Pengzhi Yang

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EDUCATION

- **Delft University of Technology (TUD)** — Delft, Netherlands
  Master of Science - Computer Science, AI Technology; — *September 2022 - Present*

- **Eidgenössische Technische Hochschule (ETH) Zurich** — Zurich, Switzerland
  ETH Robotics Student Fellowship (RSF) Program; **GPA: 6.0/6.0** — *July - August 2023*

- **University of Electronic Science and Technology of China (UESTC)** — Chengdu, China
  Bachelor of Engineering - Computer Science; **GPA: 3.90/4.00** — *September 2016 - June 2020*
  Honors Diploma - Yingcai Honors College (Top 5% students enrolled)

- **University of California, Santa Barbara (UCSB)** — Santa Barbara, United States
  Semester Exchange - Computer Science; **GPA: 4.00/4.00** — *March 2019 - June 2019*

PUBLICATIONS

- ***AI and Robotics***

1. **P. Yang**, S. Koga, A. Asgharivaskasi, N. Atanasov, Policy Learning for Active Target Tracking over Continuous $SE(3)$ Trajectories, *Learning for Dynamics and Control (L4DC)*, 2023. **Oral presentation (top 16/167)**. [pdf]

2. **P. Yang**, Y. Liu, S. Koga, A. Asgharivaskasi, N. Atanasov, Learning Continuous Control Policies for Information-Theoretic Active Perception, *IEEE International Conference on Robotics and Automation (ICRA)*, 2023. [pdf] [video]

3. **P. Yang***, H. Liu*, M. Roznere, A. Quattrini Li, Monocular Camera and Single-Beam SonarBased Underwater Collision-Free Navigation with Domain Randomization, *International Symposium on Robotics Research (ISRR)*, 2022. [oral] [doi] [video]

4. J. Li, L. Han, H. Yu, Z. Wang, **P. Yang**, Z. Ren, Potato: A Data-Oriented Programming 3D Simulator for Large-Scale Heterogeneous Swarm Robotics, ***ICRA Workshop***: *Role of Robotics Simulators for Unmanned Aerial Vehicles*, 2023. [pdf]

- ***Related Interdisciplinary Research***

5. **P. Yang**, J. Liu, H. Yang, S. Wu, B. Teng, Magnetic Field Energy of Two Parallel Current-carrying Straight Wires[J], ***Physics Bulletin***. *38(7): 9-13*, 2019. [pdf]

6. Y. Bai, A. Ikkala, A. Oulasvirta, S. Zhao, L. Wang, **P. Yang**, P. Xu, Simulating Attention Switching On Optical Head-Mounted Displays While Walking, *ACM Conference on Human Factors in Computing Systems (CHI)*, 2024. [pdf]

7. Y. Zhou, M. M. Gillavry, **P. Yang**, Z. Xu, B. Zhang, R. Bidarra, Astral Body: a virtual reality game for body ownership investigation, *Games and Learning Alliance Conference (GALA)*, 2023. [pdf]

RESEARCH EXPERIENCE

- **Dept. of Mechanical Engineering and Dept. of EEMCS, TU Delft** — Delft, Netherlands
  Master Thesis, Advisors: Dr. Cong Wang, Prof. Jens Kober, Prof. Frans Oliehoek — *January 2024 - Present*
  Lifelong Robot Learning with Retrieval-based Weighted Local Adaptation
  - Trained multiple manipulation tasks in a task-unaware lifelong setting using imitation learning. Utilized a Transformer-GMM structure to tackle sequential observations and multi-modal action distributions.
  - Employed R3M and Sentence Similarity models as fixed image and language encoders. Implemented Experience Replay from Episodic Memory (EM) storing subset of demonstrations.
  - Fine-tuned transformer-based temporal encoder and GMM-based policy head during inference via local adaptation by retrieving demonstrations from EM using image embeddings and task descriptions. Applied selective weighting to data segments based on comparisons between retrieved demonstrations and failed rollouts.

- **Institute for Dynamic Systems and Control, ETH Zurich** — Zurich, Switzerland
  Research Assistant in RSF, Advisor: Dr. Dejan Milojevic, Prof. Emilio Frazzoli — *June - October 2023*
  Sensor Benchmarking of Object Detection Models for Autonomous Vehicle Co-design
  - Utilized MMDetection3D to evaluate camera or lidar-based object detection models' performance with metrics of True Positives, False Negatives, and False Positives for Sensor and Model Benchmarking on Nuscenes Dataset.
  - Implemented Exact and Variational Gaussian Process (GP) to predict and analyze detection model performance on various ground-truth or detected input features, while quantifying estimation uncertainties as confidence intervals. Leveraged KeOps Library with GPU to significantly improve the efficiency of the exact GP model.
  - Improved the GUI for better interactions and intuitive visualization of model and feature comparisons.

- **Existential Robotics Laboratory, University of California, San Diego (UCSD)** — Remote
  Research Assistant, Advisor: Dr. Shumon Koga, Prof. Nikolay Atanasov — *February 2022 - June 2023*
  Learning-based Active Target Tracking
  - Developed a continuous control policy for active target tracking, integrating an information-theoretic cost function and a differentiable FoV, trained through both model-free (PPO) and model-based approaches.
  - Applied attention-based model architecture for permutation-invariant property dealing with an arbitrary number of moving targets. Leveraged Kalman Filter to maintain the mean and covariance for the targets and utilized both as the observation to formulate the task into an MDP problem.

- ○ Achieved prioritized landmark localization and joint exploration-landmark localization. Also applied the model in a Unity simulated environment – updating the landmarks' position estimations using a pinhole camera model with the simulated semantic segmentation and depth cameras.
- ○ Papers have been **accepted by ICRA 2023** and **L4DC 2023**, see Pub. **1**, **2**.

- **Dartmouth Reality and Robotics Lab, Dartmouth College**   Hanover, US and Remote
  Research Assistant, Advisor: Prof. Alberto Quattrini Li   *July 2019 - February 2022*
  Underwater Robot Obstacle Avoidance and Navigation
  - ○ Monocular camera and single-beam sonar for low-cost perception platform. Tested existing depth estimation methods and adopted Depth Prediction Transformers (DPT) as the backbone network for feature extraction.
  - ○ Proposed a novel DRL-based (PPO) collision-free navigation system: integrating predicted depth maps, single-beam sonar readings, and relative goal positions for an Autonomous Underwater Vehicle to navigate to the goals while avoiding nearby obstacles with continuous actions.
  - ○ Employed Unity Simulation for realistic underwater scenes to train the policy network. Combined Domain Randomization to improve the model's robustness and mitigate the problem from *sim-2-real gap*.
  - ○ Extensive ablation studies, comparisons, and field experiments demonstrated the proposed system's high efficiency, safeness, and transferability. Paper **accepted by ISRR 2022**, see Pub. **3**.

INTERNSHIP

- **Robotics X, Tencent**   Shenzhen, China
  Research Intern, Advisor: Dr. Cheng Zhou   *December 2020 - August 2021*
  Quadruped Robot Locomotion with Deep Reinforcement Learning
  - ○ Trained policy network with PPO using reference motions for quadruped robot locomotion in Pybullet.
  - ○ Introduced domain adaptation: predicting randomized dynamic parameters using sequences of Robot state and executed action data in Pybullet. Fed the predicted parameters for the policy network and computed better adaptable control policies for the robot's locomotion. Obtained a 5.09% higher average reward in various dynamics environments in Gazebo compared with Robust DRL controller.
  - ○ Deployed the project in Tencent TLeague Framework (a high-performance distributed RL framework) with Kubernetes, and almost five times accelerated the training speed. During testing, realized a faster real-time control with C++ implementations (Eigen). Achieved locomotion in the real world on flat surfaces.

SELECTED PROJECTS

- **Seminar Formal Methods for Learned Systems, TUD**   *September - November 2022*
  - ○ Acquired foundational knowledge in Modelling, Specification, and Verification for Machine Learning. Conducted Reachability Analysis for Neural Network Control Systems using Julia programming language.
  - ○ Investigated the efficacy and robustness of Shielding Techniques in ML-based systems. See final report [**here**].

- **Robot Dynamics & Control, TUD**   *September - November 2022*
  - ○ Applied a PD controller to control a quadrotor to follow different paths. Implemented torque and position-controlled robot and achieved singularity-robust control and task-priority control with a robot arm. Controlled vehicle lateral displacement motion using PID controller. Final project got **9.5/10**.

- **Compiler for Simplified C++, UCSB**   *April - June 2019*
  - ○ Course project of Translation of Programming Languages (CS160). Implemented a simplified compiler using C++, including Scanner, Parser, Abstract Syntax Tree, Type Checking, and Code Generation.
  - ○ Passed all tests successfully with zero errors and generated valid X86 assembly codes. Course received an **A+**.

SKILLS SUMMARY

- **Languages**:   Python, C++, C, C#, Matlab, JavaScript, Julia, Verilog, Shell, XML, SQL, Latex
- **Frameworks**:   Pytorch, GPytorch, Tensorflow, OpenCV, Keras, Eigen, Qt, Scikit, Pandas, D3
- **Tools**:   ROS, Unity, Kubernetes, Docker, GIT, Gazebo, Pybullet, UWSim, QGroundControl, VizDoom, Jupyter Notebook, SolidWorks, MathCad, Vivado, Wireshark, Multisim
- **Interests**:   Travelling, Photography, Swimming, Biking, Scuba Diving (Open Water Certificate), Manual Work

HONORS AND AWARDS

- ETH Robotics Student Fellowship (top 8.9%)   *March 2023*
- Shiqiang Enterprise Scholarship (top 1%)   *October 2018*
- Excellent Student Scholarship in UESTC (top 5%)   *September 2017/2018/2019*
- Excellence (top 10%) in College Students Innovation and Entrepreneurship Competition (2018) of UESTC   *January 2019*
- Outstanding Volunteer as the team leader of a voluntary teaching organization in China rural counties   *October 2017*
- Excellence Award for Business Competition at *Manulife* short-term program   *February 2018*