Research on Digital Image Processing and Recognition Technology of Weeds in Maize Seedling Stage Based on Artificial Intelligence

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Abstract: In today's agricultural development, field weeds can be said to be a strong enemy of agricultural production. In the production of traditional agriculture, herbicides and other related pesticides are mainly used to ensure the normal production of crops, which will cost a lot of manpower, material resources, financial resources and a large number of herbicides, and also cause serious environmental pollution. The development prospect of modern agriculture is precision agriculture. How to realize the sustainable development of agriculture, reduce pollution and achieve the goal of precision weeding in the current era is the difficult problem of agricultural development. Therefore, in this paper, the corn seedling stage as a model, the artificial intelligence technology and other electronic technology are integrated into the agricultural management system, and the weeds in the corn seedling stage are identified by using the weed digital image processing and recognition technology, so as to accurately spray herbicides, so as to achieve the purpose of improving agricultural productivity. Through the analysis, it is found that the method proposed in this paper has important practical significance in the development of digital image processing and recognition technology of maize seedling Weeds Based on artificial intelligence technology.

Keywords: Artificial Intelligence, Agricultural Production, Corn Seedling Stage, Digital Image
1. Introduction

Artificial intelligence [1-2], as a revolutionary general technology with rapid development, is a manifestation of the high development of modern social productivity. It will not only create huge economic benefits, but also bring rich social benefits. Artificial intelligence technology can improve the productivity level and efficiency of the whole society, and help to promote the emergence and development of intelligent economy. Artificial intelligence can not only directly improve labor productivity, but also improve capital utilization rate and capital return rate, and can promote the great change of production mode through intelligence.

The purpose of agricultural research is to minimize the harm to agricultural ecological environment and improve the quality and yield of crops. Precision agriculture is based on this purpose. Intelligent weeding belongs to the category of precision agriculture [3-5]. It mainly refers to the use of machine vision technology to identify weeds and their density distribution in crops and determine the location of crops and weeds. On this basis, appropriate herbicides should be sprayed on weed areas, and no herbicides should be used in non weed areas, so as to reduce the environmental pollution caused by chemical herbicides, improve the yield and quality of crops, and achieve the purpose of automatic weeding. Intelligent weeding [6-8] not only protects the natural environment, but also prevents crop yield reduction. Therefore, the development and application of intelligent weeding technology has important economic and environmental significance to promote the development of agricultural modernization in China.

In this paper, based on the development background of the current era, according to the application of artificial intelligence technology in our daily production and life, a research method based on artificial intelligence in the digital image processing of maize seedling weeds [9-10] recognition technology is proposed. In this paper, the artificial intelligence technology and other electronic technology are integrated into the agricultural management system, and the weed digital image processing and recognition technology is used to accurately identify the weeds in the corn seedling stage, so as to realize the precise weeding at the maize seedling stage, so as to reduce pollution and improve agricultural productivity. Through the analysis, it is found that the method proposed in this paper has important practical significance in the development of digital image processing and recognition technology of maize seedling Weeds Based on artificial intelligence technology.

2. Design of Digital image Processing and Recognition Technology of Weeds in Maize Seedling Stage Based on Artificial Intelligence

2.1 Artificial Intelligence Technology

As a comprehensive interdisciplinary subject, artificial intelligence is closely related to economics, political science, psychology, philosophy, sociology and other fields. Its research direction and application range are very wide. With the development and deepening of technology, new ideas, new designs, new theories and new technologies related to artificial intelligence will gradually increase. Although the research scope of artificial intelligence is very wide, this paper mainly focuses on the development of technology. The capital and manpower in the artificial intelligence era are from the perspective of agricultural science. Therefore, this paper mainly introduces the impact of an important
research and application field on human development, including expert system, computer vision, natural language processing, intelligent robot, artificial neural network, etc.

2.2 Shape Feature Extraction

According to the theory of plant classification, morphological feature is one of the most important and effective features in plant leaf recognition. As long as the shape of the object can be fully reflected, or the difference between objects can be effectively distinguished, and the characteristic parameters can be obtained easily and quickly, it can be used as the shape characteristic parameters of the object. The leaf morphology of maize is different from other weeds, such as spinach, morning glory and cabbage. Therefore, the difference of leaf morphology can be used to identify weeds and crops.

There are 17 species of leaf morphological characteristics. If all the shape features are extracted, the calculation and storage of image processing will be too large and time-consuming. In order to improve the recognition rate, it is necessary to select the shape feature parameters which are easy to obtain, strong discrimination, strong independence and RST invariance (that is, the rotation, scaling and translation changes of the image are constant). Based on the analysis of morphological characteristics of associated weeds in maize field, several representative characteristic parameters were selected and discussed briefly below.

Area $A_r$ is one of the most basic features to describe the region, which is obtained by calculating the total number of pixels inside the object boundary.

$$A_r = \sum_{x=1}^{M} \sum_{y=1}^{N} f(x, y) \quad (1)$$

Perimeter: it is the sum of the distances between the adjacent edge points in the leaf area, and it is also one of the most basic characteristics to describe the region. There are two formulas for perimeter calculation: eight neighborhood distance representation and Euclidean distance representation. In this paper, eight neighborhood distances are used to represent the number of edge pixels in the use region. If the distance of eight neighborhood points is used, the distance $D_k$ of adjacent pixels in the two tilt directions is:

$$D_k(f_{i,j}, f_{m,n}) = \max \{i-m|, j-n| \} = 1 \quad (2)$$

Length: the length of the minimum circumscribed rectangle of the blade, that is, the maximum distance between two points on the contour. Width: the width of the smallest circumscribed rectangle of the blade, that is, the maximum distance between the intersection point of the straight line perpendicular to the long line and the contour. The width and length only have translation invariance; area and perimeter have rotation and translation invariance, but not scale invariance.

3. Experimental Design

Six shape parameters such as rectangularity, elongation, aspect ratio, density, roundness and an invariant moment are extracted. The values of shape characteristic parameters of a group of typical
weeds and maize leaves are shown in Table 1. The results showed that the rectangularity and roundness of the leaves of Chinese cabbage and maize were larger; the first invariant distance of maize leaves was the largest, and the first invariant distance of gray vegetable leaves was the smallest; the leaf density in the field was the largest, and the roundness was the smallest; the leaf elongation length of spinach and maize was larger than that of other varieties; the leaf width length ratio of cabbage was the largest, and that of maize was the smallest. Although these six single types of shape feature parameters can be used to distinguish crops and weeds, there are some factors in the actual field environment, such as uneven illumination, overlapping leaves and occlusion, which will lead to inaccurate extraction of feature parameters and increase recognition errors. Therefore, considering the further combination of other characteristic parameters of plant leaves to identify.

Table 1. Shape characteristic values of blade

| parameter          | R     | E     | Kcb   | Dr    | Co    | Hu1   |
|--------------------|-------|-------|-------|-------|-------|-------|
| Cephalanoplos segetum | 0.6531 | 0.5623 | 0.2354 | 42.6554 | 0.3215 | 0.2654 |
| fat hen            | 0.7456 | 0.0264 | 0.9654 | 26.3256 | 0.4659 | 0.1756 |
| Convolvulus tinctorius | 0.3564 | 0.4653 | 0.5321 | 78.3654 | 0.1954 | 0.2865 |
| Corn               | 0.7865 | 0.7654 | 0.2132 | 44.3256 | 0.3211 | 0.5642 |

4. Discussion

4.1 Analysis of Digital Image Processing and Recognition Technology of Weeds in Maize Seedling Stage Based on Artificial Intelligence

The weed recognition algorithm is transplanted to the hardware platform and can run normally after debugging. In order to determine whether the execution speed of the program can meet the real-time requirements, it is necessary to test the performance of the program. The performance analysis function summary clock of CCS is used to test the time consumption of each part of the algorithm. The test results are shown in Figure 1:
The test results show that the image preprocessing part of the algorithm takes the most time, accounting for about 43% of the total time, followed by the feature optimization part, accounting for about 21%. Therefore, these two parts need to be optimized. In this paper, combined with the characteristics of CCS and DM642 hardware development platform, the code level and platform level optimization methods are used to optimize the relevant algorithms of DSP platform, so as to further improve the performance.

DS fusion rule is a rule reflecting the interaction of evidence. Several reliability functions are given based on different evidences in the same recognition framework. If these batches of evidence are not completely contradictory, then the reliability function can be calculated. By using combination rules, the reliability function can be used as the reliability function under the joint action of these batches of evidence.

**Figure 1.** Time consumption ratio of each module
Weed crowding is beneficial to the growth of farmland crops. In view of the environmental pollution caused by the large-scale spraying of chemical herbicides in China, the identification of maize and weeds at seedling stage in the field is studied based on digital image processing and pattern recognition technology, which is of great significance to realize variable spraying of herbicides, reduce costs and protect the ecological environment. In this paper, on the basis of summarizing the related research at home and abroad, the image segmentation and target recognition under the natural light conditions in the field were studied, and the feasibility of developing the field weed real-time research system was studied.

The purpose of agricultural research is to minimize the harm to agricultural ecological environment and improve the quality and yield of crops. Precision agriculture is based on this purpose. Intelligent weeding belongs to the category of precision agriculture. It mainly refers to the use of machine vision technology to identify weeds and their density distribution in crops and determine the location of crops and weeds. In order to reduce the environmental pollution caused by chemical herbicides and improve the yield and quality of crops, appropriate herbicides should be sprayed in weed areas and no
herbicides should be sprayed in weed free areas. Intelligent weeding not only protects the natural environment, but also does not reduce crop yield. That is to say, if the operator knows where there are weeds and where there are no weeds, then when spraying pesticides, they will spray herbicides in the places with weeds, and do not spray where there are no weeds. This not only saves the cost, reduces the investment, but also reduces the pollution to the agricultural ecological environment, which is conducive to the sustainable development of agriculture, which is also an obvious trend in the development of precision agriculture. In order to reduce the harm degree of weeds, protect the ecological environment from pollution; improve the quality and yield of products, as soon as possible to realize the automation and scientific control of weeds has become a very practical topic. Therefore, the development and application of intelligent weeding technology has important economic and environmental significance to promote the development of agricultural modernization in China.

5. Conclusions

This paper mainly studies the digital image processing and recognition technology of weeds in Maize Seedling Stage Based on artificial intelligence. In the current development environment, artificial intelligence technology has been widely used in our daily life. Therefore, the application of artificial intelligence technology in various industries and fields of our life is the trend of the current era. In order to better develop agricultural production and improve the level of agricultural production technology, this paper introduces artificial intelligence technology into agricultural development, so as to better carry out accurate development of agriculture. At present, the development prospect of agriculture is precision agriculture. Therefore, the weeds in maize seedling stage can be identified by using weed digital image processing and recognition technology, so as to accurately spray herbicides, so as to achieve the purpose of improving agricultural productivity. Through the analysis, it is found that the method proposed in this paper has important practical significance in the development of digital image processing and recognition technology of maize seedling Weeds Based on artificial intelligence technology.

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