ISSN 2616-7433 Vol. 2, Issue 10: 58-61, DOI: 10.25236/FSST.2020.021014

Prediction Model Analysis of Rice Leaf Color and SPAD Value Based on Computer Vision

LIU Wang-qin

Nanchang Normal University, Nanchang, China

ABSTRACT. *In order to better observe rice leaf color, and predict SPAD value, this paper will be based on computer vision analysis, analysis will elaborate computer vision technology, and then design computer vision observation scheme and SPAD value prediction model, through the scheme and model to obtain rice leaf color, predict SPAD value. The results can be used in the field of rice planting and provide support for rice planting technology.*

KEYWORDS: *Computer vision, Rice leaf color, SPAD value prediction*

1. Introduction

In Botany, plant leaves mainly have two functions: photosynthesis and transpiration, and Photosynthesis and transpiration are inevitable phenomena when plants grow. Otherwise, plants cannot grow. Therefore, the two phenomena are closely related to plant production, which is the same in rice. If we can observe the photosynthesis and transpiration performance of rice from the rice leaves, we can make a standard Correct judgment. However, limited by the technical level in the early stage of China, it was not very good to accurately observe and predict the leaves and SPAD values of rice and other plants. Therefore, it was difficult to judge the growth of plants under photosynthesis and transpiration. Under the developed level of modern computer technology, we can use computers to observe. This observation form represents computer vision and successfully solves the above problems It is of practical significance to study this problem.

2. Concept of Computer Vision Technology

Computer vision is a kind of computer technology that uses computer function to simulate human vision, and then uses the simulated vision to observe the image of things, and extracts information according to the observation results[1]. The results of this technology can provide good support for some research, and the results are often difficult for human to obtain by naked eyes, so computer vision technology has a higher level Application value of. Computer vision technology has been widely used for a long time. With the development of technology, modern computational vision technology has been successfully systematized. There is a clear system framework, that is, the system framework is mainly composed of light source, optical system, image capture function, image digitization module, digital image processing module, etc., and some advanced system frameworks also integrate intelligent technology Technology and automatic control technology, to a certain extent, can replace the manual recognition of image information, and make some judgments and decisions on the objective perspective, but also can automatically execute instructions. Thus, with the help of computer vision, the artificial becomes a manager or observer, almost no need to operate manually, as long as the computer vision technology system parameters are correct. In addition, the concepts related to computer vision technology include color model and image gray, and the specific contents are as follows.

(1) Color model

As we all know, there are different colors. This difference is called chromaticity difference. According to the color depth, we can make an accurate judgment. Therefore, the theory of chromaticity difference is widely used in the scope of scientific research. However, scientific research is very rigorous. If we only rely on dark and light colors to carry out research, it is obviously too general. At this time, we need to have an objective and detailed This concept is not only a color model, but also an accurate concept. Scientific research shows that color is electromagnetic wave with different frequencies, which can send signals to brain and nerve through human vision, so that people can distinguish color depth. Combining with this concept, a variety of color models have emerged, such as RGB, his, HS, etc. among them, RGB is widely used in computer vision observation, and color depth can be expressed by digital way In this way, the preciseness of scientific research is satisfied, and the

ISSN 2616-7433 Vol. 2, Issue 10: 58-61, DOI: 10.25236/FSST.2020.021014

reliability and accuracy of research results are ensured[2].

(2) Image grayscale

Image gray is the key factor to realize the digital display of color chromaticity difference based on color model. It mainly deals with the gray level of color image to make the color image gray, but retains the brightness brought by different color chroma. The greater the brightness is, the lighter the color is. Otherwise, on the contrary, people can accurately read the value. For example, in RGB color model, the color of all pixels in the image is determined by three components: R, G and B. each component has 255 median values, which indicates that the color range of each pixel is 255 * 255 * 255 ≈ 16 million. Within this range, the change of chromaticity difference has digital embodiment[3].

3. Computer Vision Observation Scheme Design and SPAD Value Prediction Model Construction

Combined with the concept of computer vision, the following will describe the computer vision observation scheme design and SPAD value prediction model construction method, the system is consistent with the prediction logic of rice production situation, so the application is effective.

3.1 Computer Vision Observation Scheme

In this paper, the computer vision observation scheme consists of three steps, namely, the construction of visual system, the method of leaf color acquisition, and SPAD data acquisition and processing.

(1) Construction of vision system

The construction steps of vision system are divided into three parts, namely hardware construction, software construction and parameter setting: ① in hardware construction, relevant hardware equipment is selected to achieve the purpose of construction. See Table 1 and figure 1 for hardware equipment and construction structure. In addition, considering that the observation of rice leaves under computer vision will be affected by light, the light source is carefully selected. The purpose of this is not only for lighting, but also for highlighting the characteristics of leaves, so as to facilitate the observation quality. In this paper, three primary color fluorescent lamp with color temperature of 6400k and color rendering index of > 90 is selected as cold light source[4]; ② In the software construction, this paper is mainly based on MATLAB R2006 (a kind of digital image analysis system for crop observation), which uses the functions of digital image input, image preprocessing, color eigenvalue extraction to support the observation work; ③ in parameter setting, the parameters of hardware image acquisition equipment (i.e. camera) are adjusted, and the adjustment scheme is shown in Table 2.

Table 1 Equipment Details In Hardware Construction of Vision System

Project	Type
Light box	-
Pan-Tilt	-
Ring fluorescent lamp	-
Digital camera	CCD
Computer	(HPPentiuln4,Memory is512M)

Table 2 Parameter Setting Of Hardware Image Acquisition Equipment of Vision System

Parameter item	Parameter
Photo format	JEPG
File size	1024*768
Time of exposure	1/100s
F value	4/F
Focal length	6mm

ISSN 2616-7433 Vol. 2, Issue 10: 58-61, DOI: 10.25236/FSST.2020.021014

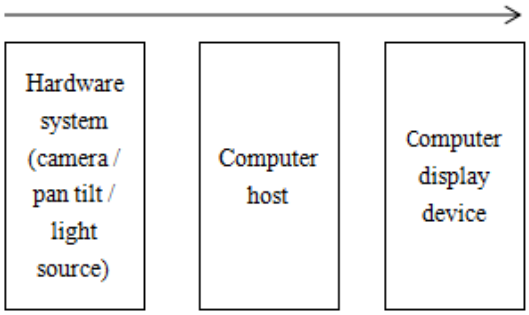

Fig.1 Hardware Device Construction Structure

(2) Leaf color acquisition method

Rice leaves can be observed on the basis of vision system. However, in order to ensure the accuracy of image acquisition and observation results, certain methods should be used for manipulation. The specific method is divided into three steps: ① select color eigenvalues, that is, select 10 color eigenvalues based on RGB color model, and select rice leaves with no abnormal surface The leaf is put into the hardware system for photographing and measuring to obtain the SPAD value of the leaf. CMV is used to extract the value in the color chromaticity difference space of each leaf, and the extracted result is the color eigenvalue. Then the SPAD value and the color eigenvalue are analyzed by variance, and the 10 highest values can be selected from all the color eigenvalues. ② the shooting time is controlled because the computer is used The observation of rice leaves by visual technology is a process of manipulation under a unified standard. Therefore, due to the limitation of the unified standard, the shooting time can not be allowed at will. If the time is too long or too short, it will lead to shooting quality problems, which is not conducive to the follow-up research. It shows that the shooting time should be reasonably controlled in the acquisition process. Considering the illumination of the external environment, it is generally recommended to take pictures for about 3 hours in the daytime on sunny days. The shooting results will be sent to the computer host through the hardware system, and then sent to the computer display device through the host computer for R, G, B color feature extraction processing; ③ shooting point control, wrong shooting point will often lead to image color observation in rice leaves Therefore, it is necessary to control the shooting point. On this basis, it is suggested that two shooting points should be selected in the shooting, that is, the complete image shooting point, which can obtain the whole image of rice leaves, including the positive and negative sides of leaves. Such images are processed in the color feature extraction, and the mean value can be selected to make judgment. The local unified shooting point is mainly aimed at the same part of all rice leaves. The captured image represents the color of the leaf on this part, which can play a supporting role in the prediction of SPAD value. However, it is worth noting that because the shooting range of the local unified shooting point is small, and the color performance of different rice leaves on the same part is also different The purpose of this method is to select the position with the most stable color for shooting, so as to facilitate the prediction of SPAD value.

(3) SPAD data acquisition and processing

The above steps only obtained the leaf color, but still did not get the SPAD value of the leaf, so we need to use the relevant data acquisition methods and processing methods to determine. First of all, SPAD instrument is mainly used for data acquisition, that is, the instrument can emit LED light source, the wavelength of light source and the intensity of emission light are enough to penetrate the leaves to obtain the chlorophyll situation of leaves. The purpose can be achieved by measuring. All the collected information will be sent to the computer host and computer display system for analysis. Secondly, the processing method is mainly used White balance gray card to control the color, to achieve the purpose of image gray processing, that is, red, green, blue three primary colors represented by RGB can be mixed into gray white through white balance. This kind of image will restore the original color under the condition of getting illumination, and the restoration accuracy is very high.

3.2 Spad Value Prediction Model Construction

According to the above computer vision observation scheme, the color characteristics and SPAD value of rice leaves can be obtained. However, to predict the growth of rice through the obtained information, it is necessary

ISSN 2616-7433 Vol. 2, Issue 10: 58-61, DOI: 10.25236/FSST.2020.021014

to build a SPAD value prediction model. The model is mainly based on the color characteristics of rice leaves to determine the SPAD value of leaves, to know the chlorophyll content in leaves, and to know the nitrogen nutrition status of leaves according to the chlorophyll content The SPAD prediction model is mainly used in the step of "predicting leaf nitrogen nutrition according to chlorophyll content". The construction method of SPAD value prediction model is relatively simple, and the relevant values can be replaced by regression equation. For this, on the basis of RGB model, the regression equation in SPAD value prediction model construction is given below, see formula (1).

Formula (1): $y = x + R$

Where y represents SPAD value, X represents color characteristic value, and R represents color attribute. The formula can be applied to the prediction of SPAD value of RBG model, and can be used to predict the color characteristic value of R-B and g-b.

4. Conclusion

In conclusion, this paper analyzed the concept of computer vision technology, and then proposed the construction of rice leaf color eigenvalue observation scheme and SPAD value prediction model design method under computer vision. Through the observation scheme of rice leaf color characteristic value and SPAD value prediction model in this paper, the computer vision system can be used to obtain the relevant images and carry out measurement. The measurement results can display the color eigenvalues and SPAD values based on RBG color model, and then combined with regression equation, it can play a role in rice production prediction.

References

[1] Qiang W, Lei X,Yanna R, et al (2012). Determination of tobacco leaf maturity degree based on computer vision technology[J]. Nongye Gongcheng Xuebao/Transactions of the Chinese Society of Agricultural Engineering, vol.28, no.4, pp.175-179.

[2] Wang Y, Wang D, Zhang G, et al (2012). Digital camera-based image segmentation of rice canopy and diagnosis of nitrogen nutrition [J].Transactions of the Chinese Society of Agricultural Engineering, vol. 28, no.17, pp.131-136.

[3] None (2014). A Review of Optical Methods for Assessing Nitrogen Contents During Rice Growth [J].Applied Engineering in Agriculture, vol.30, no.4, pp.657-669.

[4] Cavallo D P, Cefola M, Pace B, et al (2017). Contactless and non-destructive chlorophyll content prediction by random forest regression: A case study on fresh-cut rocket leaves[J].Computers and electronics in agriculture, no.140, pp.303-310.