Yang, Zhile

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EDUCATION

Master, Tsinghua University — Beijing, China
Major: Control Science and Engineering — Aug 2018 – Jun 2021
GPA: 3.79/4.0 **Rank:** 13/150 **Advisor:** Feng Chen, Full Professor

Bachelor, Tsinghua University — Beijing, China
Major: Automation — Aug 2014 – Jul 2018
Average Grade: 88.4/100 (**GPA:** 3.86/4.0)

RESEARCH INTERESTS

My research interests include reinforcement learning (RL) and robot control. In my research, I aim to develop reinforcement learning algorithms and techniques that enable machines to learn more efficiently, behave more robustly, and adapt autonomously to unforeseen environments and tasks. In particular, I am interested in how to endow a vision-based robot with the ability to navigate in real-world open environments.

RESEARCH EXPERIENCE

- **Jul. 2021 – Present: Improving the robustness of RL through multi-layer WTA network**
  One well-known shortcoming of RL is its unsatisfying robustness, which constrains it from being applied to many real-world tasks. In contrast, humans can complete tasks reliably. This work aims to design bio-inspired function approximators to improve the robustness of RL agents.
- **Apr. 2020 – Aug. 2021: Stabilizing training of RL with undiscounted returns**
  Undiscounted RL offers an effective and easy way for modeling many real-world control tasks. However, it suffers from the training instability problem. Our theoretical analysis showed the cause is the inconsistency in action sampling. We proposed a new sampling method called Last-Visit Sampling that corrects the inconsistency in a sample-efficient manner. Paper submitted to IEEE TNNLS. My contributions include the proposal of our method, a part of theoretical analysis, and the construction of testing RL environments.
- **Jul. 2019 – Apr. 2020: Improving efficiency of sim2real transfer in robot RL**
  Domain Randomization is a commonly adopted approach for sim2real robot RL. However, it suffers from training instability when the domain is complex. To overcome this problem, we propose an environment-level domain decomposition method to stabilize training. We proved that it could preserve policy optimality at the same time. With this method, we achieved zero-shot transfer for a vision-based robot navigation task. Paper published in IROS 2020. My contributions include the theoretical proof, the simulation, and the real-world experiment.
- **Feb. 2018 – Jun. 2019: Improving adaptability of RL policies to unforeseen Doom games**
  The Doom games require visual navigation and goal-reaching in unforeseen 3D maps and pose challenges to RL's adaptability. We proposed a two-phase policy structure with two surrogate targets in each phase and designed a curriculum learning paradigm. Our agent solved 5 of 10 unforeseen testing maps and won third place in the Visual Doom AI Competition 2018. My contributions include the design of the policy structure, one surrogate target, the training platform, and the final policy tuning.

PUBLICATIONS

- Haichuan Gao*, **Zhile Yang***, Xin Su, Tian Tan, and Feng Chen, "Adaptability Preserving Domain Decomposition for Stabilizing Sim2Real Reinforcement Learning", in *IROS 2020* (**oral presentation**) (*** equal**

contribution).

- Pengfei Sun, **Zhile Yang**, Tianren Zhang, Shangqi Guo, and Feng Chen, "Primitive-Contrastive Network: Data-Efficient Self-Supervised Learning from Robot Demonstration Videos", in *Applied Intelligence*, 2021.
- Dagui Chen, Qi Yan, Shangqi Guo, **Zhile Yang**, Xin Su, and Feng Chen, "Learning Effective Subgoals with Multi-Task Hierarchical Reinforcement Learning", in *2nd Scaling-Up Reinforcement Learning Workshop, IJCAI 2019*.
- Qi Yan, Shangqi Guo, Dagui Chen, **Zhile Yang**, and Feng Chen, "Transferable Environment Model with Disentangled Dynamics", in *IEEE Access*, vol. 7, pp. 106848-106860, 2019.

HONORS

- The Third Place, Visual Doom AI Competition 2018 Single Player Track
- The First Prize, Tsinghua University Student Research Training (SRT) 2018 (**group leader**)
- System Design Award, 2017 International Aerial Robotics Competition (Asian/Pacific venue) (**team representative**)
- The First Prize, The 11th Tsinghua University Transportation Science and Technology Competition
- Successful participant **(top ten)**, The 2nd ATOM Academic Science and Technology Top Innovation Talent Training Program, Department of Automation, Tsinghua University
- 2016~2017 Scholarship for Excellence in Study at Tsinghua University

TEACHING AND WORK

Intern student at Beijing Academy of Artificial Intelligence — Jul 2021 – Present

- Researching on bio-inspired network structures for improving the robustness of RL.

Teaching assistant of Matrix Analysis — Feb 2019 – Jun 2021

- Prepared lecture slides, answered students' questions, and graded assignments.

Intern student at the Institute of Automation, Chinese Academy of Sciences — Jul 2017 – Sep 2017

- Designed RL algorithms to solve two minigames in StarCraft 2, made image datasets for a competition on pattern recognition, and did group presentations on multi-agent RL.

OTHER EXPERIENCE

Lab IT administrator — Jun 2019 – Jun 2021

- Maintained GPU servers, resolve issues with remote access, simulation, etc.

SRT project: FPGA programming — Oct 2016 – Jul 2017

- Group leader. Programmed FPGA to control devices including an LCD display
- Wrote guidebooks for the course "Contemporary Electronic System Design"

International Aerial Robotics Competition — Oct 2016 – Aug 2017

- Achieved stable position control of a quadrotor based on optical flow and lidar

Member of Project Group, Department of Automation — Feb 2016 – Jan 2018

- Organized student activities including weekly academic seminars and visits to labs.

Community Service: IT service for Machang town — Aug 2015

- Installed and set up Wi-Fi for the government office building in Machang town
- Maintained computers in Pingzhai primary school

Volunteer: Campus-guide for tourists and freshmen — Oct 2014, Sept 2016

SKILLS

- Language: Fluent in English. Native speaker of Mandarin Chinese
- Development: MATLAB, Python, C/C++, Verilog
- Tools: ROS, OpenCV, PyTorch, TensorFlow, LaTeX