# SHNEKA MUTHU KUMARA SWAMY

**Ph.D. Candidate**

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## SELECTED RESEARCH EXPERIENCE

### Resource-efficient, Multi-user Mobile Augmented Reality

**Prof. Qi Han**

Aug 2018 - Aug 2024 Colorado School of Mines

Voice Multicast in a resource constrained environment

- Enabled transfer of voice to multiple users in computation and energy-constrained environments by developing novel compression and distributed admission control algorithms.
- Demonstrated the efficient working of the system using 18 devices, equipped with Zigbee and Raspberry Pi, in a real-world scenario.

Quality of Mobile Augmented Reality

- Developed a mobile phone-friendly machine learning model to predict the quality of Segmentation in AR applications and demonstrated its effectiveness in accuracy, latency, and memory usage.
- Demonstrated the utility of simple computer vision techniques in determining the spatial drift experienced in mobile AR applications. Utilized key insights from the study to develop a method to reduce spatial drift in AR applications.
- Developed adaptive method that dynamically shifts between Visual Odometry and Simultaneous Localization and Mapping (SLAM) based on the visibility of the virtual object to enable more memory, and latency-efficient MAR application while maintaining the quality of the AR experience.
- Developed a method that uses a mobile phone-friendly machine learning model to dynamically shift between template matching and segmentation to enable real-time dynamic SLAM in MAR applications.

Multi-user Mobile Augmented Reality

- Developing a Reinforcement Learning based method to enable multi-user MAR applications in resource-constrained environments.

### Framework for strategies in Multi-user Marketplace

**Prof. Maria Gini**

Jun 2015 - May 2016 University of Minnesota, MN

Evolutionary strategies for Multi-user Marketplace

- Worked on genetic algorithm based strategies to enable multi-user marketplace to evolve over time and allow an agent to come up with strategies to service in the marketplace.

## PUBLICATIONS

### Conference Proceedings

- S. M. K. Swamy and Q. Han, "Online mitigation of spatial drift of virtual objects in mobile augmented reality," ACM SigComm, Workshop on Emerging Multimedia Systems (EMS), 2024.
- S. M. K. Swamy and Q. Han, "Real-time dynamic slam using rgb cameras for mobile augmented reality," ACM SigComm, Workshop on Emerging Multimedia Systems (EMS), 2024.

## SUMMARY

Deep learning for mobile phones, Mobile Augmented Reality, Reinforcement Learning, Multi-user cooperation and communication, Simultaneous Localization and Mapping, Visual Odometry, Computer vision.

## EDUCATION

### Ph.D. in Computer Science

**Colorado School of Mines**

Fall 2018 - Summer 2024 3.9/4.00

### M.S. in Electrical Engineering

**University of Minnesota**

Fall 2014 - Spring 2016 3.5(CS)/4.00

### B.E. in Electrical Engineering

**Rajalakshmi Engineering College**

Fall 2010 - Spring 2014 8.82/10.00

## ACHIEVEMENTS

- First rank in undergraduate, in a department of 150 students, REC.
- Awarded Gold Medal in Anna University for securing 20th rank in 6000 students in the state of Tamil Nadu, India.
- Represented the state of Tamil Nadu in National Informatics Olympiad, India.

## REVIEWER SERVICE

- Reviewed multiple papers in the course of my PhD, for conferences like USENIX, IMWUT, INFOCOM, PerCom.
- Reviewed two artifacts for the conferences like PerCom, 2020.

## TEACHING EXPERIENCE

**CSCI 5511**, Artificial Intelligence, UMN.
**CSCI 4511W**, Introduction to Artificial Intelligence, UMN.
TA for all Mathematics courses in Community College of Chicago, 2017.
**CSCI 358**, Discrete Mathematics, CSM.
**CSCI 261**, Programming Concepts, CSM.
**CSCI 406**, Algorithms, CSM.
**CSCI 565**, Distributed Computing Systems, CSM.
**CSCI 560**, Fundamentals of Computer Networks, CSM.

- S. M. K. Swamy and Q. Han, "Quality evaluation of image segmentation in mobile augmented reality," in *EAI International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services (Mobiquitous)*, 2023.
- S. M. K. Swamy and Q. Han, "Quality preserving voice stream multicast over mobile low power wireless networks," in *2021 IEEE 46th Conference on Local Computer Networks (LCN)*, 2021, pp. 541–548. DOI: 10.1109/LCN52139.2021.9524944.

### Submitted

- S. M. K. Swamy and Q. Han, "Appear: Adaptive pose estimation for mobile augmented reality," Submitted to ISMAR, 2024.

### In Progress

- S. M. K. Swamy and Q. Han, *Multi-user mar using reinforcement learning*.
- S. M. K. Swamy and Q. Han, *Transformer dynamic slam*.

## COMMUNITY SERVICE

- One of the faculty, Python for high school students, UMN.
- Contributed to faculty hiring committee, by participating in faculty lunch and presentations, CSM.
- Volunteered for presentation in graduate student clubs.
- Contributed to incoming graduate student orientation, CSM.
- Helped in writing multiple grants for professor, CSM.

## MENTORING EXPERIENCE

- Mentored 2 undergraduate students, Robert Warner, and Ethan Perry for two semesters for their independent study, on voice multicasting in a communication-constrained environment, CSM.
- Mentored 1 undergraduate student, Colter Sydney, for summer research, on setting robot navigation for testing purposes, CSM.
- Mentored a class of 5 students, for their work on developing Multi-agent co-operative Simultaneous Localization and Mapping using ROS and Gazebo, CSM.
- Mentored 1 undergraduate, Jackson, for his summer research on developing VINS for multi-user MAR applications, CSM.
- Mentored 1 undergraduate, Dorian Cauwe for his summer research on developing a method to enable multi-user MAR applications in a resource-constrained environment, CSM.
- Currently, mentoring 1 undergraduate student, Haolou Sun, Duke University, for his summer research on developing a method to enable multi-user MAR applications in resource-constrained environments, CSM

## RELEVANT COURSEWORK

- Deep Learning for Robot Perception, Machine Learning, Computer Vision, Artificial Intelligence, Computer Networks, Distributed Computing Systems, Human-centered Robotics, Sensing and Estimation in Robotics, Theory of Computation.
- Control Systems, Robust Control Systems, Digital Signal Processing, VLSI, Optimal Filtering and Estimation, Power Electronics.

**CSCI 572**, Computer Networks, CSM.
**CSCI 572**, Computer Networks, CSM.
**CSCI 560**, Adjunct Faculty, Fundamentals of Computer Networks, CSM.

## ACADEMIC PROJECTS

- ANDER: Autonomous Navigate Delivery Robot, used android app to communicate the location of the delivery and used ROS for navigation, CSM.
- Implemented PoseCNN on PROPS dataset, to predict the pose of the object in the image, UMich & UMN & CSM, DeepRob.
- MultiAgent Minesweeper, developed a method to enable multiple agents to play minesweeper and analyzed the possibility of using Reinforcement Learning to play the game, UMN.
- Implemented various machine learning models, including but not limited to SVM, Pegasos from scratch, UMN.
- Automatic Control of car steering using robust control design, EE 5235, UMN.
- Automation of starter test rigs, final project for BE, REC.

## SKILLS

- Programming: Python, C++, Java, MATLAB, ROS, Gazebo, TensorFlow, PyTorch, OpenCV, Scikit-learn, Pandas, Numpy, Matplotlib.
- Tools: Git, Jupyter, LaTeX, Overleaf, Microsoft Office, Google Suite.
- Languages: English, Tamil.

## INDUSTRY EXPERIENCE

### Internship

**TVS LUCAS**

Spring 2014 — Chennai, India

Automated the performance tests that must be conducted before deeming a starter motor useful. Specifically worked on automating the lock torque, run torque, and no load tests conducted on the starter motor. Used PLC ladder logic for Allen Bradley PLC to automate the tests.

### Software Development Internship

**Cloudadic**

Sept 2016 - Aug 2017 — NC, USA

Worked on improvement of indoor navigation, by focusing on Simultaneous Localization and Mapping using particle filters. Used ROS and Gazebo for simulation and testing of the algorithms.