

Bharat Mathur

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EDUCATION

University of Maryland (UMD)
Master of Engineering, Robotics

College Park, Maryland, USA
May 2019

SRM University
Bachelor of Technology, Mechatronics Engineering

Kattankulathur, Tamil Nadu, India
May 2017





SKILLS

Background: Medical Robotics and Imaging, Manipulators, and Unmanned Aerial Vehicles (Fixed, Rotary, Hybrids, and Tilt Rotors)
Programming languages: C++, QML, Python, Simulink, MATLAB, LaTeX, NI LabVIEW
Libraries, frameworks, and simulators: Orocos KDL, OpenCV, DCMTK, Qt and QML, ImFusion, Robot Operating System (ROS), Keras, TensorFlow, URDF, Gazebo, MoveIt! and OMPL, V-REP
OS and Software tools: Linux, Windows, Shell Scripting, Git, TRAVIS CI, Jenkins, GDB, unit testing, Coveralls, Lcov, Valgrind, Doxygen
Research Interests: Computer-Assisted Surgery, Haptics, Reinforcement Learning, Controls

PUBLICATIONS & PATENTS

- **Mathur, B.**, Topiwala, A., Schaffer S., Kam M., Saeidi, H., Fleiter, T. & Krieger, A., "A Semi-Autonomous Robotic System for Remote Trauma Assessment", 2019 IEEE 19th International Conference on Bioinformatics and Bioengineering (BIBE), 2019, pp. 649-656 ([Best Conference Paper Award](#))
- **Mathur, B.**, Topiwala, A., Saeidi, H., Fleiter, T. & Krieger, A. "Evaluation of Control Strategies for a Tele-manipulated Robotic System for Remote Trauma Assessment", 2019 SIAM Conference on Control and its Applications, 2019, pp. 7-14
- Fleiter, T., Krieger, A., Saeidi, H., **Mathur, B.**, Schaffer, S., Topiwala, A., Kam, M. "Systems, methods, and media for remote trauma assessment". *U.S. Non-Provisional Patent Ser. No. 16/714,134*
- **Mathur, B.**, Bukhari, J. Mathur, V. "Systems and Methods for Portable Utensil Cleaning". *U.S. Provisional Patent Ser. No. 63/111,023*

RESEARCH & PROFESSIONAL EXPERIENCE

-  **Senior Robotics Controls Research Engineer – Surgical Robotics** Nov 2021 – Present
Stryker Corporation, Weston, Florida, USA
- Developing novel computer-assisted-surgical and medical robotic systems, technologies, and applications.
-  **Software Engineer – Imaging, Navigation & Robotics** August 2019 – Nov 2021
Globus Medical Inc., Methuen, Massachusetts, USA
- Developed motion control, haptic, and registration algorithms along with their production quality code for Excelsius3D®, one of the world's most advanced intraoperative 3-in-1 mobile X-ray imaging systems.
 - Developed a haptic control scheme and navigation planner for a 1700 lb. omni-directional mobile platform.
 - Developed an IMU based motion profile governor to enhance system stability while maintaining peak performance.
 - Resolved inter-disciplinary challenges by initiating and coordinating efforts between software and electromechanical teams.
-  **Research Assistant to Prof. Axel Krieger** November 2017 – May 2019
Medical Robotics and Equipment Lab, UMD, College Park, Maryland, USA
- Developed a semi-autonomous robotic system using a Kuka IIWA LWR arm for earlier trauma diagnosis and faster initialization of life-saving care en-route to the hospital using ultrasonography techniques.
 - Developed a specialized position-velocity control based tele-manipulation technique with haptic force feedback and virtual fixture-assisted guidance for ultrasound application.
 - Developed algorithms for 3D reconstruction of the patient's torso, and identification of landmarks (umbilicus, mammary papillae), wounds and bandages using RGB-D images.
-  **Robotics Software Consultant (Co-op)** March 2019 – May 2019
Trossen Robotics, Chicago, Illinois, USA
- Designed and guided the development of ROS and MATLAB interfaces for 5 and 6 degrees-of-freedom robotic arms.



Team Leader
Control Systems Engineer
SRM-UAV, SRM University, Kattankulathur, Tamil Nadu, India

November 2014 – June 2017
July 2013 – October 2014

- Co-founded and led a team of 20 students to receive prestigious awards in 3 international competitions.
- Designed and developed 2 novel Vertical Take-Off and Landing unmanned aircraft and their control schemes from scratch.
- Developed Unmanned Aerial Systems for wind turbine inspection, reconnaissance, and package delivery.

AWARDS & HONORS

Runner-up Best Project Award – DeepRESECT: Using CNNs to Automate Brain Tumor Resection Planning *December 2020*
The Hamlyn Winter School on Surgical Imaging and Vision 2020, Imperial College London *London, United Kingdom*

Best Conference Paper Award *October 2019*
19th IEEE International Conference on Bioinformatics and Bioengineering *Athens, Greece*

Flight Readiness Review Rank 11 And World Rank 27 (SRM-UAV) *June 2017*
Students Unmanned Aerial Systems Competition 2017 by AUVSI *Maryland, USA*

World Rank 22 (SRM-UAV) *September 2016*
Medical Express Challenge 2016 *Canberra, Australia*

SELECTED GRADUATE PROJECTS

Human Activity Recognition using CNN on Inertial Data *CMSC 422: Machine Learning*

- Programmed a Convolutional Neural Network to recognize physical activities (such as walking, running, sitting etc.) using data from on-body Inertial Measurement Sensors.

Attitude Control of a Quadrotor Using Reinforcement Learning *ENPM 808F: Robot Learning*

- Developed reinforcement learning based PID controller tuning for a half quadrotor from ground up and demonstrated this on a custom-fabricated test rig.

Dynamic Path Planning for Hospital Environment *ENPM 661: Planning for Autonomous Robots*

- Developed and simulated a hierarchically nested path planning algorithm for autonomous patient transport vehicles in hospital environments capable of avoiding static and dynamic obstacles, dynamic re-planning, and dividing corridors into designated lanes.

Tic-Tac-Toe game using Q-learning *ENPM 808F: Robot Learning*

- Developed a Q-learning based agent that learnt to play Tic-Tac-Toe.

Modelling and Simulation of a 6 – DOF Industrial Manipulator *ENPM 662: Robot Modelling*

- Simulated a 6-DOF serial manipulator's kinematics using Simulink.

Highway Lane Detection *ENPM 673: Perception for Autonomous Robots*

- Developed an algorithm to detect straight and curved lanes on a highway to be used as a sub-system for driverless vehicles.

SELECTED UNDERGRADUATE RESEARCH PROJECTS

Modelling, Simulation, Control, and Development of a Tilt Rotor UAV *Bachelor's Thesis Project*

- Pioneered a novel tilt rotor aircraft of co-axial Tricopter (Y6) configuration with wing rotor pairs mounted on 1-DOF mounts each, and tail rotor pairs on a 2-DOF mount. The aircraft maneuvered purely by thrust vectoring.

Hybrid Quadrotor UAV *SRM-UAV*

- Pioneered a hybrid UAV which combines the advantages of a rotary-wing with those of a fixed-wing aircraft. It is capable of taking off and landing from almost any location without the need for a runway.

Control of a UAV and its Payload using Head Motion *Bachelor's Minor Thesis Project*

- Developed a hands-free system to control a quad-rotor and its gimbal-mounted camera (payload) using a headset equipped with an IMU to provide an augmented flying experience for military applications.

Inspection of Wind Turbine Blades using Unmanned Aerial Vehicles *SRM-UAV*

- Developed a rotary-wing aircraft system to identify fractures and other mechanical failures in wind turbine blades using RGB and IR imaging.