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OPTIMAL PATH PLANNING FOR MOON ROVERS AND ROBOTIC EXPLORERS BASED ON REINFORCEMENT LEARNING AND MACHINE LEARNING

Abstract

In this article, an optimal path planning method based on reinforcement learning in order to applying on Moon Rovers and probes is presented. In the last decade, robot intelligentization has attracted the attention of many researchers in robotics engineering and artificial intelligence. One of the challenges ahead for researchers is the development of robots capable of learning and adaptability. The purpose of this article is to use reinforcement learning techniques to design the optimal path for lunar rovers. In this study, a new method for learning the optimal path of robots movement through interaction with the environment is presented. In this method, the user first defines the initial path for the rover and the robot begins to follow the path defined for itself. Along the way, the robot explores the environment and tries to get the right training data and optimize its performance. The purpose of applying reinforcement learning is defined by the cost function. In this study, the cost function is defined to optimize the torque applied to the robot joints. The robot is trying to learn the optimal policy that will get the most rewards from the environment. In this method, the beginning and end positions and midpoints of the movement and time of each piece of the path are determined by the user. The inverse kinematics are calculated and the angles corresponding to the positions in each joint are calculated. Using the cubic spline method, a path is drawn to these points for all joints and these paths are applied to the rover. The path is then calculated by the average torque applied to the joints by the robot and sent as reinforcement learning. The task of reinforcing learning is to modify the rover's motion path by changing the midpoints at a given interval so that the next path applied to the robot has a lower average torque than the previous one. In this method, the optimization process is not separate from the main task of the robot, and after the rover has taken the path, the next route is designed based on the current path bonus. The simulation output graphs show that the proposed method has been able to satisfy the problem constraints well and with high accurately. Since many explorers have been sent to Moon and Mars in recent years, the proposed method can be extended to other planet's explorers.