Fengkang Ying

Phone: +86 18850077449 │ **Email**: fkying@mail.dhu.edu.cn
Research Interest: robotics, deep reinforcement learning, motion planning, intelligent control

Education

Donghua University, M.E, *Shanghai, China*   **Sep 2019 – Mar 2022**

Major: Electrical Engineering | **GPA: 89.5/100 (Rank: 1/160)**

Thesis: Robotic Trajectory Generation Based on Deep Reinforcement Learning with Deterministic Policy Gradient (**National Excellent Master's Thesis Award, conferred by Chinese Association of Automation, 29 recipients in total**)

Courses: Robotics and Control (98/100), Linear System Theory (92/100), Intelligent Systems and Control (91/100), Modern Power Source Technology (93/100)

Huaqiao University, B.E, *Fujian, China*   **Sep 2015 – Jun 2019**

Major: Electrical Engineering & Automation | **GPA: 84/100 (Rank: 3/54)**

Thesis: Automatic Obstacle Avoidance and Parking System for Mobile Robots

Courses: Probability and Mathematical Statistics (99/100), Power System Analysis (94/100), Principles and Applying of Programming Logic Controller (91/100), Power Drive Technique (94/100)

Publications

- **F.K. Ying**, H.S. Liu, R.X. Jiang, and X. Yin, "Trajectory Generation for Multiprocess Robotic Tasks Based on Nested Dual-Memory Deep Deterministic Policy Gradient", *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 6, pp. 4643-4653, 2022 (***Published***)

- **F.K. Ying**, H.S. Liu, M.H. Dong, and R.X. Jiang, "Extensively Explored and Evaluated Actor-Critic with Expert-Guided Policy Learning and Fuzzy Feedback Reward for Robotic Trajectory Generation", *IEEE Transactions on Industrial Informatics*, vol. 18, no. 11, pp. 7749-7760, 2022 (***Published***)

- H.S. Liu, **F.K. Ying**, R.X. Jiang, Y.H. Shan, and B. Shen, "Obstacle-avoidable Robotic Motion Planning Framework Based on Deep Reinforcement Learning", *IEEE/ASME Transactions on Mechatronics* (***Under the 2nd round of review***)

- R.X. Jiang, **F.K. Ying** (corresponding author), G.J. Zhang, Y.F. Xing, and H.S. Liu, "Globally Perceived Obstacle Avoidance for Robots based on Digital Twin and Deep Reinforcement Learning", *2023 7th International Conference on Robotics, Control and Automation (ICRCA)*, 2023 (***Published***)

- M.H. Dong, **F.K. Ying**, X.J. Li, and H.S. Liu, "Efficient Policy Learning for General Robotic Tasks with Adaptive Dual-memory Hindsight Experience Replay Based on Deep Reinforcement Learning", *2023 7th International Conference on Robotics, Control and Automation (ICRCA)*, 2023 (***Published***)

- Y.Y. Chen, **F.K. Ying**, X.J. Li, and H.S. Liu, "Deep Reinforcement Learning in Maximum Entropy Framework with Automatic Adjustment of Mixed Temperature Parameters for Path Planning", *2023 7th International Conference on Robotics, Control and Automation (ICRCA)*, 2023 (***Published***)

- H.Y. Han, **F.K. Ying**, Z.W. Pang, H.S. Liu, "Dual-strategy Pose Estimation Network Based on Mask-RCNN", *42nd Chinese Control Conference (CCC)*, 2023 (***Accepted***)

Research Experience

IK-free Trajectory Generation with Automatic Obstacle Avoidance for Manipulators

Donghua University – KUKA robotic laboratory, Group of Roboteam   **Aug 2022 – Present**

- Proposed a prophet-guided actor-critic (PAC) algorithm for prompt and stable task replanning
- Designed a reward system to make the body and the end-effector of a manipulator avoid collisions simultaneously
- Proposed an expandable memory to augment high-quality samples from only a few expert demonstrations

Trajectory Generation for Multiprocess Robotic Tasks Based on Nested Dual-Memory Deep Deterministic Policy Gradient

Donghua University – KUKA robotic laboratory, Group of Roboteam   **Jun 2019 – Jan 2022**

- Proposed a general IK-free trajectory generation scheme suitable for manipulators of any DoFs by deep reinforcement learning
- Designed a multi-policy agent based on a novel nested architecture aiming at multiprocess assembly
- Proposed a dual-memory structure with a local-to-global strategy for efficient policy learning
- Designed a compound reward system to control the position and orientation of the end effector simultaneously and flexibly

Extensively Explored and Evaluated Actor-Critic (E3AC) with Expert-Guided Policy Learning and Fuzzy Feedback Reward for Robotic Trajectory Generation

Donghua University – KUKA robotic laboratory, Group of Roboteam   **Mar 2021 – Jan 2022**

- Proposed a novel deep reinforcement learning algorithm (E3AC) with extensive exploration and evaluation based on single-actor-multiple-critic framework and deterministic policy gradient

- Proposed a dual-memory structure based on an increasingly unbiased expert-guided strategy for efficient policy learning
- Designed a fuzzy feedback reward based on multilayer perceptron and fuzzy system for efficient reward obtaining without manually establishing explicit reward functions
- Adopted DDPG, SAC, PER, GMM, and other benchmarks to verify the proposed IK-free trajectory generation scheme

Digitalized Pick-and-Place Assembly System Based on V-REP

Donghua University – KUKA robotic laboratory, *Group of Roboteam*   **Jan 2019 – Mar 2020**
- Adjusted and tested the KUKA assembly line
- Responsible for 3D modeling of robots and other devices on SolidWorks, and real-time interaction between KUKA LBR iiwa 7 R800 and V-REP
- Constructed a virtual twin system (VTS) that was a 1:1 reproduction of the real-world assembly platform to directly apply the algorithm trained in simulation to real-world robot control

Automatic Obstacle Avoidance and Parking Technologies for Mobile Robots

Huaqiao University – College of Information Science and Engineering   **Apr 2018 – Mar 2019**
- Handled basic skills about Arduino and MATLAB
- Implemented the design, analysis, programming and testing of the automatic obstacle avoidance and parking systems
- Developed the achievements into graduation design

Intelligent Wireless Power Transmission for Electric Vehicles

Zhejiang University – College of Control Science and Engineering   **Jul 2018**
- Handled basic skills and operations about Simulink and PLECS
- Analyzed the fundamentals of wireless power transmission system
- Designed a controller based on T-parameter and compared it with the PI controller

Patents

- **F.K. Ying** *et al.*, *"An implementation of human-robot interaction for assembly line based on artificial potential field and reinforcement learning"*
- **F.K. Ying** *et al.*, *"A human-robot collaboration assembly system based on deep reinforcement learning"*
- **F.K. Ying** *et al.*, *"A robot calibration method based on vision and closed-loop transformation of multi-coordinate system"*
- **F.K. Ying** *et al.*, *"An online photometric calibration method based on direct monocular SLAM"*
- **F.K. Ying** *et al.*, *"An implementation method of efficiency optimization for automatic assembly line system"*

Miscellaneous

- **Language**: English (IELTS overall band: 7.5), Mandarin (Native)
- **Computer skills**: Python, V-REP/CoppeliaSim, MATLAB, SolidWorks, PLECS, Arduino, Microsoft Office
- **Scholarships:**
  - Recipient of 1st tier Embry Group Scholarship (2020)
  - Recipient of 1st tier Postgraduate Academic Scholarship (2019, 2020)
  - Recipient of Postgraduate Full Scholarship (2019)
  - Recipient of National Encouragement Scholarship (2016, 2017, 2018)
- **Awards and honorable mentions:**
  - National Excellent Master's Thesis Award (2023)
  - Outstanding graduate in Shanghai (2022)
  - Top ten honorary students in Academic Excellence of Donghua University (2022)
  - National first award at the 23rd China Robotics and Artificial Intelligence Competition (2021)
  - 2nd tier awardee of the 16th "Zhaoyi Cup" China Postgraduate Electronic Design Competition (2021)
  - 3rd tier awardee of the 18th Shanghai "Tomorrow's Science and Technology Star" Contest (2020)
  - Outstanding graduate at Huaqiao University (2019)
  - Recipient of Merit Certificate at the 7th Zhejiang University Control Journey Summer Camp (2018)
  - National second runner-up at the 19th National English Competition for College Students (2017)
  - Outstanding volunteer at Huaqiao University (2017)
  - Fujian district second runner-up at the 18th National English Competition for College Students (2016)
  - Outstanding student at Huaqiao University (2016)
- **Others:**
  - Speaker on Fundamentals of Deep Reinforcement Learning and Its Applications at Donghua University (2022)
  - Speaker on Deep Reinforcement Learning and Its Application Instances on Trajectory Generation for Manipulators at the University of British Columbia – ACIS laboratory (2021)
  - Vice-chairman of the Student Union of Huaqiao University, College of Information Science and Technology (2017, 2018)