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Research on Target Detection and Tracking Method of Mobile Robot Based on RGB-D

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Abstract

This subject aims to study the detection and tracking of mobile robots using RGB-D cameras. Because ordinary cameras have difficulty in distance measurement in practical applications, and inaccurate positioning results in poor tracking results, the application of RGB-D cameras in ROS mobile robots has been studied on the problems of target detection and tracking. According to the problems in the actual operation, the deep learning network model is optimized through comparison to improve the accuracy of detection, and finally the tracking strategy is formulated and the tracking test is performed on the mobile robot.

Keywords

RGB-D; Target Detection; Mobile Robot.

1. INTRODUCTION

Robots are the highest technological achievement of multi-disciplinary intersections. They have broad application prospects in navigation and positioning [1], intelligent interaction, unmanned driving [2], disaster rescue and other fields, and have high research value. Since the United States developed the world's first mobile robot AGV in the early 1950s, there has been an upsurge in mobile robot research in the world, which has opened the door to the automation of loading, unloading and handling, and has quickly been applied and applied all over the world. Promotion. Since 2015, mobile AGV robots have maintained a high degree of popularity. E-commerce giants Taobao and JD have already started the layout of intelligent warehousing [3], intelligent three-dimensional warehouses, logistics robots [4], Intelligent distribution has already demonstrated its skills in the logistics industry [5].

Figure 1. Boston "BigDog"

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2. RESEARCH PLAN

First, based on the background and significance of the subject, analyze and summarize the development and status of mobile robots at home and abroad. According to the requirements of the mobile robot tracking system, design specific schemes and build the hardware platform and software platform of the mobile robot tracking system. Then study the imaging model of the RGB-D camera, calibrate the RGB-D camera according to Zhang Zhengyou's [6] calibration algorithm and obtain the calibration results, and conduct test experiments on the mobile robot. Then compare the performance of the deep learning network model, choose a more suitable algorithm model according to the hardware system, and optimize the model. Finally, the target tracking strategy and motion control strategy of the mobile robot were formulated, and the overall function experiment test was carried out:

3. TECHNICAL ROUTE

3.1. Experimental Platform Construction

Design the hardware platform and software platform of the mobile robot tracking system. The hardware includes sensors, data processors and mobile robots. The advantages and disadvantages of the sensors, the performance of the data processors and the driving methods are analyzed in detail; the software system includes the ROS-based system software framework and function realization process.

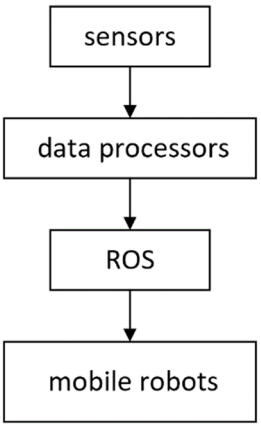

Figure 2. Experiment Process

3.2. RGB-D Camera Imaging Analysis

In order to obtain more accurate ranging accuracy, in-depth study of the RGB-D camera imaging model and analysis and calculation of camera distortion. The RGB-D camera was calibrated according to Zhang Zhengyou's calibration algorithm and the calibration results were obtained. Test experiments were carried out on a mobile robot.

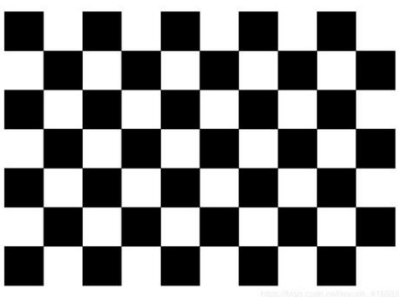

Figure 3. Camera Calibration

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3.3. Target Detection Algorithm Analysis

At present, the research of target detection and tracking algorithms based on convolutional neural networks has made major breakthroughs, but there are still problems of low accuracy and poor timeliness for target recognition. Therefore, this topic compares the performance of the Faster-RCNN [7] and SSD [8] deep learning network models, selects the algorithm model that is more suitable for the hardware system, and transplants the algorithm to the mobile robot for optimization, improvement and experimental testing.

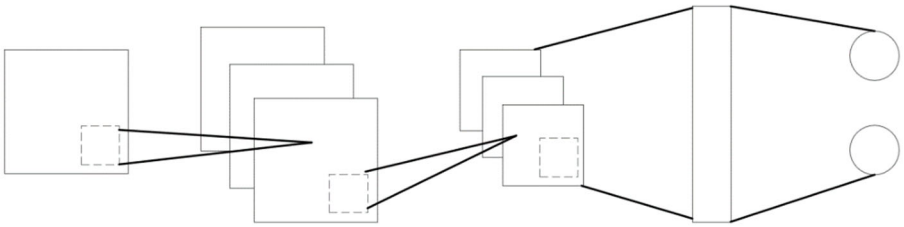

Figure 4. Target Detection Algorithm

3.4. Develop Target Tracking Strategy and Motion Control Strategy

According to whether the mobile robot detects the target and whether it is a single target or multiple targets, different target tracking strategies and motion control strategies are formulated; finally, the realization of the overall function is tested based on the mobile robot target detection and tracking system, which verifies the movement The effectiveness of robot target detection algorithms and the feasibility of tracking motion control strategies.

4. CONCLUSION

Since a single ordinary camera can only complete the task of target detection, it cannot measure the depth information of the target. When we want to obtain the target depth information, we usually use binocular cameras to collect the target information, and the depth information can be obtained through algorithm conversion. This will affect the robot's computing speed and real-time tracking. The use of monocular RGB-D can not only quickly obtain the position information and depth information of the target, but also speed up the operation of the computer and ensure the timeliness of target tracking.

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