

Sofiya Semenova

CONTACT INFORMATION

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I am a **Computer Science Ph.D. Candidate** at the University at Buffalo with interests in *mobile systems, autonomous systems, AR/VR, and spatial computing*. My Ph.D thesis focuses on the impact of system design on the performance and reliability of Visual Simultaneous Localization and Mapping (SLAM) in real-world environments. I'm currently seeking opportunities where I can continue developing high-performance systems, especially in Rust.

EDUCATION

University at Buffalo, Buffalo, NY **Aug 2018 - May 2026**
Ph.D. in Computer Science and Engineering

Thesis: "Putting the 'Systems' in Visual SLAM Systems: System Design for Robust and Reliable Visual Simultaneous Localization and Mapping"

Advised by Dr. Karthik Dantu

Brandeis University, Waltham, MA **Aug 2013 - May 2017**
B.S. in Computer Science with High Honors, Minor in Physics

Thesis: "[Clouds That Think: Applications of Machine Learning Techniques for Elastic Databases](#)"

Advised by Dr. Olga Papaemmanouil

EXPERIENCE

Research Assistant **Aug 2018 - Current**
Drones Lab, University at Buffalo, Buffalo, NY

Modular and Memory-Safe Visual SLAM — *Rust, C++, OpenCV, g2o, GTSAM, Foxglove*

- Architected and implemented a 42k+ LOC Rust framework for modular, memory-safe Visual SLAM systems ([github repository](#))
- Implemented ORB-SLAM3 (ORB feature tracking, local/global bundle adjustment) and Kimera (optical flow, iSAM2 fixed-lag smoother) pipelines in our framework, matching or exceeding performance compared to C++ baselines while providing stronger memory-safety guarantees
- Developed Rust-C++ FFI bindings for core robotics libraries: GTSAM, g2o, DBoW2, and Foxglove
- Designed automated validation pipelines including unit tests, end-to-end evaluation, and performance profiling to ensure correctness and runtime efficiency
- See publications [1] and [4].

Quantitative Analysis of Visual SLAM Systems Challenges — *C++, Python*

- Conducted large-scale benchmarking of three popular Visual SLAM/VIO systems (ORB-SLAM3, Kimera, and OpenVINS) on embedded (Jetson TX2) and desktop platforms
- Diagnosed system-level bottlenecks impacting SLAM performance on resource-constrained hardware
- See publications [2] and [3]

Edge-Offloaded, Multi-Client Visual SLAM — *C++, OpenCV, ROS, AWS*

- Designed and implemented a SLAM architecture that offloads local map optimization and loop closure to edge servers to improve system performance on resource-constrained devices
- Enabled multi-client collaborative mapping and localization through shared edge infrastructure
- Implemented map garbage collection mechanisms to support long-term operation on the edge
- See publications [5]

Software Engineering Intern **Jun 2019 - Aug 2019**
Google, Seattle, WA

- Decreased user-perceived web page load latency in Chromium by developing a logistic regression model to predictively prefetch the page(s) that a user will likely navigate to next
- *C++, Python, Scikit-Learn, TensorFlow*

Software Engineer **Jun 2017 - Aug 2018**
edX, Cambridge, MA

- Improved the performance, reliability, and maintainability of edX's video encoding and delivery pipeline by designing an AWS SNS-based API for video processing tasks, parallelizing video processing workflows, and developing Docker-based local testing infrastructure

- Increased first-week user engagement by developing APIs for course completion tracking and running A/B tests on engagement features
- *AWS {RDS, ec2, SNS }, Terraform, Docker, Python, SQL, MongoDB, Django, Javascript*

Research Assistant

Aug 2016 - May 2017

Department of Computer Science, Brandeis University, Waltham, MA

- Developed an adaptive data distribution framework to balance data fragments, replicas, and cluster nodes in elastic cloud databases. See publication [7]
- Built a demonstration for WiseDB, a machine-learning-based system for cost/performance management of cloud databases. See publication [8]
- *Java, AWS, PostgreSQL*

PUBLICATIONS

1. (In submission) **Sofiya Semenova**, Nitin Vinod, Steven Ko, Yu David Liu, Lukasz Ziarek, Karthik Dantu. “Bauhaus: A Modular, Memory-Safe Framework for Next-Generation Visual SLAM Systems.”
2. **Sofiya Semenova**, Steven Y. Ko, Yu David Liu, Lukasz Ziarek, and Karthik Dantu. “[A Comprehensive Study of Systems Challenges in Visual Simultaneous Localization and Mapping Systems.](#)” *ACM Transactions on Embedded Computing Systems (TECS)*. 2024.
3. **Sofiya Semenova**, Steven Y. Ko, Yu David Liu, Lukasz Ziarek, and Karthik Dantu. “[A Quantitative Analysis of System Bottlenecks in Visual SLAM.](#)” *ACM International Workshop on Mobile Computing Systems and Applications (HotMobile)*. 2022. — *Best Poster Award*
4. **Sofiya Semenova**, Pranay Meshram, Timothy Chase, Steven Y. Ko, Yu David Liu, Lukasz Ziarek, and Karthik Dantu. [A Modular, Extensible Framework for Modern Visual SLAM Systems. \(Poster\)](#) *International Conference on Mobile Systems, Applications and Services (MobiSys)*. 2022.
5. Ali J. Ben Ali, **Sofiya Semenova** and Marziye Kourosli, Zakieh Sadat Hashemifar, Steven Y. Ko, and Karthik Dantu. “[Edge-SLAM: Edge-Assisted Visual Simultaneous Localization and Mapping.](#)” *ACM Transactions on Embedded Computing Systems (TECS)*. 2022.
6. Ali J. Ben Ali, **Sofiya Semenova**, and Karthik Dantu. “[Platform Variability in Edge-Cloud Vision Systems. \(Poster\)](#)” *ACM International Workshop on Mobile Computing Systems and Applications (HotMobile)*. 2019.
7. Ryan Marcus, Olga Papaemmanouil, **Sofiya Semenova**, and Solomon Garber. “[NashDB: An End-to-End Economic Method for Elastic Database Fragmentation, Replication, and Provisioning.](#)” *ACM Special Interest Group in Data Management (SIGMOD)*. 2018.
8. Ryan Marcus, **Sofiya Semenova**, and Olga Papaemmanouil. “[A Learning-based Service for Cost and Performance Management of Cloud Databases. \(Demo\)](#)” *IEEE International Conference on Data Engineering (ICDE)*. 2017.

TEACHING

- CSE 468/568 Robotics Algorithms *TA, University at Buffalo* Fall 2020
- CSE 220 Systems Programming *TA, University at Buffalo* Spring 2019
- CSE 250 Data Structures *TA, University at Buffalo* Fall 2018
- CS 11a Introduction to Computer Science *TA, Brandeis University* Fall 2014

SERVICE

- International Conference on Robotics and Automation (ICRA) *Reviewer* 2024
- Transactions on Sensor Networks *Reviewer* 2024
- University at Buffalo CSE Diversity Committee *Graduate Student Representative* 2023 - 2024
- MobiSys *Artifact Evaluation Committee* 2023
- SenSys *Shadow Program Committee* 2022
- Workshop on Simplifying Edge and Mobile Intelligence @ MobiSys *Web Chair* 2020
- University at Buffalo CSE Diversity Committee *Graduate Student Representative* 2019 - 2020
- University at Buffalo CSE Graduate Student Association *Secretary* 2019 - 2020
- University at Buffalo Robotics Day *Volunteer* 2018
- Microsoft Student Partner Program *Senior Student Partner* 2016 - 2017
- Microsoft Student Partner Program *Student Partner* 2015 - 2016
- Brandeis University CS Department *Undergraduate Representative* 2015 - 2016
- BITMAP (Brandeis University Computer Science Club) *President* 2014 - 2016
- Codestellation (Brandeis University’s Hackathon) *Lead Hackathon Organizer* 2014 - 2016

HONORS & AWARDS	– HotMobile <i>Best Poster Award</i>	2022
	– MobiSys <i>Travel Grant</i>	2022
	– MobiCom <i>Travel Grant</i>	2021
	– Symposium on Edge Computing (SEC) <i>Travel Grant</i>	2019
	– Brandeis University <i>High Honors at Graduation</i>	2017
	– HampHack (Hampshire College Hackathon) <i>Best Artificial Intelligence Hack</i>	2016
	– Codestellation (Brandeis University Hackathon) <i>Best Machine Learning Hack</i>	2016
PRE- PROFESSIONAL EXPERIENCE	– MakerLab, Brandeis University <i>Web Developer Team Lead</i>	Sept 2016 - May 2017
	– edX <i>Software Engineering Intern, Backend Web Dev</i>	Summer 2016
	– Western Jihadism Project, Brandeis University <i>Software Engineer, Full Stack</i>	Apr 2015 - May 2016
	– Onshape <i>Software Engineering Intern, QA</i>	Summer 2015
	– High Energy Physics Lab, Brandeis University <i>Intern</i>	Summer 2014