripWire functionality to detect intruders

Projects at Centre for Innovation, IIT Madras

Robot Navigation using Kinect **May'14-Jun'14**
Centre for Innovation *IIT Madras*

- Developed a system to locate a robot in an area using trilateration and control it autonomously using Kinect Sensor
- Used RGB-D information to identify markers, plan trajectory and actuate via an Arduino Microcontroller

Kinect Meets DJ **Aug'14-Jan'15**
Centre for Innovation *IIT Madras*

- Developed an intuitive user centric system where music is generated using gestures captured using a Kinect Sensor
- Programmed a 3D character using Unity3D to replicate movements, play music and dance in tune with gestures
- Showcased it in front of 2500+ people during Envisage 3.0, India's largest student-run techno-entertainment show

Teaching experience

Teaching Assistant **Jan'18-Present**
EE5175 : Image Signal Processing *IIT Madras*

- Assisted in evaluating lab assignments, conducting viva and correcting examinations

Teaching Assistant **Jun'17-Nov'17**
PH1010 : Physics I *IIT Madras*

- Assisted professor in conducting classes, tutorials and examinations on topics in non-relativistic mechanics

Academic and Extra Curricular Achievements

- **Department Topper 2015-16** : Awarded the Kolluri Memorial Prize for best Academic record in Electrical Engineering in 3rd Year with a GPA of 9.75
- **Semester Abroad** : Among 8 selected from IIT Madras for a semester exchange at Czech Technical University in Prague from Sep'16 to Jan'17
- **IIT - Joint Entrance Examination Advanced 2013** : Ranked 1074 among more than 150,000 candidates
- **Robotics Competitions** : Part of a team that won in many technical events in the campus like , 1st in Autonomous Robotics (TechSoc'15), 1st in Roboceana (Wavez'15), 2nd in Manual Robotics (Shaastra'14)
- **Hindustani Classical Music** : Completed Madhyama Purna (Diploma) level in Hindustani Classical Vocals in 2009