

Dr. M. Usman Maqbool Bhutta

POSTDOCTORAL FELLOW · DEPARTMENT OF MECHANICAL AND AUTOMATION ENGINEERING, CUHK, HK

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“Robotician + Entrepreneur”

Summary

With the rise of autonomous systems, being a researcher and entrepreneur, my research direction is their deployment to the real world. For any autonomous mode of the robot, a 3D map is essential to navigate and operate at any place. I work to tackle the problems related to scale difference and loop closures for large scale 3D mapping. I've 7+ years of experience specializing in robotics R&D and project management. I previously owned an IT company, and I've been part of several startups since 2011. My full profile can view here (<https://usmanmaqbool.github.io/>).

Work Experience

RESEARCH (COMPUTER VISION TECHNOLOGIES AND ROBOTICS SYSTEM)

C3 Robotics Laboratory (C3RL), Department of Mechanical and Automation Engineering

CUHK, Hong Kong.

POSTDOCTORAL RESEARCH FELLOW

May. 2021 - Present

- Supervisor: [Prof. Darwin Lau](#), Director of C3 Robotics Laboratory (C3RL), The Chinese University of Hong Kong CUHK, Hong Kong..
- **Research in AR/VR and inspection robotics for construction**

I'm working on several projects here

AR/VR: Research in AR/VR for teleoperated robots, human-robot interaction.

Inspection: Deep learning based research for the robotic presurface inspection for the construction.

Multi-agent collaboration: For indoor vegetation and painting robotics application.

Robotics and Multi-Perception Lab, Robotics Institute

HKUST, HK

PHD

Sep 2016 - Feb 2021

- PhD Supervisor: [Prof Ming Liu](#), Director of Robotics and Multi-Perception Lab (RAM-LAB)
- **Research Contributions as First Author**

Place Recognition: Our work makes a leap towards hierarchical deep learning-based place recognition for multiagent SLAM systems. We introduce a probabilistic layer to constrain the local representation along with the global representation of images. The global description of the pre-trained model and the local consistency introduced in our work enables the system to yield good performance at large-scale.

Development Using: MATLAB, Python, Jupyter, Nvidia CUDA, Docker, Deep learning, Matconvnet

Multi-Agent SLAM: I've produced Loop-box for the multi-Agent Direct SLAM Triggered by Single Loop Closure for Large scale semi dense 3D reconstruction /large-scale structure from motion. This work is accepted for publication in IEEE Transactions on Cybernetics (IF= 11+)..

Development using: C++ 11, ROS, OpenCV, OpenGV, Paraview, EVO, UGV, LSD-SLAM, Monocular Camera.

SLAM: I've worked mainly for the multi-agent SLAM system. To find the scale difference and excellent relative transformation between difference agents. I've produced [PCR-Pro](#) work. This work got best student paper finalist award at IEEE-CYBER 2018.

Development using: C++ 11, ROS, OpenCV, OpenGV, Paraview, EVO, Monocular Camera, Plotly

Automation (Inspection): For smartphone glass inspection, I've introduced [Smart-Inspect](#) work. This work is accepted in IROS 2020. The patent is also under-review in the US.

Development using: Python, Jupyter, Nvidia CUDA, K-Means, Docker, Machine learning (ML)

Autonomous Systems Lab (ASL)

ETH Zürich, Switzerland.

ACADEMIC GUEST

Oct. 2019 - Mar. 2020

- Supervisor: [Prof. Roland Siegwart](#), Director of Autonomous Systems Lab (ASL), ETH Zürich, Switzerland.
- Co-Supervisor: [Dr. Cesar Dario Cadena Lerma](#), Senior Researcher at ASL, ETH Zürich, Switzerland.
- **Research in Place Recognition:** I've worked for making the better place recognition for the better scene understanding. Furthermore, I've also introduced light weight representation of key-frames for better channel utilization.

Development using: MATLAB, Python, Jupyter, Nvidia CUDA, Docker, Deep learning, Matconvnet

Department of Electronics

QAU, Pakistan

MPhil CANDIDATE

Mar. 2010 - Jun. 2012

- M.Phil. Supervisor: [Prof Hasan Mahmood](#), Department of Electronics, QAU.
- **Research in Image Processing (CNN):** I've introduced CNN-based license plate recognition of Pakistani's Cars. This work has been published in IEEE-ICALIP 2014.

INDUSTRY AND ENTREPRENEURSHIP

Lisee Technology Corporation Limited

Central, HK

COO

Jan 2018 - Jan 2021

- Won funding support for company | TSSSU Support HK\$ 300,000 (Jun 19 - May 20).
- Indoor Navigation for Libray using Lisee Technology | PCF Support HK\$ 160,000 (Jun 18 - May 19).

Friends Corporate Technologies

CEO

50+ Projects | Electronics/ Electrical Engineering, R&D, image processing, Web Applications Development, MVC Applications

Federal Government of Pakistan

SCIENTIFIC OFFICER

Electronics/ Electrical Engineering, R&D, image processing

Server4Sale, LLC

PHP DEVELOPER

Php web application development for Joomla and Zend frameworks.

ACADEMIC

Department of Computer Science

LECTURER (VISITING)

Teaching MCS and BS-CS courses

Department of Physics

CTI

Teaching BS physics (Electronics related courses + Labs + Projects)

Department of Electronics

INSTRUCTOR

'PHP Web Development' (a short course) offered in Department of Electronics, Quaid-i-Azam University, Islamabad, Pakistan.

Islamabad, PK

Feb 2013 - Aug 2015

Islamabad, PK

May 2012 - Feb 2013

Islamabad, PK

Dec 2009 - Mar 2010

BZU-Sahiwal, Pakistan

Feb 2016 - Jun 2016

GPGC Sahiwal, Pakistan

Oct. 2015 - May. 2016

QAU, Pakistan

Aug. 2010 - Dec. 2010

Education

Ph.D. in Robotics and AI at RAM-LAB, Robotics Institute

DEPARTMENT OF ELECTRONIC & COMPUTER ENGINEERING, THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

- PhD Supervisor: **Prof Ming Liu**, Director of Robotics and Multi-Perception Lab ([RAM-LAB](#))
- Exchange Supervisor: **Prof. Roland Siegwart**, Director of Autonomous Systems Lab ([ASL](#)), **ETH Zürich**, Switzerland.
- Exchange Co-Supervisor: **Dr. Cesar Dario Cadena Lerma**, Senior Researcher at ASL, **ETH Zürich**, Switzerland.
- Got PEEF CCMS PhD scholarship from Pakistan and overseas research award (ORA).
- Research: Multi-Agent SLAM System, Place Recognition, Autonomous Car and Deep Learning for automation industry. Hand on experience on RGB-D 3D reconstruction, Multi-view stereo, python and C++ development experience, multi-threaded coding. 3D mesh registration, paraview and parameterizations. Moreover, I've deep understanding of data structures and algorithms. Experience with software development on Linux open-source stack. Calculus, linear algebra and geometry related courses have been taken.

HKUST, Hong Kong

Sep. 2016 - Feb. 2021

M.Phil. in Electronics

DEPARTMENT OF ELECTRONICS, QUAID-I-AZAM UNIVERSITY, ISLAMABAD, PAKISTAN.

- M.Phil. Supervisor: **Prof Hasan Mahmood**, Department of Electronics, QAU.
- Research: Signal and Image Processing
- Grade: A

QAU, Pakistan

Mar. 2010 - Jun. 2012

M.Sc. in Electronics

DEPARTMENT OF ELECTRONICS, QUAID-I-AZAM UNIVERSITY, ISLAMABAD, PAKISTAN.

- **2nd position** in batch
- Projects: completed 9+ projects related to C++, Verilog/HDL and Micro-controller programming.

QAU, Pakistan

Mar. 2010 - Jun. 2012

B.Sc. in Mathematics and Physics

BHAUDDIN ZAKARIYA UNIVERSITY, MULTAN PAKISTAN

- Grade: 1st Division

BZU, Pakistan

Mar. 2010 - Jun. 2012

Presentation

IEEE/RSJ International Conference on Intelligent Robots and Systems [IROS, 2020]

PRESENTOR AS AUTHOR

- Introduced **Smart-Inspect** for the micro scale localization and classification of smartphone glass defects for industrial automation.

Las Vegas, USA

Oct. 2020

Technology Start-up Support Scheme for Universities (TSSSU)

PRESENTER AS COO LISEE TECHNOLOGY CORPORATION COMPANY LIMITED, HONG KONG.

- Introduced Lisee technology in front of selection committee panel and won TSSSU 2019-20 funding of the amount of HK\$300,000.

HKUST, Hong Kong

Jan. 2019

IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems [IEEE-CYBER 2018]

Tianjin, China

PRESENTOR AS AUTHOR

Jul. 2018

- Introduced PCR-Pro for the estimation of information matrix and scale difference for pose graph SLAM.

IET-Young Professionals Exhibition and Competition (IET-YPEC) 2018

CityU, Hong Kong

PRESENTER AS COO LISEE TECHNOLOGY CORPORATION COMPANY LIMITED, HONG KONG.

Jul. 2018

- Introduced Lisee technology at IET-YPEC 2018.

Campus Challenge @ HKUST Transportation

HKUST, Hong Kong

PRESENTER AS PARTICIPENT

May 2018

- HKUST got 80+ proposals for this competitions, and arranged a roadshow. My proposal got selected for the audience award after getting maximum votes.

High Tech Innovation and Entrepreneurship

HKUST, Hong Kong

PRESENTER AS ENTREPRENEUR

Dec. 2017

- Introduced my study related to the flying cars.

World First Youth Robotics Developemnt Forum 2017

Shangri-La Shenzhen, China.

PRESENTER AS AUTHOR.

Nov. 2017

- Introduced my work related to multi-agent SLAM system.

Honors & Awards

INTERNATIONAL

July, 2018 **Best Student Paper Finalist Award**, IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems

Tianjin, China

May, 2018 **Audience Award**, Campus Challenge - Transportation, HKUST

HKUST, HK

Nov, 2017 **Best Mapper Award**, Robotics and Multi-Perception Lab, HKUST

Shenzhen, China

May, 2017 **Completion Award**, The Graduate Teaching Assistant Training, HKUST

HKUST, HK

Dec, 2016 **Best External Award**, Robotics and Multi-Perception Lab, HKUST

Shenzhen, China

Nov, 2016 **Completion Award**, Author Workshop, Elsevier Publishing Campus

HKUST, HK

DOMESTIC

Sep 2016 **CCMS PhD Scholarship**, Won Chief Minister Marit Scholarship (CCMS) scholarship award by Punjab Government (PEEF), Pakistan for pursuing my PhD studies at HKUST, HK

Lahore, PK

Sep 2013 **Participant**, Painting for peace (Pakistan-India-Afghanistan) event, a part of the Harmony initiative

Islamabad, PK

Apr 2013 **Participant**, Case Spark in business plan competition

Islamabad, PK

Apr 2013 **Participant**, Case EPICA

Islamabad, PK

Apr 2013 **Participant**, How to be a Better Playwright Workshop by PNCA and US Embassy Pakistan

Islamabad, PK

Oct 2012 **Participant**, Punjab Youth Festival

Lahore, PK

Oct 2011 **Participant**, Int'l Youth Conference and Festival

Islamabad, PK

Sep 2011 **Participant**, Asian Youth Conference and Peace Festival

Lahore, PK

Apr 2011 **Completion Award**, Acting and Directing Theater Workshop by PNCA and US Embassy Pakistan

Islamabad, PK

Dec 2011 **Participant**, National Drama Festival

Islamabad, PK

Dec 2010 **Instuctor of short Course**, PHP Web Development' at the Department of Electronics, QAU

Islamabad, PK

Apr 2013 **Completion Award**, Running River Rafting course by Adventure Foundation of Pakistan

Mansehra, PK

Apr 2013 **Completion Award**, Paragliding course by QAU Adventure Club

Islamabad, PK

Dec 2008 **Award of Honor**, Finance Secretary of Electronics Student Society (ESS) at QAU

Islamabad, PK

Academic Activities

ICRA **Referee Service**, IEEE/RSJ International Conference on Robotics and Automation

2021, -20

IROS **Referee Service**, IEEE/RSJ RA-L and International Conference on Robotics and Automation

2021, -20, -19, -18

HKUST, HK **Teaching Assistant**, EESM 5547 - Multimedia Signal Processing

Spr 2020, Spr 2019,

Spr 2018

CASE **Referee Service**, IEEE International Conference on Automation Science and Engineering

2019

HKUST, HK **Teaching Assistant**, ELEC4820 - Medical Imaging

Fall 2018

HKUST, HK **Teaching Assistant**, ELEC 1010 - Electronic and Information Technology

Spr 2017

Skills

Robotics and Computer Vision	Ubuntu, ROS, PCL, Docker, Catkin, OpenCV, OpenGV, Ceres Solver, g2o, Libpointmatcher
Machine Learning / Deep Learning	Jupyter, Pytorch, Tensorflow, Keras, CUDA
Programming	Python, C/C++, Matlab, git, LaTeX, FPGA, Verilog
Web	mkdocs, Hugo, Jekyll, PHP, MYSQL
Languages	English, Urdu

Research Publication

Why-So-Deep: Image Correspondence Verification by Probabilistic Spatial Landmarks Elevation for Visual Place Recognition

M USMAN MAQBOOL BHUTTA*, YUXIANG SUN AND MING LIU

The IEEE Transactions on Automation Science and Engineering (T-ASE)

Journal Paper

Submitted

Loop-box: Multi-Agent Direct SLAM Triggered by Single Loop Closure for Large Scale Mapping

M USMAN MAQBOOL BHUTTA*, MANOHAR KUSE, RUI FAN, YANAN LIU AND MING LIU

IEEE Transactions on Cybernetics (IF: 11+)

Journal Paper

Oct 2020

Smart-Inspect: Micro Scale Localization and Classification of Smart Phone Glass Defects for Industrial Automation

M USMAN MAQBOOL BHUTTA*, SHOAB ASLAM, PENG YUN, JIANHAO JIAO AND MING LIU

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)

Conference Paper

Oct 2020

Multiple Lane Detection Algorithm Based on Optimised Dense Disparity Map Estimation

HAN MA, YIXIN MA, JIANHAO JIAO, M USMAN MAQBOOL BHUTTA, MOHAMMUD JUNAID BOCUS, LUJIA WANG, MING LIU AND RUI FAN

Accepted in IEEE International Conference on Imaging Systems and Techniques (IST 2018)

Conference Paper

Dec 2018

PCR-Pro: 3D Sparse and Different Scale Point Clouds Registration and Robust Estimation of Information Matrix For Pose Graph SLAM

M USMAN MAQBOOL BHUTTA* AND MING LIU

Presented in IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems (IEEE-CYBER 2018), and won **Best Student Paper Finalist Award**.

Conference Paper

Jul 2018

An intelligent approach for robust detection and recognition of multiple color and font styles automobiles license plates: A feature-based algorithm

M USMAN MAQBOOL BHUTTA*, HASAN MAHMOOD, AND HAROON MALIK

Published in IEEE International Conference on Audio, Language and Image Processing (ICALIP 2014).

Conference Paper

Jan 2015

Efficient Reset Design Techniques

QAMAR, ZOHA, BUSHRA YASEEN, AND USMAN MAQBOOL

Published in Science International Lahore

Journal Paper

2015

Patent

Semi-Supervised Learning Approach for Smart Phone Glasses Defect Inspection

MUHAMMAD USMAN MAQBOOL BHUTTA, JIANHAO JIAO, PENG YUN, YUAN WANG, XUEBIN SUN, MING LIU

TTC.PA.1315, US Provisional Patent Application (No. 62/974,937).

US Patent

Jan 2020

References

Prof Darwin Lau

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Postdoc Supervisor

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Prof Ming Liu

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Ph.D. Supervisor

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Exchange Co-Supervisor

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