Harshul Varma

Email: *harshul.varma@mail.utoronto.ca* | Phone: +1 647-608-2013 | Toronto, Canada | *LinkedIn*

WORK EXPERIENCE

Research & Development Engineer Intern, *Synaptive Medical Inc* *Toronto, ON | May 2016 – July 2017*

Assisted cross-functional team in researching, planning and developing advanced optical imaging products for neuro-surgical procedures:

- Led mechatronic system design and development of an integrated handheld imaging probe (US Patent 637045):
  - Designed and manufactured a disposable mass producible spacer to maintain a fixed distance between the probe lens and the tissue
  - Saved 70% costs on lens selection and improved imaging capabilities by conducting quantitative analysis on effect of sterilisation on anti-reflective coating on lens
  - Manufactured a power supply module to reduce physical space of the system by 20% while ensuring ISO-60601 standards
  - Developed draping strategies and prototypes to reduce exposure of probe in medical operating conditions
- Developed testing setups and coded for catheter probes using C++ and Arduino to lay out scope for future commercial products
- Assisted algorithms team to differentiate between healthy tissues and tumor by implementing image processing and machine learning algorithms in MATLAB
- Ensured effective communication by designing presentations and writing status reports to department leads

PROJECTS

Mobile Dronespot (Capstone Project – UofT, *Drone Delivery Canada***)**

Collaborated with a team of five multidisciplinary engineers to design and develop a mobile takeoff and landing site on the roof of a vehicle for a payload carrying UAV to deposit and retrieve packages for cargo delivery

- Corrected landing inaccuracies of the UAV by 90% by designing and programming a re-centring system
- Developed a weatherproof storage of the UAV in the vehicle by designing a pneumatic mechanical lift and cover system
- Manufactured and assembled a scaled down integrated protype and cut costs by $7000

Mechatronics System Integration – 'Turtlebot' (Group Project, UofT)

- Developed algorithms in ROS and C++ for obstacle collision avoidance and autonomous navigation using gazebo and gmapping in order to map an unknown environment
- Implemented image processing algorithms (SURF and FLANN) using OpenCV to identify images placed on objects using Kinect camera in order to find objects of interest in an environment
- Designed algorithms in C++ to make 'Turtlebot' find and follow a user and display emotions using images and sound

Self-Driving Robot (Group Project, UofT - *Video Link***)**

- Designed and manufactured a robot chassis, block grasping mechanism, electrical system using SolidWorks and Visio, and executed soldering, calibration and testing of sensors and microcontrollers
- Developed a PID and a 'bang-bang' control system in C++ and Arduino IDE to allow motion of the robot in a straight line for autonomous navigation in a maze
- Utilised IR and ultrasonic sensors for sensor fusion and coded algorithms in MATLAB to achieve robot localization
- Designed, fabricated and implemented a gripper claw to pick up and drop the block in desired location

Pneumonia detection in X-Ray Images

- Implemented transfer learning with fined-tuned ResNet50 Convolutional Neural Network (CNN) with data augmentation to detect pneumonia in X-Ray images to assist doctors take better informed decisions.

Face Recognition and Verification

- Modelled a face verification and recognition system ('The Happy House') using Convolutional Neural Network (CNN) on front door camera images to recognize the person and unlock the door only when the person is smiling

Autonomous Driving – Car Detection

- Implemented object detection with YOLO model in Python using TensorFlow to detect and draw boxes around cars in hood mounted camera images

Air quality Analysis and Forecasting

- Analysed and visualized 18 years of time series data of Madrid's air pollution to discover trends and seasonality to forecast pollution levels for next 2 years using deep learning (LSTM-RNN) model.
- Conducted cluster analysis on air stations using unsupervised learning (K-Means) to identify and monitor key areas with highest pollution in Madrid.

EDUCATION

Bachelor of Applied Sciences, University of Toronto *Toronto, ON | Sept 2013-June 2018*

- Mechanical Engineering – Specialization in Robotics
- Engineering Business Certificate

CONTINUED LEARNING

Deep Learning Specialization, DeepLearning.ai
Neural Networks; Hyperparameter Tuning, Regularization and Optimization; Structuring ML Projects; Convolutional Neural Networks; Sequence Models.

IBM Data Science Professional Certificate
Databases and SQL; Data Analysis with Python; Data Visualization; Machine Learning

Advanced Machining and Welding, George Brown College

AWARDS & ACCOMPLISHMENTS

- Natural Sciences and Engineering Research Council of Canada (NSERC) Experience Award
- US Patent 637045 – Multi-Functional Handheld Optical Coherence Tomography Imaging System
- 3rd prize ASME Ontario Wide Technical Poster Competition – 'Nuclear Energy for Space Exploration', 2014
- Finalist Robotics in Space Exploration 'SEEK' Competition, UofT, 2015
- Finalist SPARK Design SolidWorks Competition, UofT, 2015
- 2nd place UofT Intramural Soccer League, 2016
- Dean's List, 2018

SKILLS

Programming: Python (pandas, scikit-learn, NumPy, matplotlib, seaborn, plotly, Keras, TensorFlow), C, C++, MATLAB, ROS
Design Software*:* SolidWorks, ANSYS, AutoCAD, Visio, EAGLE, Minitab, Excel, SCORBASE, Simulink
Machine Learning: Keras, Tensorflow, Pytorch, scikit-learn, XGBoost, regression, clustering, classification