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HITESH BHOJWANI

Computer Vision | Deep Learning

GitHub: heisenberg141
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Skills

Languages: C++, Python, C, MATLAB
Libraries: Scikitlearn, Scipy, Point Cloud Library, Jupyter Notebooks, OpenCV, CUDA, Tensorflow, Pytorch, Numpy
Platforms: Linux, Git (version control), CMake, Robot Operating System (ROS, ROS2), Gazebo
Coursework: Deep Learning, Machine Learning, Artificial Intelligence, ,Computer Vision, Motion Planning

Education

Masters (MS) in Robotics Engineering, *Worcester Polytechnic Institute (WPI)* *Aug 2021 - May 2023*
B.Tech. in Instrumentation and Controls, *Guru Gobind Singh Indraprastha University* *Aug 2016 – May 2020*

Work Experience

Teaching Assistant at WPI | Digital Image Processing , Robot Dynamics *May 2022 – Current*
- *Currently* Assisting professor Ziming Zhang to grade assignments and teach image processing concepts like image filtering, image enhancement, Morphological transformations, feature detection (SIFT and MSER), SVD, Camera Modeling, Object detection and recognition, Image Segmentation, Deep Learning, etc.
- Assisted professor Mohammad Agheli to grade assignments and teach dynamic modeling of robotic systems using concepts like 3D and Projective Geometry, Probability, Calculus, Linear algebra, Numerical Optimization Methods, etc.

Graduate Researcher at MER Lab, under Dr. Berk Calli | Vision based Robotic Manipulation *Jan 2022 – Jul 2022*
- Researched an analytical grasping algorithm using classical CV techniques such as edge detection, contour approximation, etc. for object segmentation and various grasp metrics to get the best grasp candidate.
- Compared CV and ML based grasping algorithms (GGCNN, ResNet) for robotic manipulators using depth images from intel realsense RGB Depth camera (eye in hand configuration).
- Prototyped and designed a complete software architecture for visual servoing of manipulators using ROS, C++ and MoveIt library in gazebo simulation environment and for an industrial manipulator (Franka Emica Panda).

Research Assistant at IIIT Delhi | Virtual Testbed for mobile robots *Dec 2020 – Jun 2021*
- Calibrated a multiple camera setup with reprojection error of 3% and performed image stitching using homography matching to generate an accurate map of a large indoor environment.
- Utilized ROS and OpenCV to design and implement a computer vision pipeline for April tag based localization of mobile robots in a given map.

Research Intern at BotLab Dynamics, IIT Delhi | Localization using Visual Odometry | [Github] *Jun 2019 — Aug 2019*
- Developed a perception pipeline using Python and OpenCV for localization module of V - SLAM using monocular visual odometry to localize mobile robots in an indoor environment using feature matching over multiple frames and GPUs to improve performance by 24%.

Robotics Projects

VSLAM using EKF | Computer Vision, VSLAM, EKF, Sensor Fusion | [*Currently Working*]
- Developing a framework for Extended Kalman Filter (EKF) based monocular VSLAM using sensor fusion of camera and IMU data for mapping an indoor environment in real time.

Image Classification of blood clots | Deep Learning, CNN, Vision Transformer | **[Website]**
- Implemented and compared various CNN architectures for a task of binary classification of blood clots in stroke patients using a HPC Slurm GPU cluster for training on high resolution medical images to obtain 20% more accuracy than currently used method
- Down sampled the medical images with minimum feature loss to speed up the training and testing, and got comparable results to the models trained with high resolution images.

Driver Drowsiness Detection | Computer Vision, PyTorch, Deep Learning, KNN | **[Github]**
- Used normalized Facial Landmarks and compared deep learning architectures such as CNN, Binary Trees, KNN to detect the drowsiness level of a driver which resulted in 77.21% accuracy.
- Modularized and optimized the pipeline to run on a raspberry pi equipped with pi camera module.

Deep Learning from Scratch | Numpy, Deep Learning, PyTorch | **[Github]**
- Implemented various machine learning and deep learning architectures with multiple layers for tasks like classification and regression.
- Programmed optimized implementations of various metrics and methodologies like cross validation, forward and backpropagation, Stochastic Gradient Desecent (SGD), Softmax Regression with Cross Entropy (CE) loss etc. using Python and Numpy.