AKASH KUMAR SINGH

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EDUCATION

INDIAN INSTITITE OF TECHNOLOGY, KANPUR | BT-MT in Electrical Engineering
July 2016- Present | Kanpur, Uttar Pradesh (INDIA)
MT CPI : 8.8, BT CPI: 7.8

D.A.V. PUBLIC SCHOOL, NTS BARKAKANA, C.C.L. | AISSCE
June 2014 - March 2016 | Ramgarh, Jharkahnd (INDIA)
Result : 93.4%

D.A.V. PUBLIC SCHOOL, URIMARI | AISSE
March 2014 | Hazaribagh, Jharkahnd (INDIA)
CGPA : 10/10

WORK EXPERIENCE

PYTHON3 BINDINGS FOR INNERMODEL LIBRARY (GSOC) | Robocomp
May 2020 – Aug 2020 | MENTORS: Luis J. Manso, Esteban Martinena and Ramon Cintas

- The project aimed to port the code of a C++ library, innermodel (used to represent virtual environments for a simulator), to Python to make it easy for the developers to use.
- Used PyBullet as the rendering engine and Numpy to create a customized math library for the calculations in simulation.
- Wrote unit tests to ensure the correctness of the implementation.
- Added ROS2 middleware support to robocompdsl, a tool to generate boiler plate code for robotic component having different interfaces (sensor, actuators, etc.).

MULTIMODAL SEMANTIC SEGMENTATION | Reseach and Technology Center (RTC), Robert Bosch
May 2019 - July 2019 | MENTOR: Guruprasad M. Hegde

- The idea was to improve the performance of semantic segmentation on 2D RGB images using data from LiDAR point clouds for an autonomous driving car.
- Used CARLA (Open Source Simulator) to generate labelled point clouds, for training 3D semantic segmentation networks, using 3D reprojection algorithms. Used open-source Apolloscape (scene-parsing) data to generate labelled point clouds for static objects, using depth map and semantic label images provided.
- Trained Pointnet++ network on CARLA and Apolloscape datasets. Compared performance of models initialised from pretrained models on synthetic CARLA data with models trained on real data. Also compared the results between models trained on RGBXYZ point clouds and XYZ point clouds.
- Developed a framework to combine the results of a model trained on 2d RGB images and a model trained on 3d point clouds to perform semantic segmentation on a 2d RGB image.
- Implemented a Fast LiDAR point cloud segmentation algorithm, to get clusters in LiDAR point clouds for an autonomous driving car to infer accurate pose of objects in a scene.

GAZEBO-ROBOCOMP INTEGRATION (GSOC) | Robocomp
May 2018 – Aug 2018 | MENTORS: Marco A Gutiérrez and Ramon Cintas

- The project aimed to integrate Robocomp, a robotic framework, with a 3D robotic simulator, Gazebo, using zeroc-ice as a communication middleware.
- Used Gazebo plugins for robotics interfaces, corresponding to different sensors and actuators, to communicate with the Gazebo simulator.
- The integration is expected to allow developers more options from the framework and provide a better simulation with a more realistic physics engine.

TRAFFIC LIGHT DETECTION | NYU-IITK, RESEARCH TRACK
June 2018 – July 2018 | Prof. Yi Fang (New York University)

- The project aims to explore the possibilities of developing a lightweight traffic light detection model based on Deep Learning, using various model compression techniques.
- Explored various techniques of reducing the size of neural networks without any significant decrease in accuracy.
- Implemented a RFCN network using tensorflow object detection APIs.

NYO | NEW YORK OFFICE, IIT KANPUR
May 2018 - July 2018 | Prof. Manindra Agarwal

- Worked as a front end developer to develop new features and improve UI/UX of a scalable web application.
- Used latest technology stacks like TypeScript in Angular 6 as well as HTML and SCSS for styling.

PROJECTS

AUTONOMOUS UNDERWATER VEHICLE | AUV-IITK, IIT KANPUR

February 2017 – July 2019 | MENTOR: Prof. Mangal Kothari

- Implemented an Image Processing Algorithm (Image Fusion) to enhance the degraded underwater images in real time before feeding it to the perception module of the vehicle.
- Integrated UUV Simulator, an open source underwater simulator, to work with AUV-IITK code base.
- Designed and developed the software architecture for AUV consisting of dedicated layers for hardware integration, controls & navigation, motion planning, and perception using libraries such as ROS, OpenCV & Gazebo.
- Implemented sensor fusion using EKF algorithm to get odometry values.
- Implemented state machine using ROS smach to perform tasks according to a given plan.

BELLMAN OPTIMALS VS HUMANS | IIT KANPUR

Aug 2018 - Nov 2018| Prof. Nisheeth Srivastava

- The central idea was to compare human path-finding in a stochastic two-dimensional grid world with the Bellman-optimal solution found via value iteration, across various factors.
- Developed a graphical user interface to collect data via experiment conduction on how humans choose an ideal path based on intuition.
- Analyzed the data collected to calculate the cognitive bias people have, along with different measures.

PUBLICATIONS

MULTI-MODAL SEMANTIC SEGMENTATION USING SYNTHETIC DATA | RTC, Robert Bosch

May 2018 - July 2018 | Kartik Srivastava, Akash Kumar Singh, Guruprasad M. Hegde

- Presented in a workshop on Deep Learning for Automated Driving: Beyond Perception (DLAD-BP 2019), IEEE International Conference on Intelligent Transportation Systems 2019 (ITSC '19). [arxiv]

MTECH THESIS

SURVEILLANCE SYSTEM USING MULTIPLE QUADCOPTERS | IIT KANPUR

Aug 2020 - Present | Prof. Indranil Saha

- AIM: To develop a surveillance system using multi quadcopters.
- APPROACH: Developing a framework to describe a mission plan as LTL (Linear Temporal Logic) specifications and solve it by using a SMT solver (Z3-solver) to get an optimal solution. Using px4 flight along with Gazebo-SITL to simulate the framework.
- END RESULT: A working demonstration of the above idea using 4 quadcopters in a real world scenario.

SKILLS

Image Processing • Computer Vision • Linux Command Line • Robotics • 3D simulation
Machine Learning

LANGUAGES

C • C++ • Python • LATEX • HTML • CSS • Typescript • shell(BASH) • Sed • Awk • Verilog

TOOLS

ROS • OpenCV • Git • SolidWorks • Arduino • Gazebo • PyTorch • Angular • Tensorflow
Keras • GNU octave • Matlab • PyBullet

SCHOLASTIC ACHIEVEMENTS

Secured rank 3146 at National level in JEE Mains 2016 among 1.13 million students.
Secured rank 2477 at National level in JEE Advanced 2016 among 198,000 students.

RELEVANT COURSES

Representation and Analysis of Random Signals (A*) • Convex Optimization

Probability & Statistics (A) • Data Structures & Algorithms
Introduction to Machine Learning (A) • Micro-Electronics
Essentials of Scientific Computing • Cyber Security of critical infrastructure
Principles of Communication System • Control Systems and Analysis
Signals, Systems & Networks • Robot Manipulators: Dynamics and Controls
Quantum Mechanics • Formal Methods for Robotics and Automation

OTHER CAMPUS ACTIVITIES

SOFTWARE LEAD, AUV-IITK, IIT KANPUR | July 2018 - Mar 2019

- Mentored juniors towards learning software structure of the vehicle
- Managed workflow and development of software system
- Runner up at the Final Round of NIOT SAVe 2019, Indian National Competition on Student Autonomous Underwater Vehicle Challenge held in Chennai (#)[1]

SECRETARY, ROBOTICS CLUB, IIT KANPUR | July 2017 - Mar 2018

- Promoting Robotics in campus community by organizing workshops and lectures
- Assisted the Coordinators in organizing competitions in Major technical events

SECRETARY, FINE ARTS CLUB, IIT KANPUR | July 2017 - Mar 2018

- Promoting Fine Arts in campus community by organizing various competitions and exhibitions
- Assisted in development of various art pieces around the campus

[1] not verified by SPO