Siqi Guo

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Summary: Master's student in ECE at Carnegie Mellon University with expertise in robotics, bio-inspired control systems, and autonomous planning. Experienced in developing adaptive locomotion algorithms and distributed robot system integration through projects like **EigenBot** and **MMPUG**. Skilled in planning, control, and real-time system integration, with a strong academic and research foundation.

Education

Carnegie Mellon University Pittsburgh, PA
Master of Science in Electrical and Computer Engineering; GPA: 3.89/4.0 Expected May 2025

Relevant Courses: Foundations of Computer Systems, Embedded System Software Engineering, Machine Learning Signal Processing, Distributed Systems, Autonomous Control System, Storage Systems, Modern Computer Architecture and Design, Large-scale Distributed Machine Learning and Optimization

Tianjin University Tianjin, China
Bachelor of Science in Computer Science and Technology; GPA: 3.84/4.0 June 2023

Relevant Courses: Data Structure, Operating System, Computer Networks, Principles of Database, Parallel Computing, Natural Language Processing, Pattern Recognition and Deep Learning

Publications

Zhikai, Z., **Siqi, G.**, et al. Bio-inspired Distributed Neural Locomotion Controller (D-NLC) for Robust Locomotion and Emergent Behaviors (Sep '24). Submitted to 2025-ICRA.

Bingdao, F., Di, J., et al. "Backdoor attacks on unsupervised graph representation learning" (August '24). *Journal of Neural Networks* (Vol. 180, p.106668.)

Ding, Y., & **Guo, S.** "Conditional generative adversarial networks: Introduction and application" (November '22). In the 2nd *International Conference on Artificial Intelligence, Automation, and High-Performance Computing* (AIAHPC 2022) (Vol. 12348, pp. 258-266). SPIE.

Jin, D., Feng, B., **Guo, S.**, et al. "Local-Global Defense Against Unsupervised Adversarial Attacks on Graphs" (June '23). In the *Thirty-Seventh AAAI Conference on Artificial Intelligence* (Vol. 37, No. 7).

Research Experience

Eigenbot - Bio-inspired Distributed Control for Modular Robot Pittsburgh, PA
Biorobotics Lab Research Assistant (Part-time) Dec 2023 - Oct 2024
Advisor: Professor Howie Choset, Research Scientist Lu Li Carnegie Mellon University

- Modular Robot Bio-inspired Curve Walking Implementation
  - Implemented the curve walking algorithm on the Eigenbot (a hexapod robot) in CoppeliaSim, inspired by six-leg insects' behavior.
  - Fine-tuned the weights of my algorithm to achieve a smooth curve walking gait, and integrated curve walking / steering into Eigenbot's behavior tree.
- Eigenbot Firmware Development and Testing
  - Developed Eigenbot EEPROM parameters auto-setting tools, which accelerated Hexapod gaits tuning process.
  - Tested the firmware. Redesigned and debugged the module communication protocol to ensure the robot's stability and reliability. Conducted the experiments with Logan, analyzed the gaits and fine-tuned firmware parameters.
  - Integrated Foot Sensor Feedback into the robot's message protocol.
  - Collected EigenBot's data from the real-world using OptiTrack, developing a pipeline to assess metrics like Gait Phase Difference and Leg Stance Duration, benchmarking its performance with centralized predefined gait.

MMPUG - Multi-Model Perception Uber Good Pittsburgh, PA
Biorobotics Lab Research Assistant (Part-time) May 2024 - Seq 2024
Advisor: Dr. Matthew J. Travers Carnegie Mellon University

- FAR-Planner Implementation in a Heterogeneous Agent System with RC cars and legged robots
  - Implemented A* & Theta* global planner with 2.5D orientation optimization for MMPUG architecture.
  - Integrated features to make the planner adaptive to dynamic obstacles and ensure a safety distance for the robots.
  - Deployed this Global Planner on the RC cars, and tested the planner both in simulation and in the real environment.

Theory and Applications of Graph Convolutional Network Tianjin, China
Research Assistant (Part-time) Nov 2021 - May 2023
Advisor: Associate Professor Jin, Di Tianjin University

- Graph Neural Network in Strategic Deployment

  - Uncovered the relationship between Graph Attention Transformer (GAT) and Graph Convolutional Network (GCN) applied in Deep Graph Infomax (DGI).
  - Learned about the theories proposed in Unsupervised Adversarially Robust Representation Learning on Graphs, combined DGI with GAT and introduced mutual information and unsupervised learning to DGI.
- Robustness Analysis of Graph Neural Networks
  - Used Metattack and Nettack to manipulate data to obtain multiple datasets of malicious attack matrices.
  - Reproduced and compared RoSA, Pro-GNN, PA-GNN, and other algorithms, and practically applied GraphCL and GraphSS to do defense analysis.
- Backdoor Attacks in Unsupervised Learning Graph Neural Networks
  - Designed a novel unsupervised backdoor attack on Graph Neural Networks based on GIN and Momentum Contrast. Built an unsupervised backdoor threat model, defined backdoor-oriented attack targets, and derived the loss function for our attack. Verified our specific backdoor triggers and implemented the trigger injection.
  - Experimented our graph-level attack on different agency models such as GIN and GAT. Gained higher Attack Success Rate and lower Clean Accuracy Drop than previous unsupervised graph attacks.

Zero-shot Object Detection (Hitachi) Remote
Research Assistant (Part-time) May 2022 - Sep 2022
Advisor: Associate Professor Tang, Lingjia University of Michigan

- Built a developed zero-shot object detection UI application from scratch using PyQt.
- Managed various tasks prior to training the model, such as embedding the results of labels, modifying matrix dimensions using the CLIP model, and writing Shell scripts to automate processes.
- Employed PDB to debug and reduced overheads in debugging time.
- Analyzed the COCO dataset and KITTI dataset proficiently using pycoco for statistical analysis.
- Utilized Netron and Tensorboard to visualize graphs and models in order to benchmark object detection models, such as YOLO and FasterRCNN.
- Implemented Tensorflow's Resnet50 object detection model as the baseline, and performed transfer learning on AlexNet, YOLOv5, and FasterRCNN.

Projects

CloudFS, a Deduplicated Cloud File System | CMU 18-746 Course Project Oct 2024 - Dec 2024
- Implemented CloudFS, leveraging the properties of local SSD and cloud storage to make data-placement decisions.
- Identified and eliminated duplicate data with Rabin fingerprinting. Minimized storage usage and optimized data transfer in the form of segments. Designed buffer file to manully handle the file data transfer.
- Implemented the IOCTL functions to support snapshot operations, such as create, restore, install, and uninstall.
- Added in-memory LRU caching to further improve performance and reduce cloud operation costs, reaching **NO.1** on the scoreboard among all students.

BusTub, a Relational DBMS | Personal Project based on CMU 15-645 May 2024 - July 2024
- Implemented LRU-K policy, a disk scheduler and a buffer pool in the storage manager.
- Implemented disk-backed hash index in the DB system, using a variant of extendible hashing as the hashing scheme.
- Created the operator executors that execute SQL queries and implemented optimizer rules to transform query plans.
- Added transaction support by implementing optimistic multi-version concurrency control.

Distributed File System Design | CMU 15-640 Course Project Feb 2024 - Apr 2024
- Implemented the serialization protocol for the low-level RPC stub, supporting several RPCs in project's NFS.
- Designed a File-Caching Proxy based on RMI. Implement open-close session semantics for proxy operations, and the LRU replacement policy for cache management. Used version control, check-on-use and last-close-win to make sure the proxy's cache and server freshness.
- Implemented and Tuned a 3-Tier Architecture Scalable Web Service to satisfy dynamic or unexpected workloads by auto-scaling. Then, evaluated the performance of the system by benchmarking and figuring out the bottleneck.
- Designed a Two-phase Commit Protocol to ensure the consistency of the distributed file system. Customized a mechanism to recovering from nodes failures and handling lost messages.

Blind Source Signal Decomposition & Analysis | CMU 18797 Research Project Oct 2023 - Dec 2023
- Filtered the mixed HDEMG signals and detected peaks to slice the peak-wave windows. Used the PCA algorithm to reduce the dimensions of the data and K-Means to cluster the potentially same Motor Units' signals.
- Based on the clustered results, applied DTW, Covariance, Cosine in a multi-threshold way to compare the wave similarity. Verified the firing instances for each Motor Unit based on the comparison results.

Skills

Programming Languages: C/C++, Python, C#, JavaScript, LaTex, SQL, Verilog, Bash
Frameworks: TensorFlow, PyTorch, ROS, NodeJS, Flask, .NET, React, Flutter
Software and Tools: GIT, Docker, MySQL, SQLServer, Qt Creator, Visual Studio Code, Gem5, PSoC
Platforms: MacOS, Linux, Arduino, GCP