Qingquan BAO

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EDUCATION

University of Pennsylvania **Sept. 2023- May 2025 (Expected)**

- Master of Science in Robotics, at the Department of Computer and Information Science

Shanghai Jiao Tong University (SJTU) **Sept. 2019- June 2023**

- Bachelor of Engineering in Artificial Intelligence (Honor), GPA: 4.0/4.3.
- Related Courses (grade A or A+): Machine Learning, Computer Vision, Natural Language Processing, Reinforcement Learning, Data Structure, Design and Analysis of Algorithms, Operating System, Computer Architecture, Convex Optimization, Stochastic Process, Linear Algebra

RESEARCH EXPERIENCES

Embodied Depth Prediction **Massachusetts Institute of Technology, Cambridge, MA**

Research Assistant, with Prof. Gan et. al. *July 2022 - Jan. 2023*

- Conceptualized the embodied depth prediction, where an **embodied agent** in an environment must learn to accurately estimate the depth of its surroundings with **unsupervised learning**.
- Proposed a framework for actively interacting with the environment to learn depth prediction via photometric loss leveraging frontier and depth-inconsistency explorations to achieve **7% accuracy improvement**.
- Presented a **depth prediction** architecture that jointly leverages history RGB and ego-motion to predict depth in the embodied setting, and delivered a **12.6% boost** in accuracy together with active exploration.

Robust Deep Visual Graph Matching (GM) **SJTU, Shanghai, China**

Research Assistant, with Prof. Junchi Yan *Sept. 2021 - Dec. 2021*

- Built a robust **Deep Visual Graph Matching** pipeline ASAR-GM, and achieved **SOTA** in vision graph matching with little loss of robustness, fortifying applications like image retrieval with unpredictable noisy real data.
- Implemented adversarial attack on pixel and keypoints' position, and strengthened the performance of **Graph Neural Network** based GM models with the locality attack as data augmentations by **1.4%** in accuracy.
- Designed a novel regularizer to penalize the prediction error within any appearance-similar key-point group. Consolidated the **robustness** of GM models by **5%** in the adversarial training framework.

PROJECTS

Multi-Agent RL in Jidi Olympics **SJTU, Shanghai, China**

AI3617 Multi-Agent Learning (Course Project) *May 2022 - June 2022*

- Pioneered the design of a **multi-agent RL** model for the 'Jidi Olympics', optimizing for imperfect observations and dynamic spaces, achieving a **62% win rate** against Jidi PPO baseline and **second place** in class rankings.
- Enhanced **PPO** algorithm with a curiosity-driven approach, yielding a **performance boost of 50%** over the A*-inspired **reward shaping** in multifaceted scenarios.

Deep GM library with PaddlePaddle **SJTU, Shanghai, China**

Research Assistant, with Prof. Junchi Yan *Dec. 2020 - Aug. 2021*

- Engineered the PaddlePaddle version of an **open-source model library** for GM tasks, a.k.a., ThinkMatch, including SOTA Deep GM models and benchmarks. Received over **700** stars in GitHub.
- Implemented whole **deep learning pipeline** (dataset, model, training procedure) in Paddle and a **PyTorch-to-Paddle** pretrained-weights conversion tool, and donated bug findings to PaddlePaddle.

PUBLICATIONS

Qingquan Bao, Yilun Du, Feng Chen, Leslie Pack Kaelbling, Tomás Lozano-Pérez, Chuang Gan, Joshua B. Tenenbaum. "Embodied Depth Prediction." (Submitted to ICRA2024)

Qibing Ren, **Qingquan Bao**, Runzhong Wang, Junchi Yan. "Appearance and Structure Aware Robust Deep Visual Graph Matching: Attack, Defense and Beyond," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 2022, pp. 15263-15272.

SKILLS

- Program languages: Python (Numpy, PyTorch, Scikit-learn, SciPy, OpenCV), C++, SQL
- Development Tools: Git, Linux Command Line, Docker, Singularity, Slurm, AWS
- Framework: ROS, Spark