Shubh Gupta

CONTACT INFORMATION

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AREAS OF INTEREST

Robotics, Computer Vision and Human-Computer Interaction

EDUCATION

BACHELOR OF TECHNOLOGY | Electrical Engineering

July 2014 – Present | Indian Institute of Technology Kanpur

- **Major CPI/CGPA:** 9.3/10
- **Minor degree:** Computer Architecture in Dept. of Computer Science and Engineering

RESEARCH EXPERIENCE

ADOBE BIGDATA EXPERIENCE LAB (BEL) | Research Intern

May 2017 – July 2017 | Bangalore

Mentor: Ritwik Sinha, Sr. Data Scientist, Adobe BEL

- **Aim:** To design a system for predicting saliency of user interface elements in smartphone applications to assist UI designers in quick A/B testing of their designs.
- Implemented a pipeline for collecting eye gaze data from app users using smartphone front camera, and deployed on Amazon Mechanical Turk.
- Trained neural networks to predict element wise saliency values on smartphone UI images using features from image as well as underlying xml code.

PUBLICATION

Gupta, P., **Gupta, S.** , Jayagopal, A., Pal, S., & Sinha, R. (2017), "**Saliency Prediction for Mobile User Interfaces** *" arXiv:1711.03726* (To appear in WACV 2018)

TECHNICAL PROJECTS

DEMAND-BASED MAPPING USING MOTION PLANNING

August 2017 – Present | Indian Institute of Technology Kanpur

Guide: Prof. Mangal Kothari, AE, IITK

- **Aim:** To develop a joint motion planning-mapping system for a robot such that costmap of the environment for mapping is generated on-demand based on motion planner queries.
- Implemented the system in ROS framework with code in python and C++.
- Trained online learning based classifiers on real-world collected data with patch level supervision to accomodate for concept drift.

INTELLIGENT GROUND VEHICLE COMPETITION (IGVC), 2017

Nov 2016 – Apr 2017 | Indian Institute of Technology Kanpur

Guide: Prof. Gaurav Pandey, EE, IITK & Prof. Mangal Kothari, AE, IITK

- **Aim:** To build an autonomous unmanned ground robotic vehicle capable of negotiating around an outdoor obstacle course under a prescribed time while avoiding obstacles on a grassy terrain.
- Developed systems for identifying and mapping obstacles as well as robot localisation using multimodal input from IMU, encoders, LiDAR and GPS.
- Mentored a group of students working on motion planning algorithms and strategies for the ground robot.

LASER AUTOMATION SYSTEM

May 2016 – July 2016 | Indian Institute of Technology Kanpur
Guide: Prof. Shilpi Gupta, EE, IITK

- Designed a Laser Power Control unit capable of generating laser beam of required optical power using closed loop feedback control.
- Constructed a Laser Power Meter for recording optical power data of a laser beam using Arduino and LabView.

WIND PROPELLED NAVIGATION AND POLE CLIMBING ROBOTS

Sep 2015 – Mar 2016 | ABU Robocon, 2016
Guide: Dr. Anjali Kulkarni & Prof. Bhaskar Dasgupta, ME, IITK

- Aim: To design and manufacture an autonomous robot which was to be guided by driving force (wind energy) from a semi-autonomous robot, and capable of working in coordination to complete a given set of tasks.
- Designed and coded the control system for the robots, as well as developed submodules for pole climbing and adaptively controlling the driving propellors speed and position.

BADMINTON PLAYING ROBOTS

Sep 2014 – Mar 2015 | ABU Robocon, 2015
Guide: Dr. Anjali Kulkarni & Prof. Bhaskar Dasgupta, ME, IITK

- Aim: To design and fabricate two robots capable of playing doubles badminton in a full-size badminton court.
- Developed an elbow-wrist movement inspired double-pneumatic mechanism for hitting shuttlecock over large distances.
- Worked on a system for generating the actuating signal for the mechanism by estimating the trajectory of the shuttlecock using a kinect sensor.

COURSE PROJECTS

JOINT HUMAN POSE AND PART SEGMENTATION

Aug 2017 – Present | Indian Institute of Technology Kanpur
Mentor: Prof. Vinay P. Namboodiri, CSE, IITK

- Aim: To jointly predict human pose and part segments using an end-to-end trainable model using data containing partial ground truth
- Developed a new architecture by combining CVPR 2017 paper "Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields" with fcn architecture for segmentation
- Trained the model using relevant parts from MPII and PASCAL VOC part datasets, with the implementation in PyTorch.

SELECTIVE BLUR USING EXTREME POINT ANNOTATION

Sep 2017 – Nov 2017 | Indian Institute of Technology Kanpur
Instructor: Prof. Tanaya Guha, EE

- Aim: To create an application for applying a selective motion blur to an image by segmenting out a specified object.
- Modified and implemented ICCV 2017 paper "Extreme clicking for efficient object annotation".
- Developed a pipeline to take in annotation of extreme points of an object in image, find its crude boundary by generating minimum cost paths on weighted edge detections and segmentation refinement using graph-cut with this initialization.

VISION PIPELINE FOR AUTONOMOUS GROUND VEHICLE

Jan 2017 – Apr 2017 | Indian Institute of Technology Kanpur
Instructor: Prof. Gaurav Pandey, EE

- Aim: To develop vision based systems for autonomous maneuvering of an intelligent ground vehicle in traversing within lanes, avoiding obstacles and maintaining its heading while navigating in unfamiliar territory.
- Designed an algorithm for robustly detecting lane regions in a video feed using PCA with region proposals from previous frames.
- Combined LiDAR and camera inputs to seperate obstacles and lanes in an image, as well as generate a semantic map for motion planning algorithms.

INDOOR NAVIGATION AND MAPPING USING BLUETOOTH

Aug 2016 – Nov 2016 | Indian Institute of Technology Kanpur
Instructor: Prof. Indranil Saha, CSE, IITK

- Aim: To design a robot for autonomously mapping an indoor environment, and navigating to a designated spot on the map using bluetooth and ultrasonic sensors on Arduino platform.
- Used bluetooth sensor RSSI values to determine absolute location information and ultrasonic sensor for relative measurements.

STAMP COUNTING MACHINE

Jan 2016 – May 2016 | Indian Institute of Technology Kanpur
Manufacturing Lab-2, ME, IITK

- Designed and manufactured a manually operated machine consisting of mechanically synchronized stamping, counter and conveyor modules.
- Designed and analyzed the model on Autodesk inventor to calculate appropriate dimensions.
- Operated lathe, milling and drilling machines to manufacture parts.

DRAGON AUTOMATON

Aug 2015 – Nov 2015 | Indian Institute of Technology Kanpur
Manufacturing Lab-1, ME, IITK

- Designed and built a dragon model capable of moving in a fixed wave-like pattern using cam shaft mechanism.
- Designed and analyzed the model on Autodesk Inventor and used casting, welding, brazing techniques for fabrication.

AWARDS

ACADEMIC AND COMPETITIVE EXAMS

- Recipient of Academic Excellence Award in both 2015 and 2016 by IIT Kanpur
- Recipient of Best Overall Project Award in 2015 for 'Dragon Automaton' project
- Secured All India Rank-520 in JEE Advanced 2014 among 80,000 students
- Secured All India Rank-150 in JEE Mains 2014 among 13,50,000 students

COMPETITIONS

- Secured 1st position at inter-college level for designing cost-efficient circuits (2017)
- Secured 3rd position at national level in ABU Robocon 2016 representing the institute
- Secured 1st position in a college-level competition on embedded programming (2015)

LEADERSHIP POSITIONS

COORDINATOR, TEAM IGVC IITK

Nov 2016 – Apr 2017 | Indian Institute of Technology Kanpur

- Created a team of 12 undergrads from varying engineering disciplines and years of study
- Secured funding from Defence Research & Development Organisation (DRDO), India
- Tutored members on Robot Operating System (ROS) and OpenCV

COURSEWORK

SYSTEMS, CONTROLS AND ROBOTICS

- *Operating Systems*, *Digital Control*, *Computer Organization*, *Probabilistic Mobile Robotics*, *Embedded and Cyber-Physical Systems*, *Control Systems Analysis*, *Signals, Systems & Networks*

COMPUTER VISION, SIGNAL PROCESSING AND PROGRAMMING

- *Visual Recognition*, *Image Processing*, *Communication Systems*, *Digital Signal Processing*, *Principles of Communication*, *Data Structures and Algorithms*, *Fundamentals of Computing*

MATHEMATICS AND ELECTRONICS

- *Probability and Statistics*, *Partial Differential Equations*, *Linear Algebra*, *Complex Variables*, *Digital Electronics*, *Introduction to Electronics*, *Electrical Engineering Laboratory I & II*

TECHNICAL SKILLS

PROGRAMMING LANGUAGES AND FRAMEWORKS

- *C/C++*, *Python*, *ROS*, *PyTorch*, *Caffe*, *Keras*, *OpenCV*, *MATLAB*, *Verilog*, *HTML*, *JavaScript*, *LaTeX*

SOFTWARE

- *Gazebo*, *Simulink*, *LabVIEW*, *Android Studio*, *Autodesk Inventor*, *Solidworks*, *CVAVR*, *Xilinx ISE*

EMBEDDED PLATFORMS

- *Arduino*, *ODROID*, *RaspberryPi*, *FPGA*, *Intel NUC*, *8085 Microprocessor*, *PIC Microcontroller*

VOLUNTARY WORK

GUEST LECTURER

Aug 2015 | Institute of Research Development & Training, Kanpur

- Delivered a live E-lecture on Digital Electronics for Industrial training institute students.

STUDENT GUIDE

2015 | Counselling Service, IITK

- Helped first year students get attuned to rigours of college life by guiding them in case of difficulties.

ACADEMIC MENTOR

2015 | Counselling Service, IITK

- Assisted academically weaker students in the course 'Fundamentals of Computing' by taking remedial lectures and one-to-one doubt clearing sessions.

STUDENT TEACHER

2015 | Shiksha Sopan, Kanpur

- Provided educational support to economically challenged students of the community by teaching them basic math and science free of cost.

OTHER INTERESTS

- Reading novels and singing
- Swimming
- Playing musical instruments (Guitar, Synthesizer, Flute, Mouth organ and Drums)

REFERENCES

Prof. Mangal Kothari, AE
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