PENGZHI YANG

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EDUCATION

Delft University of Technology (TUD) **Delft, Netherlands**
M. Sc. of Computer Science in Artificial Intelligence Technology *Sep. 2022 – Present*

University of Electronic Science and Technology of China (UESTC) **Chengdu, China**
B. Eng. of Computer Science, ***Yingcai Honors College (Elite School of Top 2% Student)****, GPA: 3.9/4.0 (Ranking 7.11%)* *Sep. 2016 – Jun. 2020*

University of California, Santa Barbara (UCSB) **Santa Barbara, US**
Exchange Program in Computer Science, GPA: 4.0/4.0 *Mar. – Jun. 2019*

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

PUBLICATIONS

1. **[ISRR'22] Pengzhi Yang***, Haowen Liu*, Monika Roznere, Alberto Quattrini Li, Monocular Camera and Single-Beam Sonar-Based Underwater Collision-Free Navigation with Domain Randomization. *The International Symposium on Robotics Research (**ISRR**)*, 2022.
2. **Pengzhi Yang**, Yuhan Liu, Shumon Koga, Arash Asgharivaskasi, Nikolay Atanasov, Learning Continuous Control Policies for Information-Theoretic Active Perception. Submitted to *IEEE International Conference on Robotics and Automation (**ICRA**)*, 2023.
3. **Pengzhi Yang**, Shumon Koga, Arash Asgharivaskasi, Nikolay Atanasov, Policy Learning for Active Target Tracking over Continuous SE(3) Trajectories. Submitted to *Learning for Dynamics and Control (**L4DC**), 2023.*
4. **Pengzhi Yang**, Jiahao Liu, Hongchun Yang, Shaoyi Wu, Baohua Teng. **Magnetic Field Energy of Two Parallel Current-carrying Straight Wires[J]**. Physics Bulletin. 2019, 38(7): 9-13.

RESEARCH EXPERIENCE

Dartmouth Reality and Robotics Lab, Dartmouth College **Jun. 2019 – Feb. 2022**
Research Assistant, Advisor: Prof. Alberto Quattrini Li *Hanover, US and Remote*

- Underwater Robot Navigation
  - Synthesized *NYU Depth Dataset*'s RGB images with underwater features. Retrained the depth (RGB-D) prediction network with the rendered images and better estimated single-view underwater distance information with a monocular camera.
  - Proposed **a novel 3-D end-to-end DRL (Proximal Policy Optimization, PPO) underwater navigation controller**: integrating predicted depth images, single-beam sonar's readings, and GPS for an Autonomous Underwater Vehicle (AUV) to navigate to goal positions while avoiding nearby obstacles. Combined **Domain Randomization** to improve model's robustness and better transfer the navigation model from simulation to various real underwater worlds.
  - Compared existing depth estimation methods and adopted MegaDepth-trained Hourglass Network which averagely saved **28.27%** of the navigation time. Equipped with only a cheap monocular camera and single beam sonar, our approach achieved **30.97%** higher efficiency than traditional navigators using a multibeam echosounder (like Bug2).
  - Conducted **field experiments** in a swimming pool and demonstrated the model's transferability.
  - Paper **accepted by ISRR 2022**, see Publications 1.

Existential Robotics Laboratory, University of California, San Diego (UCSD) **Feb. 2022 - Present**
Research Assistant, Advisor: Prof. Nikolay Atanasov, Dr. Shumon Koga *Remote*

- Active Exploration and Mapping
  - To map the landmarks with uncertainty in a limited time horizon, proposed a continuous control policy using PPO for active perception with information-theoretic cost by employing a differentiable field of view and an attention-based policy architecture. Leveraged Kalman Filter to maintain the mean and covariance for the landmarks to formulate the task into a **Markov Decision Process (MDP)** problem.
  - Applied the trained model in Unity simulated environment – update the landmarks' position estimates using a pinhole camera model with the simulated semantic segmentation and depth cameras.
  - Performed thorough experiments which illustrated the proposed method's superiority in landmark localization over an open-loop optimization technique and a policy with different network architecture. Also achieved prioritized landmark localization and joint exploration-landmark localization.
  - Extended the work by employing model-based reinforcement learning for training to track various numbers of moving targets over continuous SE(3) trajectories.
  - Papers have been submitted to **ICRA 2023** and **L4DC 2023**, see Publications 2, 3.

Center for Robotics, UESTC **Nov. 2019 – Jun. 2020**
Undergraduate Research Assistant, Advisor: Prof. Shuzhi Ge *Chengdu, China*

- 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 **Mar. 2018 – Jan. 2019**

Undergraduate Research Assistant, Advisor: Prof. Baohua Teng *Chengdu, China*

- 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.
  - Paper accepted by Physics Bulletin, see publications 4.

INTERNSHIP

Robotics X, Tencent **Dec. 2020 – Aug. 2021**

Machine Learning Intern, Advisor: Dr. Cheng Zhou *Shenzhen, China*

- End-to-End Control for Quadruped Robot with Learning-based Methods
  - Trained a deep reinforcement learning (PPO) model with reference motions to control a quadruped robot, *Max*, to walk in Pybullet.
  - Applied Domain Randomization by randomizing dynamic parameters (friction, robot's mass and etc.) during training. Successfully transferred the model to **Gazebo and real-world environments**.
  - Introduced domain adaptation: predicting dynamic parameters using sequences of *Max*'s *state*, *action* data in Pybullet. Fed the predicted parameters for the PPO network and computed more adaptable control policies for *Max*'s locomotion. Obtained a **5.09%** higher average reward in various environments in Gazebo compared with Robust DRL controller.
  - Deployed the code in **Tencent TLeague Framework** (a high-performance distributed RL framework) with **Kubernetes**, and nearly **five times** accelerated the training speed. During testing, realized a faster real-time control with **C++ implemetations (Eigen)**.

Stars Lab, Beihang University **Mar. 2022 – Jul. 2022**

Software Developer, Advisor: Prof. Liang Han *Remote*

- 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 broadcast technique for the 3D simulator packaged by PyTorch TorchScript and ran on GPU. Shown to perform much better than Octree tricks.

SELECTED PROJECTS

- **Robot Dynamics & Control, TUD** **Oct. – Nov. 2022**
  - Applied a PD controller to control a quadrotor to follow different paths. Implemented torque and position-controlled robot and achieved the singularity-robust control and task-priority control with a robot arm. Controlled vehicle lateral displacement motion using PID controller.
- **Compiler for Simplified C++, UCSB** **Apr. – Jun. 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 no errors and generated valid X86 assembly codes. Got an A+ at last.
- **Development of an Eight-Stage Pipelined MIPS Processor, UESTC** **Apr. – Jun. 2018**
  - Built a 32-bit CPU based on gate-level circuits; embedded deep pipeline into its ALU module; ran FFT on this simulated processor.
  - Won **1st place** in the Efficiency Competition amongst all teams.

SKILLS SUMMARY

Programming:
Python, C/C++/C#, Matlab, XML, Shell, Verilog, SQL.

Softwares:
Pytorch, Tensorflow, Keras, Eigen. Kubernetes, Docker, Git, Jupyter Notebook. ROS, Gazebo, Unity, Pybullet, UWSim, QGroundControl, VizDoom, SolidWorks. Mathcad, Vivado, Multisim. Adobe Softwares.

Interests:
Travelling, Photography (https://500px.com/y_marcus), Swimming, Biking, Scuba Diving (Got Open Water Certificate), Reading, Movies.

HONORS & AWARDS

Shiqiang Enterprise Scholarship (top 1%)	Oct. 2018
Excellent Student Scholarship in UESTC for three times (top 5%)	Sep. 2017, 2018, 2019
Excellence (top 10%) in the College Students Innovation and Entrepreneurship Competition (2018) of UESTC	Jan. 2019
Second prize of English Speech Contest in UESTC	Jun. 2018
Outstanding Volunteer as the team leader of a voluntary teaching organization in China rural counties	Oct. 2017
Excellence Award for Business Competition at Manulife short-term program	Feb. 2018