Shubham Maroti Wagh

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Research Interests

End-to-end Learning, Optimization, Computer Vision and Robotics.

Education

- **Erasmus Mundus Masters in Vison and Robotics (VIBOT)** Distinction | Rank: 3
  Heriot-Watt University - UK | Universitat de Girona - Spain | Université de Bourgogne - France *2016–2018*
- **Bachelor of Technology in Electrical and Electronics Engineering** 8.16/10
  Visvesvaraya National Institute of Technology, Nagpur - India *2012–2016*

Awards and Honors

- Recipient of **International Student Mobility** scholarship from the Regional Council Burgundy, France (2017, 2018).
- Recipient of **Erasmus+ Mobility** Grant for Erasmus Mundus Master in Computer Vision and Robotics (2017).
- **First prize** in *Breast Tomosynthesis Density Classification Challenge* as part of final project in *Medical Image Analysis* module of the VIBOT Master (2017).
- Selected to present *B.Tech Thesis* project at **IEEE RAS Summer School on Multi-Robot Systems** held at *National University of Singapore*, Singapore (2016).
- **Semi-finalist** award of *200 USD* in *Texas Instruments Innovation Challenge India Design Contest (TIIC - IDC 2015)* for the project implementation - "*Detection of fault in Railway Track using Optical Fiber*". This project got featured in **Times of India** of Nagpur edition and an opportunity to implement the idea with **National Entr. Network**.
- Ranked among the **top 1%** of 1.2 million students in the All India Engineering Entrance Exam (2012).

Professional and Research Experience

- **Q-Bot Limited (Digital & AI Team)** **London, UK**
  Research Engineer *Sept. 2018 – Present*
  - Developing deep learning models to identify properties in the UK that are suitable for underfloor insulation.
  - Working on underfloor void scene understanding to automatically generate spray region proposals for robots to spray.
  - Assisted with an autonomous underfloor SurveyBot project using semantic scene understanding and SLAM.
  - Endowed robots with features necessary to validate insulation foam depth coverage and spot height measurements.
  - Implemented robust sensor calibration routine (Lidar and camera-Lidar) for Mk6.3, Mk7 spray-robots and HHM.
  - Prototyped auto-generation of 3D CAD models from floorplan images and simplistic floorplan from 3D point clouds.
  - Improvement of firmware, which integrates the sensory/visual feedback, with the robotics algorithms.
  - Developed robotic control and deployment software UI for building-insulating mobile robots.
- **Heriot-Watt University (Ocean Systems Lab)** **Edinburgh, UK**
  *MSc Student | **Advisors**: Dr. Sen Wang and Dr. Yvan Petillot | MSc Thesis: Distinction* *Feb. – Aug. 2018*
  - Proposed two unsupervised learning frameworks for 3D reconstruction and motion estimation in underwater environments using unstructured sequences of optical and sonar images.
- **Laboratory for Analysis and Architecture of Systems (LAAS - CNRS)** **Toulouse, France**
  *Research Intern | **Advisor**: Dr. Antonio Franchi* *June – Aug. 2017*
  - Worked on the use of visual SLAM for state estimation of aerial robots using active stereo vision devoid of MoCap.
  - Modelled gripper system of quad-rotor for its manipulation and physical interaction capabilities.
- **Visvesvaraya National Institute of Technology (Dept. of Electrical Eng.)** **Nagpur, India**
  *BTech Student | **Advisor**: Dr. Anjali Junghare | BTech Thesis: 9/10* *Nov. 2015 – April 2016*
  - Designed two loop anti-windup PID controller for set-point tracking of rotating arm and balancing the vertical position of pendulum for Rotary Single Inverted Pendulum (RSIP).
  - Comparative analysis was experimentally conducted with observer-based pole placement and LQR controller methods.

- **Institut Pascal (Image, Perception Systems & Robotics Department)** **Aubière, France**
  ***Job Title**: Research Intern | **Advisor**: Dr. Roland Chapuis* *May – July 2015*
  - Analyzed various path-planning algorithms and implemented an optimized pure-pursuit algorithm represented by way-points in order to provide smooth tracking of the vehicle (VipaLab).

Key Academic Projects

- **Autonomous Navigation of Flying Robots based on End-to-End Learning** **Edinburgh, UK**
  ***Advisors**: Dr. Sen Wang and Dr. Yvan Petillot | Robotics Project* *Oct – Nov 2017*
  Performed an end-to-end autonomous navigation of flying robot AR Drone 2.0 by using real-world monocular image frames to follow a forest trail, imitating behaviour of human pilot.
- **Magnetic Resonance Imaging and Calibration** **Edinburgh, UK**
  ***Advisor**: Dr. Yves Wiaux | Computational Imaging - Final Project* *Oct – Nov 2017*
  Applied minimization algorithms to solve the three main ill-posed inverse problems solving reconstruction of MRI image and sensitivity maps when one of them is unknown and the case when both are unknown.
- **Breast Tomosynthesis Density Classification using Local Binary Patterns** **Girona, Spain**
  ***Advisor**: Dr. Robert Martí | Medical Image Analysis - Final Project* *April – May 2017*
  Achieved a novel method for the classification of the breast density into the BI-RADS scale using Local Binary Patterns (LBP) as a base descriptor and K - Nearest Neighbours (KNN) as a classifier.
- **Autonomous Frontier Exploration, Mapping and Path-Planning using Octomap** **Girona, Spain**
  ***Advisor**: Dr. Marc Carreras | Autonomous Robotics - Final Project* *April – May 2017*
  Completed an informed search algorithm on a grid for autonomous exploration using A^* approach and sampling based path-planning algorithm using rapidly exploring random tree (RRT) for homing of the TurtleBot.
- **Pascal Project Challenge** **Girona, Spain**
  ***Advisors**: Dr. Xavier Llado and Dr. Arnau Oliver | SSI - Final Project* *March – May 2017*
  Executed the task of recognizing objects from a number of visual object classes in realistic scenes using bag of words (BoW) strategy to build feature vectors.
- **3D Human Body Scanner** **Le Creusot, France**
  ***Advisor**: Dr. Yohan Fougerolle | Software Engineering - Final Project* *Oct – Dec 2016*
  Devised a 3D human body scanner software able to fully interface with a scanner rig composed of a turning table and a stationary depth sensor outputting watertight mesh results that can be used mainly but not limited to 3D printing.
- **Detection of fault in Railway Track using Optical Fiber** **Nagpur, India**
  ***Advisor**: Dr. B.S. Umre | TIIC - IDC 2015* *Oct 2014 – April 2015*
  Created an engineering solution using fiber optic cable to supplement track circuits for detection of broken rails.

Theses

- *Learning Underwater Motion and 3D Reconstruction from Optical and Acoustic Sensors*, MSc Thesis, Heriot-Watt University, 2018.
- *Perfromance Evaluation: Anti-windup Two-Loop PID Controller for Rotary Single Inverted Pendulum*, BTech Thesis, Visvesvaraya National Institute of Technology (VNIT), 2016.

Languages and Technologies

- *Programming skills* - C, C++, Python, LaTeX, MATLAB, SciLab, Octave, bash.
- *Packages & Middleware* - ROS, Gazebo, MoveIt, OMPL, PCL, OpenCV, Open3D, scikit-learn, Keras, Tensorflow.
- *Operating System* - Windows & Linux (Ubuntu).
- *Continuous Integration* - Gitlab CI, Circle CI.
- *IDE* - CLion, PyCharm, GitKraken.

Extracurricular Activities

- Technical Affairs Secretary, Member of VNIT Nagpur Student Council (2015 - 2016).
- Academic Secretary, Dept. of Electrical Engineering, VNIT Nagpur (2014 - 2016).
- Instructor for short student workshops on ROS and OpenCV at VNIT Nagpur (2014 - 2015).
- Active Member of IEEE VNIT Student Chapter (2013 - 2016).