Enguang Fan

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Education

University of Illinois, Urbana-Champaign, Urbana, USA 2022 – 2023

*M*aster of Computer Science

University of Illinois, Urbana-Champaign, Urbana, USA 2019 – 2022

B.S. in Statistics & Computer Science, **The Highest Distinction**

Beijing Jiaotong University, Beijing, China 2017 – 2019

***Transferred** to UIUC*, majored in Telecommunication Engineering

Skills

- Programming: C/C++, Python, Java, Julia, Matlab, R, Rust
- Tools: Pandas, NumPy, Sympy, PyTorch, Tensorflow, Keras, scikit-learn
- Techniques: Object-Oriented Design, Unit Testing, Machine/Deep Learning

Internship Experience

Software Engineer Intern, Huawei Inc. March 2021 – June 2021

- Developed a probabilistic programming library for a new domain specific language, implemented MCMC inference algorithms (Metropolis–Hastings, Gibbs Sampling, No-U-Turn, etc)
- Developed a tensor-based statistics library for pseudo-random number generation, sampling from various distributions (joint normal, Beta, Poisson, Binomial, etc), speed up the sampling process for MCMC based on old code base by 30% speed up.

Research Experience

Research Assistant, University of Illinois. May 2020 – Feb 2021

Stan, R, Shell, Linux Supervised by Prof. Sasa Misailovic

- Worked with PhD students to build a system for automated transformation of probabilistic programs and evaluation of robustness of the transformed programs, this is the first automated system to evaluate the effectiveness of probabilistic programs.
- Evaluated robustness of probabilistic programs, using Stan and R; also obtained experience benchmarking, simulation, and performance modeling experience.

ROS-based swarm drones May 2022 – July 2022

- Designed a custom ROS (*Robotic Operating System*) package for swarm drones simulation, enabling multi-drone communication and coordinated control.
- Developed a real-time UDP-based communication protocol integrated into the ROS package, facilitating coordination and local mapping information sharing across drone swarm. Achieved a 50% message delivery speed improvement over ROS-native protocol.
- Implemented a Cooperative SLAM (Simultaneous Localization and Mapping) algorithm for multi-drone scenarios within the Gazebo simulation environment.
- Integrated YOLOv4 for real-time object recognition, localization, and mapping, enhancing the capabilities of the custom ROS package.

Swarm-Based GPS Spoofing Detection *May 2023 – Oct 2023*

- Contributed to a research project focused on enhancing GPS spoofing detection in disadvantaged platforms, such as Air Launched Effects (ALE) in modern battlefields.

- Conducted performance comparisons of various techniques, including inertial measurement units (IMUs), communication with nearby ALEs, and received signal strength from networking connections.
- Proposed a novel architecture for sensor fusion, intelligently combining observations across multiple sensors to detect GPS spoofing and reconstruct coordinates with confidence levels.
- Utilized simulation studies based on real-world mobility and sensor traces to demonstrate that the proposed approach significantly improves location accuracy compared to baseline techniques. This enhancement contributes to the navigational capabilities of ALEs in GPS-denied environments.

Teaching Experience

CS 341 System Programming

Graduate Teaching Assistant, Fall 2022

- Mentored students in mastering UNIX system calls for efficient C program development, encompassing process creation, I/O operations, and network communication.
- Guided students through robust concurrency models, emphasizing synchronization techniques like semaphores and mutexes for thread management and coordination.
- Equipped students with memory optimization skills, covering dynamic memory allocation and deallocation strategies, while also promoting secure coding practices against vulnerabilities.
- Assisted students in advanced I/O handling, file system interactions, and process control mechanisms, fostering in-depth comprehension of process lifecycle and system interaction.

CS 437 Topics in Internet of Things

Graduate Teaching Assistant, Fall 2023

- Guided students in IoT lab sessions, assisting with vehicle assembly and sensor integration for real-world IoT applications.
- Supported students in developing navigation algorithms, leveraging sensor data and sleep-based timing for obstacle avoidance in constrained environments.
- Mentored advanced labs on spatial mapping, involving ultrasonic sensor data processing and visualization for informed navigation decisions.
- Collaborated with instructors to deliver a comprehensive IoT curriculum, covering protocols, sensing, cloud platforms, and real-world project deployments.

Honors

- UIUC Fall 2022 Teachers(TA) Ranked as Excellent by Their Students [Link]
- First Class Academic Scholarship at Beijing Jiaotong University (Top 3% in GPA)
- Industry sponsored Academic Scholarship at Beijing Jiaotong University
- Second Prize of English Speech Contest for College Students at Beijing JIaotong University

Publications

[1] **Enguang Fan**, Anfeng Peng, Matthew Caesar, Jae H Kim, Josh Eckhardt, Greg Kimberly, Denis Osipychev. *"Towards Effective Swarm-Based GPS Spoofing Detection in Disadvantaged Platforms."* In *MILCOM 2023 Track 4 - Integrated Network Architecture and Systems-of-Systems (MILCOM 2023 Track 4)*, Boston, USA, Oct 2023, pp. 7.

Research Statement

My research focus centers on robotics perception, system design, networking, and security. In my recent MILCOM 2023 paper, titled "Towards Effective Swarm-Based GPS Spoofing Detection in Disadvantaged Platforms," I tackled the challenge of countering GPS spoofing for small platforms like Air Launched Effects (ALEs). By leveraging sensor fusion techniques, including inertial measurement units, communication with neighboring ALEs, and networking signal strength, I proposed a novel architecture that significantly improves GPS signal integrity and navigation accuracy in GPS-denied environments. My broader research interests revolve around developing robust solutions that bridge theory and real-world implementation, fostering advancements in technology with tangible impacts across diverse domains.