

Mohamed Al-Khulaqui

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PERSONAL INTRODUCTION

I am a highly motivated and versatile individual, If I am not already working on a project then I am researching a new one. My research areas and fields of experience include robotic vision, motion planning and control. I am passionate about robotics, automation and AI, always eager to learn more and find challenging problems to engage myself in. I'm a tech enthusiast and always try to stay up-to-date with the latest technologies.

EDUCATION

- **Beijing Institute of Technology** Beijing, China
M.S. Mechanical Engineering; GPA: 3.6 . Sep 2021 - Jul 2023
Thesis: Motion Planning Framework of Robotic Rat for Behavioral Interaction
Notable Courses: Advanced Robotics, Design and Application of Robotic Systems,
Micro-Nano Manufacturing and Mirco-Nano Robotic Technology.
- **Beijing Institute of Technology** Beijing, China
B.S. Mechatronics Engineering; GPA: 3.36 . Sep 2017 - Jul 2021
Thesis: Plane Detection and Humanoid Robot Local Path Planning Based on Depth Vision.

TECHNICAL SKILLS

- **Robot Motion Planning:** Experienced with various motion planning algorithms, probabilistic methods and non-linear optimization as well as hardware implementations using C++ and ROS.
- **Control of Robotic Systems:** Kinematic and Dynamic modeling, Trajectory Optimization, Model Predictive Control.
- **Vision & Sensors:** RGB-D Cameras, IMUs, Image processing (OpenCV), Point cloud processing (PCL).
- **Machine Learning:** PyTorch, TensorFlow, Deep Reinforcement Learning, Imitation Learning, Object Detection & Recognition (YOLO)

COMPUTER SKILLS

- **Programming:** C/C++, CMake, MATLAB, Python, OpenCV, Linux, ROS, Qt, LaTeX, Git, Bash.
- **Simulation:** Isaac Sim, MuJoCo, Simulink, Gazebo.
- **3D Modeling & CAD:** Solidworks, AutoCAD, Blender.
- **Embedded Development:** Experienced with C and C51 development of micro-controller applications (STM32, Arduino).

PUBLICATIONS

- [1] X. Guo, G. Jia, M. Al-Khulaqui, Z. Chen, T. Fukuda, and Q. Shi. Real-time pose estimation of rats based on stereo vision embedded in a robotic rat. In *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4690–4695, 2023. DOI: 10.1109/IROS55552.2023.10342475.
- [2] H. Xie, G. Jia, M. Al-Khulaqui, Z. Gao, X. Guo, T. Fukuda, and Q. Shi. A motion generation strategy of robotic rat using imitation learning for behavioral interaction. *IEEE Robotics and Automation Letters*, 7(3):7351–7358, 2022. DOI: 10.1109/LRA.2022.3182472.

- [3] Z. Xu, M. Al-Khulaqui, H. Ma, J. Wang, Q. Xin, Y. You, M. Zhou, D. Xiang, and S. Zhang. Optimization based dynamic skateboarding of quadrupedal robot. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 2024. (Accepted).

RESEARCH & WORK EXPERIENCE

- **Motion Control Algorithm Engineer**

Xiaomi Technology Inc. Robotics Department

Aug 2023 ~ Current

- **Robotic Control and Motion Planning:**

Developing motion control algorithms for quadrupedal robotic platforms using MPCs and deep reinforcement learning.

- **Student Researcher**

Beijing Advanced Innovation Center for Intelligent Robots and Systems (BAICIRS)

3 years

- **Bio-Inspired Robotics Team:** Prof. Qing Shi

Conducted research on motion planning, pose detection, etc. for the rat-inspired robotic platform SMuRo. Co-authored two scientific papers.

- **Humanoid Robotics Team:** Prof. Xuechao Chen

Carried out the development of a depth vision local path planning algorithm for the team's humanoid robot BHR-2. Organized into bachelor thesis which received "outstanding" grade.

PROJECTS

- **Quadruped: Cyberdog 2**

Xiaomi Inc., Robotics Department

Motion Control Algorithm Engineer - Dr. Yangwei You

Aug 2023 - Current

- **Reinforcement Learning Based Quadruped Locomotion:**

Used Methods: Actor-Critic Methods, PPO

Tools: Isaac Sim, Python, PyTorch, C++,

- **Optimization Based Quadruped Skateboarding:** [3]

Used Methods: Model Predictive Control

Tools: ROS, C++, Gazebo

- **Robotic-Rat: SMuRo**

BAICIRS, Bio-inspired Robotics Team

Member of Research Team - Prof. Qing Shi

Jul 2021 - Jul 2023

- **Motion Planning Framework of Robotic Rat for Behavioral Interaction:**

Master Thesis: Developed motion re-targeting method for rat-robot mapping, modeled rat behaviours using ProMPs and implemented rat tracking through visual servoing.

Used Tools: ROS, C++, ProMP, Gazebo, Ipopt Non-linear Optimization Library

- **Real-Time Rat Pose Estimation:** [1]

Used Tools: PyTorch, Python, Gazebo

- **Imitation Learning for Motion Generation:** [2]

Used Tools: PyTorch, Python, C++, Gazebo

- **Humanoid Robotics**

BAICIRS, Humanoid Robotics Team

Graduation Project - Prof. Xuechao Chen

Dec 2020 - Jun 2021

- **Footstep Planning for a Humanoid Robot Based on Depth Vision:**

Bachelor Thesis, "outstanding" grade.

Used Tools: C++, MATLAB, Point Cloud Library (PCL)

LANGUAGES

- **English:** Fluent, IELTS 8.0.
- **German:** Intermediate, Goethe B1.
- **Chinese:** Fluent
- **Arabic:** Fluent, Mother Language.
- **Japanese:** Basic

REFERENCES

- **Yangwei You:** PhD,
Xiaomi Technology Inc., Robotics Department
Head of Motion Control for Quadruped Team.
youyangwei1@xiaomi.com
- **Mingliang Zhou:**
Xiaomi Technology Inc., Robotics Department
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- **Qing Shi:** PhD, Professor,
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- **Xuechao Chen:** PhD, Professor,
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