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"Roboticist + 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 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

Instructer   *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 - Feb. 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**, Switzer-land.
- 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 in-dustry. Hand on experience on RGB-D 3D recontruction, Multi-view stereo, python and C++ development experi-ence, multi-threaded coding.3D mesh registration, paraview and parameterizations. Moreover, I've deep under-standing 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*

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

M.Sc. in Electronics   *QAU*, Pakistan

Department of Electronics, Quaid-i-Azam University, Islamabad, Pakistan.   *Mar. 2010 - Jun. 2012*

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

B.Sc. in Mathematics and Physics   *BZU*, Pakistan

Bahauddin Zakariya University, Multan Pakistan   *Mar. 2010 - Jun. 2012*

- Grade: 1st Division

Presentation

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*
Presentor 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*
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 compeitions, 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

July, 2021	**Educational Technology Innovation: Gold Award**, The Teaching and Learning Innovation Expo, CUHK	*CUHK, Hong Kong*
July, 2021	**Pedagogical Innovation: Silver Award**, The Teaching and Learning Innovation Expo, CUHK	*CUHK, Hong Kong*
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*
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 Embassay 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

RA-L	**Referee Service**, IEEE Robotics and Automation Letter	*2022*
TC	**Referee Service**, IEEE Transactions on Cybernetics	*2020, -21*
ICRA	**Referee Service**, IEEE/RSJ International Conference on Robotics and Automation	*2022, -21, -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

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

*Journal (**IF: 5.3+**)*

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

Aug 2022

2022 IEEE Transactions on Instrumentation & Measurement

Autonomous Mobile Robot Navigation using Adaptive Neuro Fuzzy Inference System

Conference Paper

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

May 2022

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

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

*Journal (**IF: 5.4+**)*

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

Jan 2022

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

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

Conference Paper

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

Aug 2021

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

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

*Journal (**IF: 11.7+**)*

M Usman Maqbool Bhutta*, Manohar Kuse, Rui Fan, Yanan Liu and Ming Liu

Oct 2020

2022 IEEE Transactions on Cybernetics

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

Conference Paper

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

Oct 2020

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

Multiple Lane Detection Algorithm Based on Optimised Dense Disparity Map Estimation

Conference Paper

Han Ma, Yixin Ma, Jianhao Jiao, M Usman Maqbool Bhutta, Mohammud Junaid Bocus, Lujia Wang, Ming Liu and Rui Fan

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

Conference Paper

M Usman Maqbool Bhutta* and Ming Liu

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

Conference Paper

M Usman Maqbool Bhutta*, Hasan Mahmood, and Haroon Malik

Jan 2015

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

Efficient Reset Design Techniques

Journal Paper

Qamar, Zoha, Bushra Yaseen, and Usman Maqbool

2015

Published in Science International Lahore

Patent

Semi-Supervised Learning Approach for Smart Phone Glasses Defect Inspection

US Patent

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

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

US Patent

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

Jan 2020

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

References

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