

**Shubhabrata Mukherjee**

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**Google Scholar:** <https://scholar.google.com/citations?user=rA8xSP4AAAAJ&hl=en>

### **Machine learning and data analytics:**

Used various classical machine learning techniques of Classification, Regression, and neural-network-based techniques like ANN, CNN, and RNN (time series) in industry projects and research.

Worked on a Multi-optimizer platform with Bayesian optimization, Genetic algorithm, etc.

Experience using R, Snowflake (SQL), and Matlab for ML in industry and current doctoral research.

Experience in various classical unsupervised Learning like PCA, clustering, etc.

Experience using OpenCV with TensorFlow and Pytorch in object detection and biometric privacy research.

Used and trained various pre-trained CNN models with ONNX, Apache MXNet, PyTorch, TensorFlow, etc.

Experience using python packages like NumPy, Pandas, scikit-learn, matplotlib, NLTK, etc.

Developed LSTM-based sequential classification for network handover optimization research.

### **Related Coursework:**

Deep learning using Python; Computer Vision; Pattern recognition; Introduction to statistical learning and R; Principal of big data management; Neural & Adaptive Networks

### **Networking and Automation skills:**

Kubernetes-based end-to-end containerized multi-NFV architecture implementation.

Developed automation for data analytics pipeline for optimization using shell scripting and python.

Used ns3 simulator for signal prediction using LSTM-based handover optimization.

Perform and report testing activities and bug lists to support product validation for a new build.

Experienced in various traffic simulators like IXIA, Spirent, Mobipass, etc. in the industry.

### **Education:**

University of Missouri-Kansas City, USA: Ph.D., Computer network & comm. systems, **exp. Summer 2023.**

University of Missouri-Kansas City, USA: Master of Science, Electrical Engineering, May 2017.

West Bengal University of Technology, India: Bachelor's, Electronics & Communication Eng., 2009.

### **Professional Experience:**

#### **1. SPAN (Sept '22 – Dec'22), Data scientist intern**

- Complete docker and airflow-based implementation of anomaly notification using python.
- Conduct literature analysis, validate findings, and design machine learning models.
- Implement, test, and evaluate new features and products using field measurements.
- Collect, clean, and analyze data sets of electrical consumption and forecast electrical consumption data.
- Research and break down requirements for new products and features.

#### **2. T-Mobile (May '21 – Dec'21), Technology Strategy intern: 5G and AI**

##### **• UAV-Aided Infrared Imaging-Based Object Detection and Localization**

We developed a UAV-based streaming infrastructure for live object detection and localization. Ours is one of the initial attempts to measure infrared-based object detection and localization performance of the latest YOLOV7-official model.

<https://ieeexplore.ieee.org/document/10025436>

##### **• Autonomous fault management for next-generation networks**

We developed an AI-based multi-phase framework of end-to-end autonomous fault management for 5G and beyond. An optimum combination of classical machine learning and deep learning has been experimented with and implemented.

<https://ieeexplore.ieee.org/document/10077215>

### **3. Intel Corp. (May '20 – Jan'21), Graduate Intern for Network AI**

#### **Dynamic and static Closed-loop NFV optimization:**

- Multi-objective Bayesian optimization experiments of NFV workload.
- Performance comparison of various optimization like Genetic algorithm, TuRBO, etc.
- Automation environment development to support optimization tests and benchmarking.
- End-to-end Kubernetes-based NFV architecture implementation.
- Reinforcement-learning-based DAaaS (Data analytics as a service) framework implementation.

### **University of Missouri Kansas City (Aug '19 – Current), Graduate Assistant**

Working as a graduate research assistant for computer vision at CBIT lab. (Spring 2022)  
Instructed lab for "Electronic circuit lab (ECE 331)" (Spring 2021)  
Assisted teacher for the graduate class of "Wireless Communication". (Spring 2020)  
Assisted teacher with the class "Intro to wireless networking". (Spring 2020)  
Assisted teacher with the class "Internet of Things". (Fall 2019)  
Assisted teacher for the class of "Foundation of Software Engineering" (Fall 2019)

### **Google Inc, Test & Automation Engineer**

#### **Project: EPC testing and automation (Contract with Virtusa: Jan '19 – June'19)**

Develop test cases for testing MME, SGW & other components of the EPC core network.  
Experience in tools like Spirent, Wireshark, TCPdump analysis, etc.

#### **Project: ©Loon by Google X Lab (Contract with Ercom Inc: June '17 – Dec'18)**

Testing emulated & real UE, analyzing logs to validate enodeB build and bug fixes.  
Automating test environment, modifying and upgrading python / shell-based tools for analysis.

### **Sprint Corp., Network Implementation Engineer (Contract with Yoh LLC: Aug '16 – May'17)**

Responsible for Integration & testing various Nokia & Airspan Mini Macro & UE Relay products.  
End-to-end system testing, Software Upgrade, OAM, troubleshooting & performance testing.

### **Past work experiences in India:**

- Ericsson Global services Ltd.: Assurance Engineer (Full-time, India, Nov 2011 – Dec 2013)
- Nokia Siemens Networks: Transmission Engineer (Full-time, India, May 2010 - Nov 2011)
- Birla VXL technologies Ltd.: Graduate Engineer Trainee (Full-time, India, June 2009 – May 2010)

### **Academic Research Projects:**

#### **1. Privacy-preserving biometrics using deep neural networks**

In our **CBIT** (Computational Intelligence and Bio-Identification Technologies) lab, we are using deep neural networks for preserving biometric privacy. This project is funded by TrippleBlind©. This project is also a part of the NSF CBL initiative. A journal is being submitted on biometric privacy preservation at IEEE Transactions on Information Forensics and Security.

<http://nsfcbl.org/2022/06/m8-m-c-secure-inner-product-for-privacy-preserving-pattern-matching-2/>

#### **2. UAV-based handover optimization in heterogeneous network scenarios using deep learning**

A traditional signal-based handover may not ensure the best user experience in terms of throughput, packet loss, or latency. We are developing a deep learning-based handover technique using coordinated feedback from the associated UAVs. We have used LSTM-based sequential classification to choose the optimum time to handover for various types of users based on their unique QoS requirements.

<https://github.com/shubha07m/Coordinated-handover-optimization-using-deep-learning>

#### **3. Facial-Expressions-recognition-using-Machine-Learning**

Our primary goal is to identify when a human is talking and when he remains silent by classification of facial expression. We would also plan to identify the nature of dialog from the expression.

<https://github.com/shubha07m/Facial-Expressions-recognition-using-Machine-Learning>

#### **4. Development of ultra-reliable communication techniques for MCPTT (Master's thesis project):**

The thesis discusses possible strategies to achieve reliability in a mission-critical network. Based on this a framework for a reliable mission-critical system has also been proposed. A simulation study of the effects of different pivotal factors that affect communication channels is described. This study provides a better understanding of the requirements for improving the reliability of a practical communication system.

## **Publications:**

### **Published:**

- [1] S. Mukherjee and C. Beard, "A framework for ultra-reliable low latency mission-critical communication," 2017 Wireless Telecommunications Symposium (WTS), Chicago, IL, USA, 2017, pp. 1-5, doi: 10.1109/WTS.2017.7943546.
- [2] Mukherjee, S., Choi, T., Islam, M.T., Choi, B.-Y., Beard, C., Ho Won, S. and Song, S. (2020), A supervised-learning-based spatial performance prediction framework for heterogeneous communication networks. ETRI Journal, 42: 686-699.  
<https://doi.org/10.4218/etrij.2020-0188>
- [3] S. Mukherjee, O. Coudert and C. Beard, "UNIMODAL: UAV-Aided Infrared Imaging Based Object Detection and Localization for Search and Disaster Recovery," 2022 IEEE International Symposium on Technologies for Homeland Security (HST), Boston, MA, USA, 2022, pp. 1-6, doi: 10.1109/HST56032.2022.10025436.
- [4] S. Mukherjee, O. Coudert and C. Beard, "An Open Approach to Autonomous Ran Fault Management," in IEEE Wireless Communications, vol. 30, no. 1, pp. 96-102, February 2023, doi: 10.1109/MWC.004.2200244.
- [5] Master's thesis on "A framework for ultra-reliable low latency Mission critical communication."  
[https://mospace.umsystem.edu/xmlui/bitstream/handle/10355/60660/Thesis\\_2017\\_Mukherjee.pdf?sequence=1&isAllowed=y](https://mospace.umsystem.edu/xmlui/bitstream/handle/10355/60660/Thesis_2017_Mukherjee.pdf?sequence=1&isAllowed=y)

### **Under internal review:**

- [6] "Secure and private ensemble matchers using multi-vault obfuscated templates", IEEE Transactions on Information Forensics and Security.

### **Under preparation:**

- [7] YOLO-infinity: Mission-critical infrastructure protection and low light surveillance using infrared-based ground threat detection and localization.
- [8] Privacy-preserving of biometric image templates: A review of new age techniques and future trends.

## **Conference presentation:**

1. Presented the paper "UNIMODAL: UAV-Aided Infrared Imaging Based Object Detection and Localization for Search and Disaster Recovery" at the 2022 IEEE Symposium on Technologies for Homeland Security.
2. Presented the work on "Secure inner product for privacy-preserving pattern matching" in NSF, CBL (2022)
3. Presented the work on "Load balancing heterogeneous network using deep learning" in NSF, CBL seminar (2019)
4. Presented the paper "A framework for ultra-reliable low latency mission-critical communication" at the 2017 IEEE Wireless Telecommunications Symposium.

## **Peer review activities:**

1. Volunteered as a judge in T-Mobile Artificial Intelligence Ops Hacksgiving. (2021 Fall) <https://t-mobileaimlopshacksgiving2021.splashthat.com>
2. Reviewed two papers for IEEE Symposium on Technologies for Homeland Security.
3. A member of O-RAN ALLIANCE. <https://www.o-ran.org/> (May '21 – Dec'21)
4. A member of the Ran Intelligence and Automation sub-group, Telecom Infra Project <https://telecominfraproject.com/openran/> (May '21 – Dec'21)

## **Awards, Grants, and other research activities:**

1. Developed an ML-based end-to-end anomaly notification up to the final product at SPAN.
2. The Autonomous fault management project done at T-Mobile got featured on WayUp.  
<https://www.wayup.com/guide/community/t-mobile-tech-internships/>
3. UMKC graduate student travel grant (FY2022-2023) for conference presentation.
4. Submitted internal invention applications based on the research done at Intel Internship.
5. Submitted internal invention applications for the research work at the T-Mobile internship.
6. Doctoral NR Award from UMKC SCE.
7. Dean's International Scholar Award from UMKC Dean's office.
8. "Kudos! For being Alive" award from MS Head, Bharti Airtel India, LTE Operations.