

# Dr. M. Usman Maqbool Bhutta

POSTDOCTORAL ASSOCIATE · COMPUTER VISION AND SENSING SYSTEMS (COVISS), ABE, UNIVERSITY OF FLORIDA

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“Robotician + Entrepreneur”

## Summary

I am interested in developing more effective problem-solving strategies for complex challenges and acquiring new technologies and tools as needed. I can describe myself as a dedicated individual with strengths in project management, market research, team building, proposal writing, and presentation skills. I have over 8 years of specialized experience in robotics research and development, as well as project management. I previously served as the co-founder and Chief Operating Officer of a startup company that provided indoor navigation services using visible light communication technology [Lisee Technology Corporation Limited Hong Kong]. I have also held a director position at Friends corporate technologies and introduced Dalocation.com, a dynamic real estate mapping platform. In 2018, HKUST organized the Campus Challenge @ HKUST Transportation event, which received over 80 proposals. My work was recognized with the Audience Award, which I received from HKUST President Wei Shyy. I have also presented the Lisee technology at the IET-YPEC held at the City University of Hong Kong. In 2018, our company received HK\$160,000 in funding support from the Proof-of-Concept Fund at HKUST. Furthermore, in 2019, we were awarded HK\$300,000 in funding from the Technology Start-up Support Scheme for Universities in Hong Kong. I have been involved in several other entrepreneurial ventures in the real estate, marketing, and automation sectors since 2011. I am a straightforward individual who is passionate about research and development and enjoys turning ideas into reality. My full profile is available at the URL (<https://usmanmaqbool.github.io/>).

## Work Experience

### Research (Computer Vision Technologies and Robotics System)

#### Computer Vision and Sensing Systems (COVISS) Lab, Department of Agricultural and Biological Engineering

UF, United States.

##### Postdoctoral Associate

Aug. 2023 - Present

- Supervisor: [Prof. Henry Medeiros](#), Director of Computer Vision and Sensing Systems (COVISS) Lab, University of Florida UF, United States..
- Research in place recognition and agricultural robotics

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

CUHK, Hong Kong.

##### Postdoctoral Research Fellow

May 2021 - Jun. 2023

- Supervisor: [Prof. Darwin Lau](#), Director of C3 Robotics Laboratory (C3RL), The Chinese University of Hong Kong CUHK, Hong Kong..

- Research in place recognition, AR/VR and inspection robotics for construction

I'm working on several projects here

**Place Recognition:** Working on the light-weight representation of images and making better use of previously trained models.

**AR/VR:** Research in AR/VR Platform design, multi-agent mixed reality, assistive prosthetics for the handicapped persons, 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

Islamabad, PK

#### CEO

Feb 2013 - Aug 2015

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

### Federal Government of Pakistan

Islamabad, PK

#### Scientific Officer

May 2012 - Feb 2013

Electronics/ Electrical Engineering, R&D, image processing

### Server4Sale, LLC

Islamabad, PK

#### PHP Developer

Dec 2009 - Mar 2010

Php web application development for Joomla and Zend frameworks.

## Academic

### Department of Computer Science

BZU-Sahiwal, Pakistan

#### Lecturer (Visiting)

Feb 2016 - Jun 2016

Teaching MCS and BS-CS courses

### Department of Physics

GPGC Sahiwal, Pakistan

#### CTI

Oct. 2015 - May. 2016

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

### Department of Electronics

QAU, Pakistan

#### Instructor

Aug. 2010 - Dec. 2010

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

## Education

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

HKUST, Hong Kong

Department of Electronic & Computer Engineering, The Hong Kong University of Science and Technology

Sep 2016 - Jun 2021

- **Thesis:** "Towards A Swift Multiagent SLAM System For Large-scale Robotics Applications", June 17, 2021
- 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.

### M.Phil. in Electronics

QAU, Pakistan

Department of Electronics, Quaid-i-Azam University, Islamabad, Pakistan.

Mar 2010 - Jun 2012

- **Thesis:** "A Feature Based Algorithm for Automobile License Plate Detection and Recognition in Pakistan", Mar, 2012
- M.Phil. Supervisor: **Prof Hasan Mahmood**, Department of Electronics, QAU.
- Research: Signal and Image Processing
- Grade: A

## M.Sc. in Electronics

Department of Electronics, Quaid-i-Azam University, Islamabad, Pakistan.

QAU, Pakistan

Sep 2007 - Jun 2010

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

## B.Sc. in Mathematics and Physics

Bahauddin Zakariya University, Multan Pakistan

BZU, Pakistan

Sep. 2005 - Aug. 2007

- Grade: 1st Division

## Honors & Awards

July, 2021	<b>Educational Technology Innovation: Gold Award</b> , The Teaching and Learning Innovation Expo, CUHK	CUHK, Hong Kong
July, 2021	<b>Pedagogical Innovation: Silver Award</b> , The Teaching and Learning Innovation Expo, CUHK	CUHK, Hong Kong
July, 2018	<b>Best Student Paper Finalist Award</b> , IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems	Tianjin, China
May, 2018	<b>Audience Award</b> , Campus Challenge - Transportation, HKUST	HKUST, HK
Nov, 2017	<b>Best Mapper Award</b> , Robotics and Multi-Perception Lab, HKUST	Shenzhen, China
May, 2017	<b>Completion Award</b> , The Graduate Teaching Assistant Training, HKUST	HKUST, HK
Dec, 2016	<b>Best External Award</b> , Robotics and Multi-Perception Lab, HKUST	Shenzhen, China
Nov, 2016	<b>Completion Award</b> , Author Workshop, Elsevier Publishing Campus	HKUST, HK
Sep 2016	<b>CCMS PhD Scholarship</b> , 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	<b>Participant</b> , Painting for peace (Pakistan-India-Afghanistan) event, a part of the Harmony initiative	Islamabad, PK
Apr 2013	<b>Participant</b> , Case Spark in business plan competition	Islamabad, PK
Apr 2013	<b>Participant</b> , Case EPICA	Islamabad, PK
Apr 2013	<b>Participant</b> , How to be a Better Playwright Workshop by PNCA and US Embassy Pakistan	Islamabad, PK
Oct 2012	<b>Participant</b> , Punjab Youth Festival	Lahore, PK
Oct 2011	<b>Participant</b> , Int'l Youth Conference and Festival	Islamabad, PK
Sep 2011	<b>Participant</b> , Asian Youth Conference and Peace Festival	Lahore, PK
Apr 2011	<b>Completion Award</b> , Acting and Directing Theater Workshop by PNCA and US Embassy Pakistan	Islamabad, PK
Dec 2011	<b>Participant</b> , National Drama Festival	Islamabad, PK
Dec 2010	<b>Instuctor of short Course</b> , PHP Web Development' at the Department of Electronics, QAU	Islamabad, PK
Apr 2013	<b>Completion Award</b> , Running River Rafting course by Adventure Foundation of Pakistan	Mansehra, PK
Apr 2013	<b>Completion Award</b> , Paragliding course by QAU Adventure Club	Islamabad, PK
Dec 2008	<b>Award of Honor</b> , Finance Secretary of Electronics Student Society (ESS) at QAU	Islamabad, PK

## Presentation

### Navigating Academia Research & Industry, ITCN Asia 2023

Pak-China Friendship Centre,  
Islamabad

#### Panelist

Feb. 2023

- 'I emphasize taking the voluntary initiative by the tech industry first. Companies should realize that they need academic involvement to grow at a swift pace. Most VPs of big companies belong to academia.
- 'In return, companies would at least solve their quality hiring problems. Usually, universities need more funding for R&D and IP filings, etc. In a broader view, both could get huge benefits.

### Teaching and Learning Innovation Expo 2021

CUHK, Hong Kong

#### Posters Presentation

Jul. 2021

- 'Mixed Reality in Hands-On Learning of Robotics' by Xinyan Zhao, Sabrina Lam, M. Usman M. Bhutta, Darwin Lau and Jimmy Lee.
- 'Online Robotics Laboratory Framework for Interactive and Group Hands-On Learning' by Ken Hui, Ken Kwok, M. Usman M. Bhutta, Darwin Lau and Jimmy Lee.

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

Las Vegas, USA

#### Presenter as author

Oct. 2020

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

### Technology Start-up Support Scheme for Universities (TSSSU)

HKUST, Hong Kong

#### Presenter as COO Lisee Technology Corporation Company Limited, Hong Kong.

Jan. 2019

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

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

Tianjin, China

Presenter 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 participant

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.

## Scientific Review Services and Academic Services

### Journal Referee Services

TJS **Peer Reviewer**, The Journal of Supercomputing

2024

RA-L **Peer Reviewer**, IEEE Robotics and Automation Letter

2024, -23, -22

TC **Peer Reviewer**, IEEE Transactions on Cybernetics

2022

### Conference Referee Services

IROS **Peer Reviewer**, IEEE/RSJ RA-L and International Conference on Robotics and Automation

2024, 23, -21, -20, -18

ICRA **Peer Reviewer**, IEEE/RSJ International Conference on Robotics and Automation

2023, -22, -21, -20

UF, US **Poster Judge**, UF/IFAS Agricultural and Biological Engineering Poster Symposium

2024

### Teaching Assistant Positions

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

Spr 2020, Spr 2019,

Spr 2018

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

Fall 2018

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

Spr 2017

## Skills

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

## Research

G: [Google Scholar](#) | ORCID iD: [0000-0002-3512-4279](#)

### Journal Publications

#### In-Sensor Visual Perception and Inference

Journal

Yanan Liu and Rui Fan and Jianglong Guo and Hepeng Ni and M. Usman Maqbool Bhutta

Jul 2023

2023 Intelligent Computing

#### Robust mobile robot navigation in cluttered environments based on hybrid adaptive neuro-fuzzy inference and sensor fusion

Journal (IF: 8.8+)

Muhammad Husnain Haider, Zhonglai Wanga, Abdullah Aman Khan, Hub Ali, Hao Zheng,

Shaban Usman, Rajesh Kumar, M. Usman Maqbool Bhutta, Pengpeng Zhi

Aug 2022

2022 Journal of King Saud University-Computer and Information Sciences.

## **MAFNet: Segmentation of Road Potholes with Multi-modal Attention Fusion Network for Autonomous Vehicles**

Zhen Feng, Yanning Guo, Qing Liang, M. Usman Maqbool Bhutta, Hengli Wang, Ming Liu, and Yuxiang Sun

*Journal (IF: 5.3+)*

Aug 2022

2022 IEEE Transactions on Instrumentation & Measurement

## **Why-So-Deep: Towards Boosting Previously Trained Models for Visual Place Recognition**

M Usman Maqbool Bhutta\*, Yuxiang Sun, Darwin Lau and Ming Liu

*Journal (IF: 5.4+)*

Jan 2022

IEEE Robotics and Automation Letters (RA-L)/ICRA, 2022

## **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

*Journal (IF: 11.7+)*

Oct 2020

2022 IEEE Transactions on Cybernetics

## **Efficient Reset Design Techniques**

Qamar, Zoha, Bushra Yaseen, and Usman Maqbool

*Journal Paper*

2015

Published in Science International Lahore

## **Conference Proceedings**

### **Autonomous Mobile Robot Navigation using Adaptive Neuro Fuzzy Inference System**

Muhammad Husnain Haider and Hub Ali and Abdullah Aman Khan and Hao Zheng and M. Usman Maqbool Bhutta and Shaban Usman and Pengpeng Zhi and Zhonglai Wang

*Conference Paper*

May 2022

2022 International Conference On Innovations And Development Of Information Technologies And Robotics (IDITR), 2022

### **Scale-Adaptive Pothole Detection and Tracking from 3-D Road Point Clouds**

Wu, Rigen and Fan, Jiahe and Guo, Libo and Qiao, Lei and Bhutta, M. Usman Maqbool and Hosking, Brett and Vityazev, Sergey and Fan, Rui

*Conference Paper*

Aug 2021

2021 IEEE International Conference on Imaging Systems and Techniques (IST), 2021

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

M Usman Maqbool Bhutta\*, Shoaib Aslam, Peng Yun, Jianhao JIAO and Ming Liu

*Conference Paper*

Oct 2020

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

*Conference Paper*

Dec 2018

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

*Conference Paper*

Jul 2018

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

### **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

*Conference Paper*

Jan 2015

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

## **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

*US Patent*

Jan 2020

U.S. Provisional Patent Application No. 62/974,937, Filing Date 01/06/2020.

### **Automatic Surface Defect Detection System for Smart Phone Glass Based on Deep Learning**

Yuan Wang, Jianhao Jiao, Peng Yun, Muhammad Usman Maqbool Bhutta, Xuebin Sun, Ming Liu

*US Patent*

Jan 2020

U.S. Provisional Patent Application No. 62/974,938, Filing Date 01/06/2020.

## References

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### **Prof Henry Medeiros**

Associate Professor · Director of Computer Vision and Sensing Systems (COVISS) Lab,  
Department of Agricultural and Biological Engineering University of Florida, FL, USA  
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*Postdoc Supervisor*

*hmedeiros@ufl.edu*

### **Prof Hafiz Malik**

Professor · Director of Information Systems, Security, and Forensics (ISSF), Electrical and  
Computer Engineering, University of Michigan-Dearborn, MI, USA.  
+1 (313) 593 5677

*Research Supervisor*

*hafiz@umich.edu*