Aditya Wagh

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EDUCATION

New York University   New York City, NY
Master of Science in Mechatronics and Robotics; GPA: 3.667/4   Sep 2021 – May 2023

Birla Institute of Technology and Science, Pilani   Pilani, India
Bachelor of Engineering in Electronics and Instrumentation   Aug 2015 – May 2019

EXPERIENCE

Central Electronics Engineering Research Institute   Pilani, India
Deep Learning Intern   Jul 2018 - Dec 2018
- **Data Annotation**: Contributed to the development of a software pipeline for pixel wise annotation of a novel data set consisting of 6000+ Infrared and RGB aerial images of power cables
- **Mask RCNN**: Fine-tuned a pre-trained Mask-RCNN model for panoptic segmentation of power cables on this new dataset and achieved a validation accuracy of approximately 70%

TECHNICAL SKILLS

- **Languages**: Python, C++, CUDA, Bash, MATLAB, HTML, CSS
- **Frameworks**: PyTorch, Keras, TensorFlow, OpenCV, Open3D
- **Tools & Platforms**: VSCode, Vim, Git, GitHub, HPC Clusters
- **Operating Systems**: Linux, MacOS, Windows

RELEVANT COURSEWORK

- **Robotics**: Foundations of Robotics, Robot Perception, Robot Localization and Navigation
- **Machine Learning**: High Performance Machine Learning, Deep Learning, Mathematics for ML, Introduction to Tensorflow Neural Networks & Deep Learning, CNNs in Tensorflow,

PROJECTS

- **Post-Earthquake Damage Assessment using Fully Convolutional Networks**   Tensorflow, Keras | GitHub
  - Designed multi-task fully convolutional networks for semantic segmentation of building components and their damage state
  - Implemented batch normalization layers to enable faster convergence and better generalization over real data since the data used for the project was synthetically generated using physics based graphical models
  - Achieved a mAP of 83% over 5 component classes and mAP of 70% for 5 damage state classes

- **Dimensionality Reduction using Convolutional Autoencoders**   PyTorch | GitHub
  - Developed a deep convolutional autoencoder to reduce the dimensions of 28x28 sized Fashion MNIST images
  - Designed an encoder-decoder network with latent space dimension of 64 to guarantee proper reconstruction of input
  - Implemented batch normalization layers, learning rate decay and exponential scaling for faster convergence
  - Further reduced dimensions of the latent space to 2 dimensions using t-SNE to visualise the reduced dimensions

- **Visual Place Recognition using Bag of Visual Words**   Tensorflow, Keras | GitHub
  - Computed SIFT features for each image in database and queries using OpenCV's built-in SIFT feature extractor
  - Employed the k-means clustering algorithm to compute 800 cluster centroids to be used as visual words to generate a histogram of visual words in each image
  - Computed histograms of visual words for all the query images and database images using OpenCV's histogram generator and extracted similar images from the database by using the k-nearest neighbours algorithm on the generated histograms

- **Two-View Geometry based Relative Pose Estimation**   OpenCV | GitHub
  - Calibrated a camera using a calibration rig and removed radial distortion from the input images using the obtained camera matrix and distortion coefficient

- Computed the fundamental matrix using the normalized 8 point algorithm and obtained the essential matrix using the fundamental matrix and camera matrix
- Decomposed the essential matrix to obtain the orientation and translation vectors between the images

- **Marker based Augmented Reality**   **OpenCV | GitHub**
  - Obtained interest points to compute the epipolar geometry by detecting the corners of an AprilTag fiducial marker
  - Solved a PnP problem to compute 3D to 2D correspondence between the marker corners and face of a cube in 3D space
  - Projected 8 corners of the cube on the image and constructed a cube in 2D by joining the points.

- **3D Plane fitting in Point Cloud Data**   **Open3D, Plotly | GitHub**
  - Implemented the RANSAC algorithm to remove outlier data points which do not lie on a plane in the 3D point cloud data
  - Randomly selected 3 points in data and computed plane parameters using parametric equation of a plane
  - Computed the best plane parameters by minimizing perpendicular distance of each point in data from the plane

- **Variable Computation in Recurrent Neural Networks**   **NumPy | GitHub**
  - Implemented the paper arxiv:1611.06188 in NumPy
  - Implemented a learnable scheduler which varies the amount of computation based on data provided to the neural network
  - Achieved a 50% reduction in the number of computation for redundant text data

- **Kinematic and Dynamic Control of a KUKA Manipulator**   **Meshcat, Pinnochio | GitHub**
  - Designed a robot controller for the KUKA 7-joint manipulator
  - Computed the forward and inverse kinematic and dynamic parameters of the manipulator
  - Designed and compared a PID Controller, Resolved Rate Controller and an Impedance Controller for the manipulator

- **Smart Pet Feeder**   **PBASIC | GitHub**
  - Developed a smart bluetooth operated automatic feeder with an accompanying android app
  - Designed an android app to control 3 features of the feeder - drop food, disable feeder and reset food drop count.
  - Employed a HC-06 bluetooth module to connect a BASIC Stamp micro-controller to to the mobile app
  - Designed and 3D printed CAD models of the chasis of the feeder

LEADERSHIP

- **IEEE Student Branch, Birla Institute of Technology & Science, Pilani**   Pilani, India
  Vice-Chairperson   Jul 2017 - May 2018

- **Society for Student Mess Services, Birla Institute of Technology & Science, Pilani**   Pilani, India
  Governing Council Member   Aug 2018 - Jul 2019

REFERENCES

- **Dr. Syed Zafaruddin**: Assistant Professor, Birla Institute of Technology & Science, Pilani

- **Dr. Sumeet Saurav**: Scientist, Intelligent Systems Group, Central Electronics Engineering Research Institute Pilani