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, Matlab,
- Tools: PyTorch, Tensorflow, NumPy, Sympy, scikit-learn
- Techniques: Object-Oriented Design, Unit Testing, Machine/Deep Learning

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 - 2023 IEEE Military Communications Conference (MILCOM)*, Boston, USA, Oct 2023, pp. 7.

[2] Yifan Chen, **Enguang Fan**, Matthew Caesar. *"Distributed UAV Swarms Positioning Using Multi-Agent Reinforcement Learning"* To be submitted

Industry 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

Probablistic Programming Data Augmentation May 2020 – Feb 2021

- 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 Modeling 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 – Aug 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.

Deep-learning based Robotic Inertial Odometry Aug 2023 – Dec 2023

Inertial Odometry, or IMU Dead Reckoning, plays a pivotal role in the field of robotics and autonomous navigation. This project aimed to enhance the accuracy and reliability of IMU-based localization through the integration of advanced deep learning models. Key highlights of the project include:

- Recurrent Neural Networks: We employed a stacked bidirectional LSTM network to learn the underlying temporal IMU noise pattern. architectures to capture sequential dependencies in the IMU data. RNNs are well-suited for modeling the temporal aspects of inertial measurements.
- Transformer Models: Beyond LSTM model, we also explored the effectiveness of a Transformer model with sequential encoding, which has decent performance for IMU data.
- Data Fusion: The project incorporated sensor fusion techniques(Error-State Extended Kalman Filter, Unscented Kalman Filter), combining data from multiple sensors, including IMU, GPS, and camera data, to achieve more accurate odometry estimations.

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.
- 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.
- 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

- IEEE MILCOM 2023 Student Travel Grant Winner [Link]
- UIUC Fall 2022 Teachers(TA) Ranked as Excellent by Their Students [Link]
- First Class Academic Scholarship at Beijing Jiaotong University (Top 3% in GPA)