Anirudh Topiwala

topiwala.anirudh@gmail.com, 240-302-3398, anirudhtopiwala.com, LinkedIn, GitHub: /anirudhtopiwala

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EDUCATION

A. James Clark School of Engineering, University of Maryland (UMD)   **College Park, MD**
Master of Engineering, Robotics (GPA: 3.82)   Expected May 2019
Nirma University   **Ahmedabad, India**
Bachelor of Technology, Mechanical Engineering (First Class with Distinction)   May 2017

TECHNICAL SKILLS

Tools and Software: C++, Python, Matlab, ROS, Keras, PyTorch, OpenCV, PCL, TensorFlow, Algorithms, Git, Travis CI, GDB, Coveralls, Lcov, Unit Testing, Arduino, Latex, Solidworks and ANSYS.

Robotic Frameworks: ROS, Gazebo, URDF, Rviz, iiwa_stack, MoveIt, OMPL, Orocos KDL, Eigen and Vrep.

PUBLICATIONS AND PATENTS

- **A. Topiwala**, L. Al-zogbi, T. Fleiter, and A. Krieger, "Adaptation and Evaluation of Deep Learning Techniques for Abdominal Skin Segmentation," pp. 1–8, in MICCAI 2019 (Manuscript under Review).   April 2019
- B. Mathur, **A. Topiwala**, S. Schaffer, M. Kam, H. Saeidi, T. Fleiter, and A. Kreiger, "A Semi-Autonomous Robotic System for Remote Trauma Assessment," pp. 1–8, in IROS 2019 (Manuscript under Review).   March 2019
- B. Mathur, **A. Topiwala**, H. Saeidi, T. Fleiter and A. Krieger, "Control Strategies for a Semi-Autonomous Ultrasound Robotic System", SIAM Conference on Control and Its Applications (Manuscript Accepted) Jan 2019
- Fleiter, T., Krieger, A., Saeidi, H., Mathur, B., Schaffer, S., **Topiwala, A.**, Kam, M."A Robotic System for Remote Trauma Assessment", U.S. Provisional Pat. Ser. No. 62/779,30.   December 2018

RESEARCH ASSITANTSHIP

Medical Robotics and Eqipment Lab – UMD   April 2018 – Present
Dynamic planning using Reinforcement learning and Optical flow – UMD   Jan 2019 – Present

- Developing a novel control strategy to pick up a moving pool ball with a robotic manipulator. (C++, ROS)
- Improving the reinforcement learning task and control strategy by adding optical flow as an input parameter.

Skin Detection for Autonomous Ultrasound Machine – UMD (RA)   Jan 2019 – Present

- Doing active research on different methods to segment skin of varied colors. An increase of 12 percent is already established using dynamic thresholding methods in RGB, HSV and LAB color spaces. (Python)
- Experimenting with neural networks like UNET, Mask R-CNN, Segnet and custom networks to further improve the segmentation pixel accuracy. (Python, Keras, TensorFlow, PyTorch)
- Created and justified the need for an abdominal database of 1000 images to improve skin segmentation accuracies.

Semi-Autonomous Ultrasound Scan Using Kuka Arm – UMD (RA)   May 2018 – Dec 2018

- Developed a semi-autonomous system to remotely perform an ultrasound scan on a patient using Kuka LWR arm.
- Kuka arms are teleoperated using a Haptic device and a 6 DOF force sensor mounted on the arm. (C++, ROS)
- Achieved localization accuracies under 0.94 ± 0.179 cm while performing eye-in-hand calibration.
- Developed a Hybrid control strategy after carrying out a comparison study between position and rate control.

Wound Detection using Deep Learning – UMD (RA)   May 2018 – Dec 2018

- Developed a Faster RCNN model using deep base network like VGG and transfer learning to get accurate wound detections under a mAP of 0.66. The number of classes were also extended to umbilicus and bandage detection.
- Created custom dataset of 6500 images using data augmentation and verified it by an expert radiologist. (Keras)

RELEVANT PROJECTS

Perception for Autonomous Vehicle – UMD   Jan 2018 – May 2018

- Implemented traffic sign detection and classification using SVM, MSER features and HOG features.
- Implemented lane detection for straight and curved lanes by using edge detection and perspective transforms.
- Actively carried out object recognition and tracking for a moving vehicle.
- Carried out Visual odometry for a car moving around a block using feature extraction and manipulating fundamental matrix. (all tasks carried out in Matlab).

ARIAC (Agile Robotics for Industrial Automation Competition) – UMD   Jan 2018 – May 2018
- Establishing control between collaborative robots (UR10 and AGV) to fulfil the orders given to the competition environment and moved parts from assembly bins to AGV's. MoveIt and Gazebo are the ROS plugins used. (C++)
- Improvising the system by adding contingencies for Part Drop and Important Order First. (C++, ROS)

Frontier-Based Exploration for Autonomous Robots – UMD   Jan 2018 - May 2018
- Carrying out frontier detection and using A star and RRT algorithm to generate point to point path. (C++, ROS).
- Implementing the gazebo simulations on turtlebot and improvising the method using fast frontier detection.

Inverted Pendulum Project - University of Maryland, College Park   Sept 2017 – Dec 2017
- Actively controlled an inverted pendulum on a cart using Q learning and OpenAI. Improved the convergence time by using Deep Q Learning. (Python, Keras)
- Developed dynamic equations using lagrangian and checked for the controllability and observability of the system. Established control of two pendulums on the cart using LQR and LQG controller. (Matlab)

Tic Tac Toe Project (UMD)   Sept 2017 - Dec 2017
- Designed a tic tac toe game, and used self-play and Q learning to train the network. (Matlab)
- Different exploratory methods were used, out of which the epsilon greedy algorithm worked the best, with a 100 percent win for the computer against a human.

Object Avoidance for a Differential Drive Robot- UMD   Sept 2017 - Dec 2017
- Implemented Q learning to make the robot learn how to avoid obstacles using gazebo and gym. (Python)
- Compared this method with object avoidance carried out in Simulink (Matlab) using data from ultrasonic sensors.

Robotic Arm - UMD   Sept 2017 - Dec 2017
- Established trajectory control for a 6 degrees of freedom robot so that it can reach any point on a spherical object. Designed and modelled the robot in Solidworks and then imported into Matlab to simulate inverse kinematics.

INDUSTRIAL EXPERIENCE

Larsen & Toubro – Sargent & Lundy   Vadodara, India
Engineering Intern   Jan 2017 - Apr 2017
- Designed and optimized a hold down clamp and pipe for carrying demineralized water in a mega power plant.
- Carried out optimizations like, fillet radius of clamp, length and material analysis to keep the stresses below the allowable stress limit. After 17 test runs, the final design parameters were accepted by the company.
- Wrote a technical report on the optimization's performed and it got accepted for validation by the design team

Robocon Team, Core Design Engineer – Nirma University, Ahmedabad, India   Aug 2013 - Aug 2014
- Worked in a team of 20 students, to design and fabricate autonomous robots according to the competition's theme.
- Designed four-bar grippers for instant pneumatic actuation and picking up objects.
- Developed a ladder-climbing mechanism for an 8-kg robot that could climb a ladder of 6 feet in just 12 seconds. For the same task a 1kg robot was also developed which could be pneumatically thrown to the top of the ladder. This reduced the time taken by the robot to just under 2 seconds and helped us bag the Championship trophy and represent India at the International level.

RELEVANT COURSES
- Perception and Planning for Autonomous Robots, Deep Learning, Software Development for Robotics and Robot Learning, Data structures and Algorithms, Robotics Specialization (UPenn) and Algorithms (Princeton).