Study on Image Preprocessing of Soybean Moisture Content Measurement

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Abstract: Image preprocessing method in this paper, the water content of soybean in image detection is studied, using gaussian filtering, average filtering, filtering, median filtering the box on the image pretreatment, after calculating the SURF feature vector by approximate BBF search algorithm to determine each of the feature points of two adjacent near distance determination of feature points, then the feature points matching, don't use MatLab and OpenCv3 above pretreatment method was tested the experimental results show that the different images and processing methods to reduce the number of matching points, improve the efficiency and accuracy of matching has a great influence.

1. Introduction

In the significance analysis of soybean water content, the image is preprocessed first, and the good effect of image preprocessing will directly affect the subsequent image processing and analysis. Image filtering refers to the suppression of the noise of the target image under the condition of retaining the detailed features of the image as much as possible, which is indispensable for image preprocessing. The good processing effect will also directly affect the effectiveness and reliability of subsequent image processing and analysis.

Mathematical morphology (Mathematical morphology) is a based on lattice theory and topology of the image analysis, Mathematical morphology is the basic computing including: binary corrosion and expansion, open and close operation, the skeleton extraction, limit corrosion, hit hit miss transform, morphological gradient, the TOP - hat deformation, grain size analysis and watershed transform, grey value of corrosion and expansion, grey value open and close operation, grey morphological gradient, etc.

2. Image Processing of Soybean Moisture Content

There are many methods for processing soybean water content images. The basic idea is that after image preprocessing, SURF feature vectors are extracted, and k-d tree approximate BBF search algorithm is used to determine the distance between two similar feature points of each feature point for feature point matching [1]. The basic process based on SURF feature matching is shown in the figure. We preprocessed the image, extracted the feature points of the image, determined the distance between the feature points of two adjacent forests of each feature point through k-d tree approximate BBF search algorithm, and finally matched the feature points.

3. Image Preprocessing

There are many preprocessing methods for soybean water content image, such as box Blur, mean Blur, Gaussian Blur, Median Blur and bilateral Filter. Box Blur, mean Blur, Gaussian Blur are linear, Median Blur and bilateral Filter are nonlinear. In addition to the above common morphology filters, morphology mainly studies morphology and structure of plants and animals.

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4. Neighborhood Operator and Linear Neighborhood Filtering

Neighborhood operator is an operator that determines the final output value of sub-pixel by using the pixel value around a given pixel. And linear neighborhood filter is a common neighborhood operator, the output value of pixel depends on the weighted sum of input pixels.

Table 1 f(x, y)

45	60	98	127	132	133	137	133
43	71	82	106	123	125	131	132
47	70	86	104	123	128	134	126
46	68	88	98	121	125	128	135
53	67	83	101	119	122	124	135
49	70	81	97	112	118	126	131
53	62	70	85	101	116	122	132
50	59	66	73	89	103	110	121

Table 2 h(x, y)

0.1	0.1	0.1
0.1	0.2	0.1
0.1	0.1	0.1

Table 3 y(i, j)

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As shown in the figure, the output pixel $y(i,j)$ of linear filtering is the weighted sum of the input pixel $f(i+k,j+I)$values.

$$y(i,j) = \sum_{k,I} f(i+k,j+I)h(k,I) \quad (1)$$

Where, h (k,I), which we call the "core", is the weighted coefficient of the filter, namely the "filter coefficient" of the filter.

5. Gaussian Filtering

Gaussian filter can remove the gaussian noise, widely used in image processing, the noise reduction process of gaussian filter is a process to the weighted average of the whole image, each pixel value, is the other pixels in the field of itself and, after a weighted average of the gaussian filtering concrete operation is: use a mask to scan each pixel in the image, with a mask to determine the weighted average grey value of pixels in neighborhood to replace template center pixel value.

The gaussian blur process of image is the convolution of image with normal distribution, and the convolution of image with circular box blur will produce more accurate out-of-focus imaging effect. Since the Fourier transform of the gaussian function is another gaussian function, gaussian blur is a low-pass filtering operation for the image. The one-dimensional zero-mean gaussian function is as follows.

$$G(x) = \exp(\frac{-x^2}{2sigma^2}) \quad (2)$$

Among them, the gaussian distribution parameter sigma determines the width of the gaussian

function. For image processing, the commonly used two-dimensional gaussian function is as follows:

$$G_0(x,y) = Ae^{\frac{-(x-u_x)^2}{2\sigma_x^2}+\frac{-(x-u_y)^2}{2\sigma_y^2}} \quad (3)$$

6. Mean Filtering and Square Filtering

In simple image smoothing, the algorithm USES convolution template to process each pixel in the image one by one, which can be visually compared to filtering and finishing the pixels of the original image one by one. In image processing, the algorithm process of processing neighborhood pixels one by one is called filter. The working principle of smooth linear filter is to use the template to carry out weighted average of pixel gray in the neighborhood, also known as the mean filter. Square filtering and mean filtering kernel are basically the same, the difference is the need for homogenization. So h(k,I), if I homogenize it.

7. SURF Feature Vector Extraction

The basic idea of SURF feature matching algorithm is that after SURF feature vectors were obtained, the approximate BBF search algorithm was used to determine two adjacent feature points of each feature point for distance determination, and then feature point matching was conducted []. SURF feature descriptors generate feature vectors. First, the integral image should be obtained, and each pixel point of the original image should be scanned. Within a certain scale space, Hessian detector is used to verify whether the extracted feature points are extreme points []. If they are maxima, they will be retained as candidate feature points, otherwise excluded. A window region is formed to extract feature vectors to determine the principal directions of all feature points. SURF feature vectors are obtained through four processes: obtaining integral images, detecting feature points, constructing scale space and generating SURF feature descriptors.

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9. Conclusion

In this paper, an image preprocessing method, including gaussian filtering, mean filtering, box filtering and median filtering, was proposed for the detection of soybean sweat content. SURF feature vector extraction was also introduced.

Don't above using MatLab and OpenCv3 pretreatment methods were tested, in two groups of test results, logarithmic matching point decreases, but effectively eliminating the mismatching points to improve the accuracy of the match, improved matching algorithm used by running time is shorter, the matching efficiency is higher, the experimental results show that the improved algorithm effectively reduces the number of false matching points, improve the efficiency and accuracy of matching.

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