Path Planning for Cellular-connected UAV using Heuristic Algorithm and Reinforcement Learning

Junqi Bao *, Yunchu Yang*, Yapeng Wang*, Xu Yang*, Zhenyu Du*

*Faculty of Applied Sciences, Macao Polytechnic University, Macao SAR, China

{p2109422, p1507937, yapengwang, xuyang, p2108837 }@mpu.edu.mo

Abstract— **With the development of Unmanned Aerial Vehicle (UAV), a novel technology called cellular-connected UAV has been proposed to make UAV complete its mission more efficiently. We consider a scenario where UAV must take off from a random start point, travel over some specific points (e.g. collecting data from sparce sensors in large area) and reach a random end point while keep connected to the Ground Base Station. One of the major challenges is to plan the flying path of UAV while satisfies all constraints. We abstract the path planning problem into Travel Salesman Problem (TSP) and use A* combine with Genetic Algorithm, Simulated Annealing Algorithm and Reinforcement Learning Model to solve TSP to get the best path for cellular-connected UAV. In addition, we did experiments and recorded the results to analyze the advantages and disadvantages of these algorithms.**

Keywords— **UAV, Cellular-connected UAV, path planning, Heuristic Algorithm, Reinforcement Learning, Travel Salesman Problem**

Junqi Bao received the B.Sc. in Nanjing University of Science and Technology ZiJin College in 2021. He is currently pursuing the M.Sc. degree in computer applied technology with the Faculty of Applied Sciences, Macau Polytechnic University. His research interests include image matching, computer vision, multiple view geometry, robotics, SLAM.

Yunchu Yang received the B.Sc. in Macau Polytechnic University in 2019. He is currently pursuing the M.Sc. degree in computer applied technology with the Faculty of Applied Sciences, Macau Polytechnic University. His research interest include path planning for UAVs , speech recognition, natural language processing, matching learning, text translation.
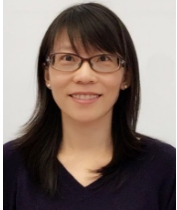
Xu Yang received the B.Sc. in University of Electronic Science and Technology of China in 1997, M.Sc. and Ph.D. degrees in Queen Mary University of London, UK in 2003 and 2009. She joined the Faculty of Applied Sciences, Macao Polytechnic University in 2013 as an lecturer. Her current research interests include wireless communications, medical image analyses, machine learning.

Yapeng Wang received the B.Sc. in North China Electric Power University, China in 1998, M.Sc. and Ph.D. degrees in Queen Mary University of London, UK in 2002 and 2007. He joined the Faculty of Applied Sciences, Macao Polytechnic University in 2021 as an associate professor. His current research interests include wireless communications, automatic speech recognition, machine learning.

Zhenyu Du received the B.Sc. in Zhengzhou University in 2020. He is currently pursuing the M.Sc. degree in Faculty of Applied Sciences, Macao Polytechnic University. His research areas include wireless communications and reinforcement learning for radio resource allocation.