Vivek **Agrawal**

Software Engineer · Roboticist

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"Persistence is very important.You should not give up until you are dead or completely incapacitated"

Summary

- Third Year Undergraduate Student at department of **Electrical Engineering**
- 1+ year experience working with **Deep Learning** models focused on **computer vision** and **Autonomous Navigation**
- 1+ year experience working with Motion Planning, and control algorithms
- Strong Coding Skills in **C(2+ year)** & **Python(1+year)**

Education

Indian Institute of Technology Kanpur — *August. 2017 - Present*

B.Tech. in Electrical Engineering — *CPI : 8.2/10.0*

Creative Public Senior Secondary School — *2015 - 2016*

Class XII — *Percentage : 83.40%*

Creative Public Senior Secondary School — *2013 - 2014*

Class X — *Percentage : 90.83%*

Field of Interest

Artificial Intelligence	Robotics	Internet Of Things(IOT)
Deep Learning & Reinforcement Learning	Autonomous system	Shared Autonomy
Computer Vision	Motion Planning	Natural Language Processing

Skills

Programming Language	C, C++, Python, R, HTML, CSS
Deep Learning Frameworks	Pytorch, Tensorflow, Keras
Python Libraries	Robot Operating System(ROS), Opencv, Numpy, Matplotlib, Scipy
Tools and Software	Matlab, Gazebo, AutoCad, Arduino, Autodesk Inventor, GNU-Octave, rviz
Operating Systems	Linux(Ubuntu), Windows, Raspbian
Utilities	Git, LaTeX

Academic Projects

Swarm Robotics — *IIT Kanpur*

Advisor : Dr. Soumya Ranjan Sahoo — *May 2019 - June 2019*

- **Project Overview :** This Swarm is a group of ground robots that navigates in an unknown environment by localizing themselves and coordinating with each other to complete the specified task.
- **Design & Fabrication :** Designed the complete model of swarm robots on **AutoDesk Inventor** and then fabricated the robots.
- **Controls :** Designed a full-fledged controller for **Omnidirectional** robots. Found the system parameters and then transfer function by plotting characteristics of the motor and then used them in designing the controller.
- **Electronics & Communication :** Designed the circuit for the robots. Main electric components that were included in the robots were Raspberry Pi, Arduino, Inertial Measurement Unit Sensor(IMU), Ultrasonic Sensors, WiFi module, and DC Motors. Used Raspberry pi as the master processing unit of the swarm. Communication between swarms is done through the network over WiFi using **SPI protocols**. Each swarm member senses his environment and sends the relevant information to master from where information is manipulated and pass to the slaves.
- Wrote **Obstacle avoidance** algorithm for bot to navigate in environment.
- Collected and analyzed data of sensors and actuators using **Robot Operating System (ROS)** library.

Shared Autonomy Via Deep Reinforcement Learning and Formal Methods

IIT Kanpur

Advisor : Prof. Indranil Saha

May 2019 - Present

- **Project Overview :**
  - Project is aimed at developing an autonomous system which can work with humans and help them to do challenging and life-threatening tasks.
  - Develop a surveillance system for rescue operations so that robot can navigate in an unstructured environment.
  - There is a **human in the loop** to take critical decisions and to take control of the robot at any instant if robot does not take appropriate decisions.
  - The Robot will continuously learn from the actions taken and update its weight parameters based upon experience.
  - Use **Deep reinforcement learning** algorithms along with concepts of **formal methods** to solve the problem. Train the robot in an random environment and test it in a different unstructured environment.
- **Current Work :**
  - Used **Astra Depth camera** on Turtlebot2 to sense the environment.
  - Used Robot Operating System(ROS) for collecting and analyzing data between different packages
  - Used **Gazebo for simulating** Turtlebot2 in a real environment like situation.
  - Applied **Dueling Deep Q-Learning** algorithm, to train the robot to navigate in an environment without the need for any human intervention.
  - Applied **Soft Actor-Critic** Algorithm, to train the robot with RGB image, and depth image as input and using this predict an action which later on gets added with human input (if provided) and commands a safe action for the robot.
  - Also uses human input in the critic part to criticize the actor action.
  - Used **TensorFlow** library for D-DQN algorithm and **Pytorch** library for Soft Actor-Critic algorithm.

Team Projects

ABU Robocon 2018 and 2019

IIT Kanpur

Advisor : Dr. Ashish Dutta

May 2018 - April 2019

- **Project Overview :**
  - The ABU Asia-Pacific Robot Contest (ABU Robocon) is an Asian Oceanian College robot competition. In the competition robots of several universities of Asia compete to complete a task within a specified period of time.
  - The 2018 problem statement was based upon making 2 robots one manual and other autonomous that can throw shuttlecocks in the ring. We made the autonomous robot as our summer project.
  - The 2019 problem statement was based on Mongolian theme of their festival **Nadam**, based upon this we have to make 2 robots one semi-autonomous and one fully autonomous. **Semi-autonomous** is a 4 wheeled **Omni-directional robot** and do specified tasks. The **Autonomous robot** is a **4 legged robot** that follows a trajectory and avoids certain obstacles. In this competition, we **secured the 5th place among 84 teams** participated all across India in technical proposal round.
- **Computer Vision :**
  - Worked upon the **autonomous navigation** of robots using computer vision algorithms. Wrote an algorithm for **lane detection** from the arena by applying certain noise filters and contour detection algorithms.
  - Wrote an algorithm for **ball detection** and its **distance estimation** from robot using triangular similarity on area and distance of the object, and focal length of the camera.
- **Electrical Subsystem :**
  - Designed circuit of robots and wrote **control algorithm** of a **4 legged** spider robot actuated with 12 servo motors.
  - Designed a fully-fledged **wireless controller** for semi-autonomous robot.
- **Mechanical Subsystem :**
  - Modified the **Theo Jansen mechanism** for a **4 legged robot**, designed the CAD model of it. **Simulated** leg on **Matlab** to find optimal link lengths and **headed** a team for making a **working prototype** of the robot.
  - Designed the CAD model of the robot of 2018 problem statement using **Autodesk Inventor** and then manufactured the same.

Relevant Course Work

Data Structure and Algorithms
Probability and Statistics
Partial Differential Equation*
Linear Algebra and Differential Equation
Control System Analysis
Signal System and Networks
Introduction to Electronics
Deep Learning Specialization**
Machine Learning for Signals***
Image Processing***
Introduction to Electrical Engineering
Artificial Intelligence for Robotics**

*Exceptional Performance **Online ***Ongoing

Awards & Achievements

2018 **A* in courses**, Given For exceptional Performance in the Course — *IIT Kanpur*
2017 **All Indian Rank(AIR) 456**, Among 0.5 million students in JEE Advance 2017 — *India*
2017 **All Indian Rank(AIR) 1118**, Among 1.5 million students in JEE Mains 2017 — *India*
2015 **International Rank 1041, City Rank - 1st**, In 17th Science Olympiad — *Delhi, India*

Extracurricular Activity

Robotics Club

IIT Kanpur

Secretary

May 2018 - April 2019

- Represented club at **Techkriti 2019** in **Robowars** by building a destructive robot from scratch
- Assisted in conducting various workshops and took lectures of freshers on various topics related to computer vision and Embedded Electronics
- Proposed various project ideas and approaches to increase the involvement of campus community in club

Team Robocon IIT Kanpur

IIT Kanpur

Team and Finance Manager

May 2018 - April 2019

- Made a working environment in a Team of 24 Members.
- Made budget proposal of team Robocon for Science and Technology Council of IIT Kanpur
- Ensured proper management and clearance of bills

Learning While Travelling

IIT Kanpur

Campus Ambassador

March 2018 - June 2019

- Guided many students to choose proper career options according to their interests and requirement.