PENGZHI YANG

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EDUCATION

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

University of Electronic Science and Technology of China (UESTC)   **Chengdu, China**
*B. Eng. of Computer Science, **Yingcai Honors College (Elite School - Top 2% Student)**, GPA: 3.9/4.0 (Ranking 7.11%)*   *Sept. 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, to better estimate 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 a GPS for an Autonomous Underwater Vehicle (AUV) to navigate to goal positions while avoiding nearby obstacles. Combined **Domain Randomization** to improve the model's robustness and better transfer the navigation model from simulation to various real underwater worlds.
  - ➢ Compared existing depth estimation methods and adopted the MegaDepth-trained Hourglass Network which on average 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, which 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, we 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 a Unity simulated environment – update the landmarks' position estimates using a pinhole camera model with the simulated semantic segmentation and depth cameras.
  - ➢ Performed thorough experiments to illustrated the proposed method's superiority in landmark localization over an open-loop optimization technique and a policy with a different network architecture. Also achieved prioritized landmark localization and joint exploration-landmark localization.
  - ➢ Extended the work by employing model-based reinforcement learning in order 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 wire distances, gave a reasonable and intuitive theoretical description of the problem.
  - ➢ 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 (i.e. friction, robot's mass) during training. Successfully transferred the model to **Gazebo and real-world environments**.
  - ➢ Introduced domain adaptation: predicted 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 almost **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 it on GPU. It was 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 zero errors and generated valid X86 assembly codes. Received an A+.

- **Development of an Eight-Stage Pipelined MIPS Processor, UESTC**   **Apr. – Jun. 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

Programming:
  Python, C/C++/C#, Matlab, XML, Shell, Verilog, and 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, and 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 in the 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