Pengzhi Yang

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Education

- **Delft University of Technology (TUD)** — Delft, Netherlands
  Master of Science - Computer Science, Artificial Intelligence Technology — *September 2022 - Present*
- **University of Electronic Science and Technology of China (UESTC)** — Chengdu, China
  Bachelor of Engineering - Computer Science; ***GPA: 3.90/4.00, Ranking: 7.11%*** — *September 2016 - June 2020*
  Honors Diploma - Yingcai Honors College
- **University of California, Santa Barbara (UCSB)** — Santa Barbara, United States
  Exchange Program - Computer Science; ***GPA: 4.00/4.00*** — *March 2019 - June 2019*

TOEFL: Reading 29/ Listening 26/ Speaking 25/ Writing 25/ Total 105, **GRE**: Verbal 156/ Quantity 170/ AW 4.0

Research Interests

I am avidly invested in exploring the potential of deep reinforcement learning (DRL) methods to enhance the decision-making proficiency of robots through the integration of robust perceptual capabilities.

Publications

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. [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]
3. **P. Yang***, H. Liu*, M. Roznere, A. Quattrini Li, Monocular Camera and Single-Beam SonarBased Underwater Collision-Free Navigation with Domain Randomization, *The International Symposium on Robotics Research (ISRR)*, 2022. [oral] [pdf] [doi] [video]
4. **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]
5. 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, *Submitted to ICRA The Role of Robotics Simulators for Unmanned Aerial Vehicles Workshop*, 2023.

Research Experience

- **Existential Robotics Laboratory, University of California, San Diego (UCSD)** — Remote
  Research Assistant, Advisor: Dr. Shumon Koga, Prof. Nikolay Atanasov — *February 2022 - Present*
  Learning-based Active Target Tracking
  - Proposed a continuous control policy trained with PPO for active target tracking with an information-theoretic cost by employing a differentiable FoV.
  - 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 utilize 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 (Proximal Policy Optimization, 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.
- **Center for Robotics, UESTC** — Chengdu, China
  Undergraduate Research Assistant, Advisor: Prof. Shuzhi Ge, Dr. Chen Wang — *November 2019 - June 2020*
  Robot Indoor Localization

- Modified ACS files to create VizDoom Mazes with required behaviors: discretized agent's actions and built APIs for interaction.
- Reproduced Active Neural Localizer with A3C algorithm in the created mazes based on Bayesian Filter. Adjusted the Perception Model using distance information in the simulated 3D environments and facilitated the system's practical applications.

- **School of Physics, UESTC** Chengdu, China
  Undergraduate Research Assistant, Advisor: Prof. Baohua Teng *March 2018 - January 2019*
  Research on Energy of Magnetic Field of an Ideal Physical Model
  - Calculated the energy density distribution of magnetic field in two parallel long current-carrying straight wires based on the principle of vector synthesis of magnetic induction intensity.
  - Simulated the magnetic field distribution and total magnetic energy curves under different current directions and different wire distances, gave a reasonable and intuitive theoretical description of the problem.
  - Paper accepted by Physics Bulletin, see Pub. 4.

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 (Max) 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 Max'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). The system adapted to the real robot was also achieved.

- **Stars Lab, Beihang University** Remote
  Software Developer, Advisor: Prof. Liang Han *March 2022 - July 2022*
  Development of a 3D Simulator for Large-Scale Heterogeneous Swarm Robots
  - Developed highly efficient functions for swarm robots' in-pair interactions such as collision avoidance.
  - Improved the efficiency using Pytorch broadcasting technique for the 3D simulator packaged by PyTorch TorchScript and ran it on GPU. It was shown to perform much better than Octree tricks.

Selected Projects

- **Robot Dynamics & Control, TUD** September 2022 - 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.
  - Course Project got **9.5/10**.

- **Compiler for Simplified C++, UCSB** April 2019 - 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. Received an **A+**.

- **Development of an Eight-Stage Pipelined MIPS Processor, UESTC** April 2018 - June 2018
  - Built a 32-bit CPU based on gate-level circuits; embedded a deep pipeline into its ALU module; ran FFT on this simulated processor.
  - Won **1st** place in the Efficiency Competition amongst all teams.

Skills Summary

- **Languages**: Python, C++, C, C#, Matlab, JavaScript, Verilog, Shell, XML, SQL, Latex
- **Frameworks**: Pytorch, Tensorflow, OpenCV, Keras, Eigen, D3, Scikit, Pandas
- **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

- 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
- Second prize in the English Speech Contest in UESTC - June 2018
- 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