Research and Implementation of Robot Path Planning Based on Image Recognition Technology under Computer Background

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Abstract. With the improvement of people's living standards and the continuous development of science and technology, people have higher and higher requirements for the auxiliary system needed in daily life. In recent years, the robot field, as a hot field, is often concerned by people. At the same time, image recognition technology is well known and has been widely used in daily life, and its unique characteristics can provide some help for robot path planning. Therefore, it is very necessary to study the robot path planning based on image recognition technology under the computer background. This study discusses the principle and application of image recognition technology, the current situation of robot path planning and the application of image recognition technology in the research of robot path planning, which provides a certain basis for solving this problem.

Keywords: Robot Path Planning, Image Recognition Technology, Computer

1. Overview of image recognition technology

1.1. The principle of image recognition technology
When humans see something, the brain quickly determines whether it has seen it or something like it. This process is a bit like search, in which humans identify what they see by matching what they see with the same or similar things in their memory. Machine image recognition is similar, by classifying and extracting important features to eliminate redundant information to identify the image [1].

1.2. The development of image recognition technology [2]
In the summer of 1966, Minsky, the father of artificial intelligence, assigned students a summer assignment: they were asked to write a program that asked the computer to tell the operator what it saw through the camera. This is the beginning of the development of image recognition technology.

In the 1970s and 1980s, the emergence of modern electronic computers gave the computer the opportunity to try to answer what it saw. The researchers first drew lessons from the way humans see things. In order for the computer to understand the image it sees, we must first restore the three-dimensional structure of things from the two-dimensional image. Another inspiration is that people think that people can recognize an apple because they already have a priori knowledge: the apple is
red, round and smooth. This is the method of the so-called "prior knowledge base". This method can only extract a few basic features, of course, it is not practical, and can only be used in some optical character recognition, microscopic / aerial image recognition and so on.

In the 1990s, image processing hardware technology has made rapid progress. As a result, computer vision technology has made greater development, and began to be widely used in the industrial field. Therefore, the researchers' new method is to judge things through the recognition of local features and establish a local feature index. In that case, the technology has produced a qualitative leap, that is, although the perspective or observation environment of the computer has changed, the results of the computer can match the actual object more accurately.

In the 21st century, thanks to the huge amount of data and the emergence of digital cameras, computer vision has developed rapidly. Many applications have emerged in this stage, including typical camera face detection. The authoritative platforms for face recognition and face comparison recognition.

After 2010, neural network image recognition is a relatively new image recognition technology at present. For example, the basic processes for neural networks to identify animals in photos and for computers to identify diseased tissues in medical images are as follows:

**Figure 1.** The basic processes for neural networks to identify animals in photos.

**Figure 2.** The basic processes for computers to identify diseased tissues in medical images.
Through the deep neural network, the task accuracy of all kinds of visual recognition has been greatly improved. Now, face recognition can acquire a misjudgement rate of less than 1/1000000. In the final analysis, the principle of machine image recognition is similar to that of human image recognition, and the process is more or less the same. However, with the progress of technology, machines can not only recognize flowers and grass and recognize people like human beings, but also begin to have the ability to recognize people beyond that of human beings.

1.3. Application of image recognition technology

Through the intelligent recognition algorithm based on deep learning, many search engines can automatically identify the internal information of each image. For example, who is the character in the picture, what breed is the puppy in the picture, what kind of scene is in the picture, and so on. Image search and image recognition is not only a subversive search method, but also the technological basis of many emerging technologies. In theory, as long as the pictures that have been made public on the Internet, there are ways to get them by means of map search, and in most cases, Google's map search will be able to meet your needs. There are usually two reasons why you can't search, one is that there are too many search results and there is no real answer you are looking for, and the other is that there are too few search results and insufficient information. The solution is to modify the picture keywords.

Using Google's image search function, Google will make a rough prediction of the picture content and give a keyword related to the picture by default after uploading the picture. But no matter how powerful the computer is, it is not as smart as the human brain, and people can modify the "picture keywords" to get the results we want.

2. Overview of robot path planning

Path planning technology is one of the core contents of floor-sweeping robot research, robot positioning and map construction is to serve for path planning. The so-called robot path planning technology is that the robot plans a safe running route according to the perception of its own sensor to the environment, and completes the task efficiently at the same time. Robot path planning usually needs to solve three problems [3]:

1). It enables the robot to move from the initial position to the target position, which is also the basic goal.

2). Enables the robot to bypass obstacles and make it understand the input characters. In other words, the robot needs to complete the corresponding tasks when it passes through certain points.

3). Optimize the running trajectory as far as possible and reduce the energy loss.

Robot path planning can be divided into two types: 1) point-to-point path planning; 2) complete ergodic path planning.

Point-to-point path planning requires the robot and its algorithm to find an optimal and reasonable path from the starting point to the end point. This optimal route can enable the mobile robot to pass smoothly in the workspace without encountering any obstacles, thus successfully solving the above three problems.

Complete ergodic path planning is a special kind of path planning. This planning method is needed for the movement of a robot in two-dimensional space. This method means that under the premise of satisfying some optimal performance data, the robot can find a suitable route in the set area according to the instructions. This line not only connects the starting point and the end point together, but also passes through as many reachable points as possible.

For example, for floor-sweeping robots, their task is to clean the room. Then the path planning of the sweeping robot belongs to the complete ergodic path planning. The trajectory of the floor-sweeping robot needs to be spread all over the space to the maximum extent, and its path needs to connect all the connectable barrier-free points. The quality of this path can reflect the working quality of the robot. At the same time, the walking route of the sweeping robot should avoid walking repeatedly in the same area, so that the robot can clean the largest area in the shortest time. This judgment reflects the efficiency of the robot.
3. Research on robot path planning based on image recognition technology

At present, various machine learning algorithms are mostly used in robot path planning based on image recognition technology [4].

First of all, from the perspective of robot vision, some corresponding location and recognition methods can be applied. There are many open source location algorithms, such as SIFT and SURF in opencv. There are two common methods: 1) A method based on descriptors. However, if the target has highly repetitive texture or only sparse edge information, the descriptor is basically invalid and cannot be matched. 2) Template matching method: It includes similarity measurement based on grayscale. This method is time-consuming and will be affected by light changes, cluttered environment (clutter) and occlusion, and the result is not very stable [5].

Here are some commonly used algorithms:

(1) Dijkstra algorithm.

It was proposed in 1959. The algorithm adopts a special mode. The algorithm mainly solves the problem of the shortest path from a single node to another node in the graph. The most important feature of this algorithm is that the next node selected in each iteration is the nearest child node of the current node. This makes the algorithm ensure that the distance of each iteration is the shortest. In order to achieve this goal, the path searched in each iteration is the shortest. In each process of the algorithm, the algorithm sorts the shortest paths from the starting node to all the points that can be connected in the current mode. This can effectively prevent the perceptual lag of the algorithm [6].

(2) A* algorithm.

This algorithm belongs to heuristic search algorithm. In other words, the algorithm can establish search rules in the search process. This rule will be used later to measure the distance between the real-time location and the target location. This can make the path search direction under this algorithm move first towards the location of the target point. This is also one of the reasons for the high computational efficiency of this algorithm.

(3) D* algorithm.

This algorithm is a variant of A* algorithm. Anthony Stentz proposed the D* algorithm in 1994. This algorithm is a reverse incremental search algorithm. In other words, contrary to the search direction of other algorithms, the algorithm searches from the target point to the starting point step by step. Moreover, in the search process of the algorithm, the distance measurement information of each node to the surrounding node and the target point will be calculated and updated. If there are obstacles in the dynamic environment, so that the robot can not continue to search along the original planned path, the algorithm will adapt to the situation. D* plans the path of the current node again based on the distance information of each point obtained in the previous step. Compared with other algorithms, the advantage of this algorithm is that it does not need to be completely replanned from the target point. This improves its efficiency.

In the application, Dijkstra algorithm and A* algorithm are usually used in path planning of various games, as well as the path planning of robots and drones to be explored in this study. The D* algorithm is also consistent with the idea of this study, and is often used in the path detection of robots and the path planning of various rovers.

4. Conclusion

At present, when the robot research is in full swing, one of the main ways to improve the practicability and efficiency of the robot is to improve its path planning system. This can make the robot more applicable, so that it can be used in more fields and accepted by more people. As a very promising technology in the age of AI, image recognition technology is naturally applied in the field of robot path planning. Among the many machine learning algorithms, robot path planning mainly uses Dijkstra algorithm, A* algorithm and D* algorithm. Among them, the latter two play a more important role in this field.
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