1. Construct a 3-pixel × 3-pixel window and calculate the sum of squares C of the difference between the neighboring pixel value and the center pixel value in the window, denoted by

$$C = \sum_{P=1}^{8}\left(g_p - g_{i,j}\right)^2, \quad (1)$$

where: is the neighborhood pixel value; , is the center pixel value.

2. Set the limit value of C as W, judge the size of C and W. If C ≤ W, select the center pixel value as the threshold value and calculate the LBP value, i. e., use Equation (1) to calculate the LBP value; when C > W, select the median of the 9 pixel values as the threshold value and calculate the LBP value, expressed as

$$LBP(x_i, y_i) = \sum_{p=1}^{p} s(x)2^{p-1} s(x) = \begin{cases} 1, g_p - g_M \geq 0 \\ 0, g_p - g_M \langle 0 \end{cases} \quad (2)$$

where: is the neighboring pixel point; is the neighboring point pixel value; is the median of 9 pixel values; is the binary function, LBP is better robust to local area illumination, and after many experiments, the recognition rate is higher when W is 200.

3. Calculate the LBP value in step.

4. To get the LBP feature image.

5. Count the number of times the LBP value appears, and get the LBP histogram.

Comparative verification of the LBP algorithm before and after the improvement is performed using the Yale face database.The Yale face database has 15 people with 11 images each, and the image size is 100×100 pixels.The experiments change the number of each person in the training samples (from 3 to 10), and the rest are used as the test samples to compare the recognition of the LBP algorithm before and after the improvement.

УДК 338

RESEARCH AND APPLICATION OF MICROWAVE MOISTURE SENSOR INFORMATION COLLECTION SYSTEM

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Summary. *Methods for determining moisture content can be divided into two types: direct measurement and indirect measurement. Among indirect measurements, nuclear magnetic resonance, infrared radiation and radio waves are the most commonly used measurement methods. At microwave frequencies, moisture will be polarized and oscillate, and the transmitted microwaves will be scattered, projected, reflected, etc. Therefore, the moisture content of crops such as grain can be determined from measured parameters.*

Destructive methods are used to detect grain moisture content because the main body of grain must be physically crushed or the organic composition of the crop itself must be changed during the detection process. The method of non-

destructive detection of crop water content is to measure crop water content by detecting some characteristic parameters closely related to water content without destroying its own structure, and the speed is faster.[1]

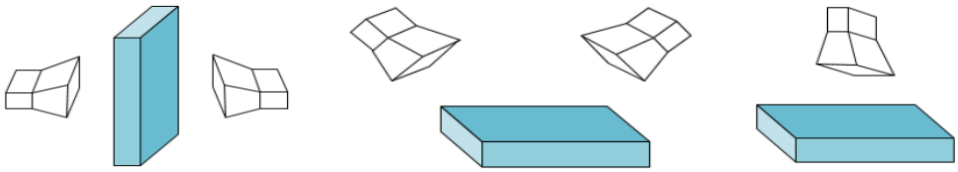
The microwave method uses characteristics such as voltage attenuation and phase changes caused by microwaves penetrating the object to be measured to measure the moisture content of crops. Crops with different moisture contents have specific microwave losses and phase offsets. The functional relationship between the dielectric constant and crop parameters is related, and related parameters such as frequency, phase, voltage, and energy before and after microwave penetration are analyzed, so as to By calculating the dielectric constant of the crop, the moisture content of the object to be measured can be obtained. Microwave detection is more accurate, can perform real-time non-destructive testing, and has high stability. It can carry out repeatable experiments and other advantages, but some measuring instruments are more expensive.

The dielectric constant of dry grains is generally 2.5~4.5. Compared with the dielectric constants of proteins, starches and other substances in grains, the dielectric constant of water is 78.5. Therefore, there is a huge difference in the dielectric constants of water and other substances in grains. The radio frequency dielectric method makes it relatively easy to measure the moisture content of grains. The dielectric properties of grains are also used in other aspects of agriculture, such as preservation and freezing of fresh corn, dielectric sorting of seeds, and quality identification of fruits and vegetables.

The dielectric property of grain is the interaction between the external electric field and grain. The complex dielectric constant $\varepsilon = \varepsilon' - j\varepsilon''$ is often used to describe the dielectric property of grain, where $\varepsilon'$is the dielectric constant, ε'' is the dielectric loss factor, and j is the imaginary unit. ε' reflects the grain's ability to store and polarize energy in an external electric field, ε'' reflects the grain's ability to consume energy in an electric field, under the action of an electric field, the polar molecules in the grain will rub and collide with each other.” The heat consumption of grain becomes the medium loss factor. The dielectric constant ε' and dielectric loss factor ε'' have nothing to do with the shape of grain, but only the composition of grain.

With the emergence of impedance analyzers and network analyzers, the measurement methods of grain dielectric constant are becoming more and more diverse, and the detection results are becoming more accurate. The dielectric constant measurement methods selected are also different depending on the requirements such as the range of measurement frequency, accuracy of results, temperature of the working environment, and the shape and size of the grain to be measured.

Methods for detecting grain moisture content based on microwaves can be divided into resonant cavity detection methods, transmission/reflection detection methods and free space detection methods.



a *b* *c*

Figure 1 – System diagram of sample measured by free space method: *a* – transmission method; *b* – double antenna reflection method; *c* – single antenna reflection method

The free space method is a special case of transmission and reflection. Divided into transmission method and reflection method, as shown in fig. 2.

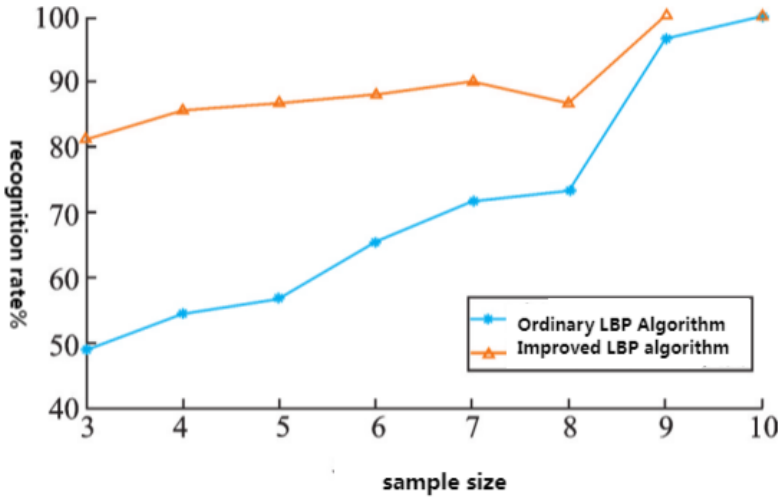


Figure 2 – Recognition rate of LBP algorithm before and after improvement of Yale face library

This article proposes an improved LBP algorithm based on the traditional LBP algorithm. After the above test analysis, the improved LBP algorithm can improve the speed of face recognition and has certain practical value.

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IMAGE RECOGNITION SYSTEM BASED ON CONVOLUTIONAL NEURAL NETWORK

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Summary. *In recent years, image recognition technology has been widely used in civil, military, scientific research and other fields. Convolutional neural network has the advantages of automatic feature extraction, hierarchical structure, spatial*