DESIGN OF RICE REGIONAL TEST INFORMATION COLLECTION SYSTEM BASED ON CLOUD COMPUTING
/
基于云计算的水稻区域试验信息采集系统设计

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ABSTRACT
This paper combines the image processing and analysis technology of artificial intelligence to realize the function of farmland data acquisition and analysis. The data acquisition function is completed by different types of sensors. The collected information can be divided into two categories: meteorological information and image and GPS information. Based on cloud computing technology, an information collection system for rice regional experiment was established. The information collected by the sensor was analysed by cloud computing technology, which provided a basis for agronomic operation and result evaluation of regional experiment. The test results show that there is no significant difference between the rice data collected by cloud computing and the manually collected rice data. It can replace the manually collected rice information, reduce labour costs and improve experimental quality. Regional test of crop varieties is an intermediate link in the breeding and popularization of new varieties, and the results of regional test are the main basis for the approval of crop varieties. With the popularization and application of network, it brings opportunities for the networking of regional test management, statistics and variety evaluation. At the same time, with the help of network function, it can realize the online transmission of data, solve the delay problem of regional test results, and query the statistical analysis and evaluation results of regional test at any time.

摘要
本文结合人工智能的图像处理与分析技术，实现了农田数据采集与分析的功能。数据采集功能由不同类型的传感器完成，采集的信息可分为两类，一类是气象信息，另一类是图像和 GPS 信息。基于云计算技术，建立了水稻区域试验信息采集系统，利用云计算技术对传感器采集到的信息进行分析，为区域试验的农艺操作和结果评价提供依据。测试结果表明，云计算采集的大米数据与人工采集的大米数据没有明显差异，可以替代人工采集的大米信息，降低人工成本，提高实验质量。农作物品种区域试验是新品种选育和推广的中间环节，区域试验结果是农作物品种审定的主要依据。随着网络的普及和应用，给区域试验管理、统计和品种评价网络化带来了机遇。同时，借助网络功能，可以实现数据的在线传输，解决区域测试结果的延时问题，随时查询区域测试的统计分析和评价结果。

INTRODUCTION
The crop regional test is to plant the tested varieties in different locations for many years, investigate agronomic characteristics and measure the yield to evaluate their adaptability and high yield under large-scale planting conditions *(Wakhare P B. et al., 2020)*. Crop regional trials provide important scientific basis for variety approval and are an important link between crop breeding and variety promotion and application. It has always been highly valued by breeding companies, scientific research units and agricultural management departments *(Elena G. et al., 2021)*. Intelligent agriculture provides a reliable way for the future development of agriculture. Smart agriculture adopts cutting-edge science and technology, realizes accurate agricultural sowing, reasonable irrigation and spraying of water, fertilizer and pesticides, and makes agricultural production with low consumption and high efficiency, high quality and high yield of agricultural products. According to the provisions of the Seed Law, before new varieties are approved and applied to production, they must go through regional tests *(Hua X. et al., 2021)*. The regional test of crop varieties is a multi-site joint test organized by the administrative department of agriculture and carried out within a certain ecological area. It includes two parts: multi-site test and production test. The regional test of rice is a new variety of rice from selection to promotion.

The indispensable intermediate test, through the identification of the high yield, adaptability, stress resistance and quality of the new variety, provides a scientific basis for the variety certification and promotion *(Wen Y. et al., 2020)*. Rice regional test is an experimental process to correctly identify the production traits and adaptation range of new rice varieties (combinations) and provide the basis for the popularization and application of varieties. The test must be carried out in multiple years and places *(Huang S. et al., 2020)*.

It is difficult for general varieties to adapt to all test sites, and some excellent varieties will be eliminated due to poor performance at individual test sites. At present, affected by some subjective and objective factors, there are also some problems in the process of regional trials of crops, which will affect the quality and effect of the trials *(Raskin P. D., et al., 2010)*. Precision agriculture systems generally consist of different systems such as global positioning systems, information collection systems, remote sensing monitoring systems, geographic information systems, expert systems, intelligent agricultural machinery systems, environmental monitoring systems, and network management systems *(Liu F. et al., 2020)*. Therefore, we use ASP as the technical support of the foreground service and the technology provided by the database system Access as the background data management to establish a network management information system suitable for regional trials of rice varieties *(Wu Q. L. et al., 2018)*. The main characteristic of precision planting is to fully consider the spatial differences of farmland characteristics and implement different management measures for crops according to the spatial differences of farmland properties, such as variable fertilization, variable irrigation, etc., in order to obtain maximum economic benefits and produce minimum environmental pollution *(Siahaan P. et al., 2020)*. Because the selection and application of fine varieties play a huge role in the world's agricultural production, governments and seed companies all over the world attach great importance to the regional testing and approval of crop varieties, and many countries have already implemented the approval system of crop varieties *(Yu L. et al., 2020)*. Regional experiment, according to the characteristics of the variety, develop appropriate cultivation techniques to promote the popularization and application of the variety *(Na Q et al., 2020)*. Based on cloud computing technology, this paper established an information collection system of rice regional experiment, and analysed the information collected by sensors by using cloud computing, which provided basis for agronomic operation and result evaluation of regional experiment *(Zhu H. et al., 2020)*.

The application of new technology methods is the development trend of modern intelligent agriculture, and it is also an inevitable choice to solve the problems faced by crop regional experiments *(Lee P. U. et al., 2018)*. Driven by artificial intelligence technology and combined with automatic collection, analysis and processing technology of artificial intelligence machine, researchers realize the real-time collection, analysis and processing of farmland information. At the same time, according to the analysis results, the operation of the corresponding intelligent equipment is controlled to improve the growth environment of crops, save manpower and material resources while increasing the yield of crops, and realize the intelligent, efficient and sustainable development of agriculture *(Uga Y. et al., 2021)*. The main tasks of regional trials of crop varieties can be summarized as follows: scientifically evaluate the high-yield, stable-yield, stress-resistance and other major economic characters of the tested varieties, and clarify the popularization value, adaptation range and supporting high-quality and high-yield cultivation techniques of new varieties, so as to provide the main basis for variety approval and regional layout of improved varieties *(Zhao L. et al., 2020)*. Therefore, it is very important to do a good job in regional trials of varieties. In the process of implementing precision agriculture, firstly, the parameters related to crop growth must be obtained through automated agricultural machinery, and then the variable operation diagram can be obtained through computer system analysis according to crop demand, and then the intelligent agricultural machinery can operate to realize variable management of agricultural production. There is no obvious difference between the rice data collected by cloud computing and the manual survey results, which can replace the manual collection of rice information, reduce labour costs and improve the quality of experiments. With the popularization and application of the network, opportunities are brought to the network of regional test management, statistics and variety evaluation. At the same time, with the help of network functions, it can realize online data transmission, solve the problem of delay in regional test results, and can query the statistical analysis and evaluation results of regional test at any time.

Literature points out that the combination of Internet and agriculture is an innovative way of agricultural production, sales and management, which has a great impact on various links of different industrial chains, such as agricultural production, operation, management and service, through real-time, internet of things and intelligent means, and also provides a brand-new power source for the development process of traditional agriculture transforming to modernization.

With the continuous improvement of national requirements for regional test, more and more regional test stations with perfect facilities have established regional test stations, which not only meet the planting and normal growth of crops, but also need to carry out growth period investigation, fertilization and irrigation, pest and bird control and harvest yield measurement, etc. The content of the experimental research in the literature can fully reflect the characteristics of local natural conditions and economic conditions, can solve the key problems in production practice, and can meet the requirements of short-term or long-term production technology development. Literature shows that when setting up pilots, it is necessary to consider not only the economic effectiveness of the number of pilots, but also the representativeness of their ecological conditions. The test site must be representative, and the soil conditions and climate environment of the test site must be typical of the pilot site to facilitate the correct evaluation and utilization of the test results. Literature shows that due to the limitation of test conditions or the influence of human factors, observation and measurement are uncertain, the true value is usually difficult to obtain, and the test error is inevitable in general. In the same pilot, the principle of taking the variety as the only difference should be strictly implemented, and the field operation and cultivation management should be absolutely consistent. Literature shows that adopting appropriate and scientific experimental design can effectively control the experimental error caused by the difference of soil fertility among different regions, but it cannot control the experimental error caused by the difference of soil fertility within different regions. Therefore, fields with uniform soil fertility should be selected as far as possible, which is the most effective means to control the test error caused by the difference of soil fertility.

MATERIALS AND METHODS

Operation of the system

The operation process of the system includes two stages: the initialization stage and the operation stage. The operation stage includes three system modules: data editing, data processing, and data query. In order to improve the accuracy of the experiment, a scientific and reasonable experiment design must be carried out. The rice area experiment generally adopts a random block design. In actual operation, the following work should be done in earnest. Set up duplicates.

The number of repetitions varies with the number of tested varieties. If the number of tested varieties is small, 4 repetitions are better, and if there are more varieties, 3 repetitions. The area of the repeated plots is suitable for the tested varieties to form a normal population, which is generally $13.33m^2$. Rectangular shape is preferred, but the aspect ratio should be controlled within 3:1 to reduce marginal effect. Set the zone group. According to the principle of local control, the same repeated plot of all tested varieties is controlled in a certain section to form a block, and the number of test blocks is the same as the number of repetitions. In order to obtain unbiased test error estimation, 7 points must be scored for each tested variety in the block, with 1 point added for every 3 days, 5 points at most, 1 point deducted from 7 points for every 3 days, and no score for less than 3 days. The experimental field is the carrier and platform of rice variety test. Choosing the appropriate experimental field is of great significance to ensure the safety, representativeness and effectiveness of the test and improve the accuracy, precision and efficiency of the test. Therefore, the ability to scientifically and objectively evaluate and compare the quality of the tested varieties depends to a large extent on the accuracy of the test.

The error variation coefficient is used to express the test accuracy, that is, the percentage of the standard error of the error term to the test mean:

$$CEV\% = \left(S_e / \bar{X} \right) \times 100 \tag{1}$$

In the formula, S_e is the standard error of the test error, X is the test mean, and CEV is the test accuracy.

Under a certain probability a, the percentage of the smallest significant difference of the variety mean that can be identified by the regional test to the test mean:

$$RLSD\alpha(\%) = \left(LSD\alpha / \bar{X} \right) \times 100 \tag{2}$$

In the formula, $LSDa$ is the least significant difference of the mean value of the variety, and $\bar{X}$ is the mean value of the experiment. $RLSD$ is also a relative number, and its size is the same as CEV.

$$GCV = \left(\sqrt{MS_V} / \bar{Y} \right) \times 100 \tag{3}$$

In the formula, MS_V is the genetic variance of the tested varieties, and $\bar{Y}$ is the test mean. GCV is the genetic variation coefficient of yield among various experimental varieties.

System composition and working principle

The information needed to implement precision planting mainly includes GPS positioning information, farmland geographic information, field sampling information, agrometeorological information, crop growth and yield information, and expert knowledge related to crop planting, etc.

Image recognition is an important branch of artificial intelligence. Its meaning is to imitate the activities of human image recognition and transform this recognition process into computer programs, so that the machine can imitate the human brain to perform image recognition and classification activities. As the application of image recognition technology becomes more and more widespread, some people also use it for agricultural product quality inspection and agricultural disease identification. In order to ensure the accuracy of classification, machine learning gradually can no longer meet the requirements. At this time, deep learning, which is a neural network with multiple hidden layers, appears. Generally, there are three kinds of networks: convolutional neural networks, cyclic neural networks and time-dependent recurrent neural networks. Among them, convolutional neural networks are mostly used to deal with the problem of image data classification. Rice information collection system consists of three parts: information perception layer, network transport layer and information management layer. The information perception layer includes three modules: meteorological information, environmental information and crop information, as shown in Figure 1.

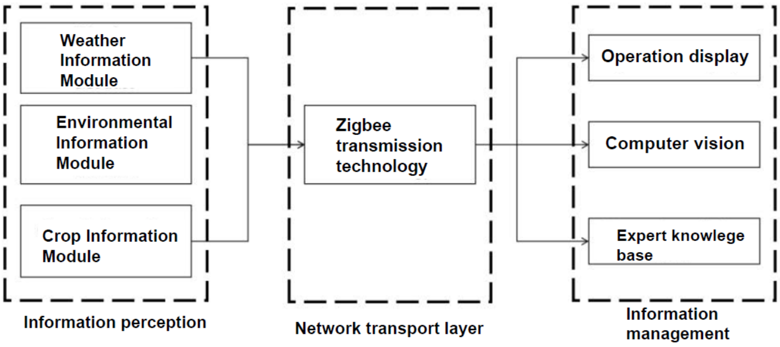

Fig. 1 - The components of the system

The rice information collection system includes four parts: an information collection module, a wireless communication module, an information processing module, and a control execution module. The process is shown in Figure 2. The information collection module is a variety of sensors and cameras, which can collect meteorological information, environmental information and crop information in the test station.

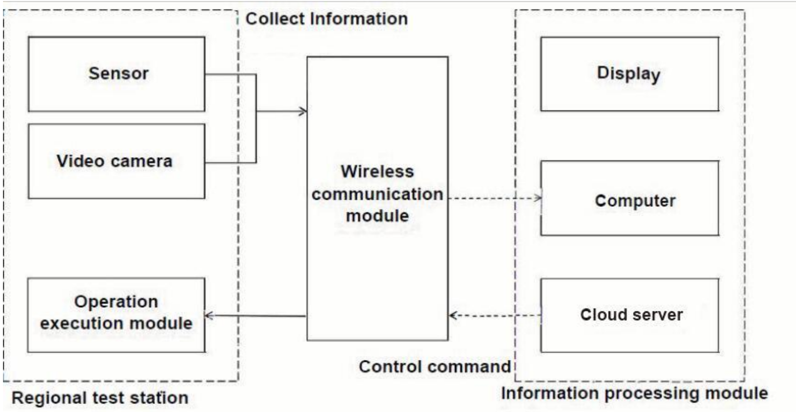

Fig. 2 - System workflow

Figure 3 is the structure diagram of the whole system. The farmland environmental information such as soil temperature, humidity, wind direction and wind speed, illumination intensity sensor, atmospheric pressure sensor, rainfall sensor and CO_2 gas concentration sensor are sensed, and remote real-time monitoring of farmland is realized through remote data transmission.

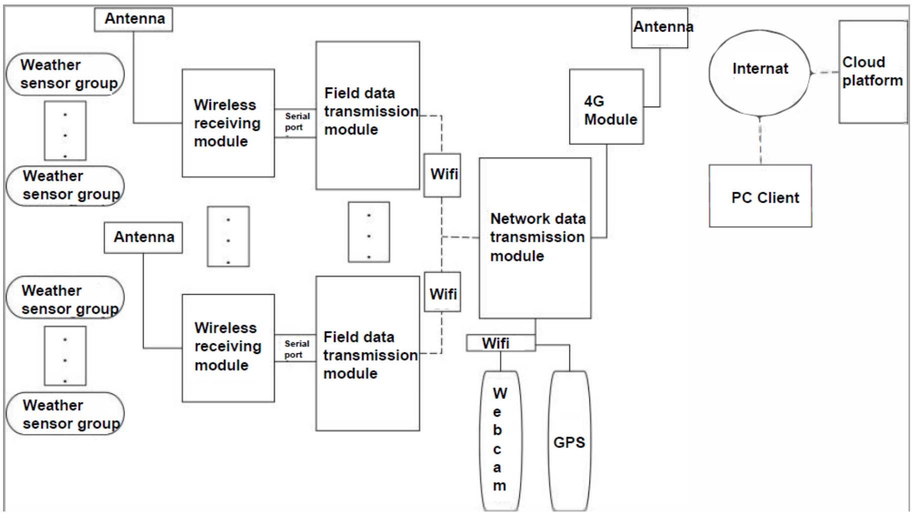

Fig. 3 - Four-layer IoT system structure diagram

The equipment of the information perception layer mainly collects meteorological information, environmental information and crop information. The network transmission layer transmits the information collected by the information perception layer to the information management layer, which is the link between the two. The information management layer is located in the office area of the test station. The computer of the information processing module is a Lenovo Yangtian 4000 desktop computer with an Intel i7 processor, 8G memory and 1T hard disk, and Windows 10 operating system is installed. The display is LS2223WC, which can be used for parameter setting and data display. The work map should be a raster data structure, but at the same time it should include vector coordinates and field boundary information, so that it is convenient for agricultural machinery automation and manual work when there is no machinery. Similarly, compared with rice leaves, insect bodies are quite different in shape and colour.

Table 1 and Table 2 show the colour and shape characteristics of diseases and insect pests.

Table 1

Disease colour and shape characteristics

Disease name	Colour characteristics	Shape feature
Chronic leaf rice blast	Yellowish brown	Fusiform
White leaf blight	Yellow-brown, gray-white	Yellow-brown, gray-white
Slice disease	Wilting and yellowing	Thin strip
Sheath blight	Greyish green or greyish brown	Moire or oval
Helminthosporium oryzae	Dark brown	Ellipse
Rice Sheath Rot	Brown, light in the middle	Irregular type with indistinct margin
Rice leaf smut	Dark brown to black	Along the vein of the leaf, it is intermittent and linear
Aphelenchoides besseyi	Yellowish white or yellowish brown	Twisted paper

Table 2

Pest body colour characteristics

Pest name	Body colour characteristics
Striped rice borer	Head greyish brown, forehead white to smoky, round, apex pointed.
Chilo suppressalis	The head, chest and front wings of the male moth are greyish brown, and the lower lip must be very long and protruding forward. The abdomen is gray on both sides. The female moth has yellow forewings and a black spot in the lower corner of the middle chamber.
Cnaphalocrocis medinalis	The body and wings are yellowish brown. When resting, the wings spread obliquely on both sides of the back. Compound eye black, antennae filiform, yellow white.
Rice planthopper	It can be divided into two types: long winged and short winged. All brown, shiny. There are three distinct convex lines in the front of the sternum. There are small spines outside the first tarsal of hind foot.

Decision-making system should have the function of model management, which can not only add new decision-making models into the system, but also modify and improve existing decision-making models. In the operation stage, the experimental data are mainly processed, including data input, modification, statistics, analysis, summary, query and data exchange with other software and sites. The error of rice regional test refers to the difference between the observed and measured values and their true values in yield, growth period and various economic characters of the tested varieties. In order to improve the accuracy of the test, the error must be controlled by the following ways. First, the use of scientific experimental design can effectively reduce and estimate errors. Second, choose a good test site to minimize soil differences. Third, strict field operations and cultivation management to make them standardized and standardized. The rice precision planting information system should include several parts such as attribute data management subsystem, farmland spatial data management subsystem, remote sensing data processing subsystem, rice planting expert system and decision-making subsystem. The system structure and function are shown in Figure 4.

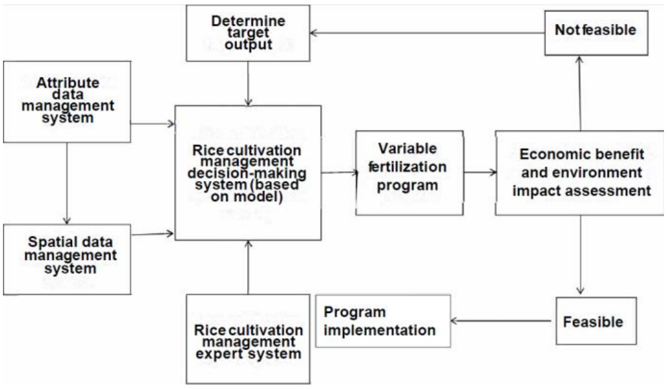

Fig. 4 - Structure and function of rice precision planting information system

RESULTS

In 2018, the function of the information collection system was tested in the early rice regional test of a unit. Based on cloud computing technology, an information collection system for rice regional experiment was established, which includes four parts: information collection module, wireless communication module, information processing module and control execution module. Five varieties were randomly selected from the early rice planted in the current season, and the heading date, effective panicles per unit, grains per panicle and yield of each variety were collected by manual investigation and cloud computing, and the difference of information collected by the two methods was compared. The heading period is the number of days the rice is harvested from sowing to 50% tiller. The effective number of ears per unit is the total number of rice ears per 667m^2 field. The yield is calculated after the yield of the test plot. The difference of the information collected by the two methods is shown in Table 3. Among the five sets of data, cloud computing has the most accurate assessment of the heading date, which is only 1 to 2 days behind the actual results. Therefore, cloud computing can replace manual collection of rice growth and yield information, which can greatly reduce the labour cost of regional trials and improve the test quality.

Table 3

Differences in information collected by the two methods

Varieties tested	Collection method	Heading date [d]	Effective ears per unit area [10,000 ears·/ 667m^2]	Number of grains per panicle	Output [t·hm^{-2}]
1	Manual survey	84.3	22.4	99.3	7.45
	Cloud computing	85.0	23.2	96.3	7.74
2	Manual survey	76.3	18.7	106.5	7.33
	Cloud computing	81.5	19.6	110.1	6.36

Table 3
(continuous)

Varieties tested	Collection method	Heading date [d]	Effective ears per unit area [10,000 ears·/ 667m^2]	Number of grains per panicle	Output [t·hm^{-2}]
3	Manual survey	87.3	25.9	96.7	7.56
	Cloud computing	87.8	23.5	94.5	8.20
4	Manual survey	88.6	20.0	105.6	7.62
	Cloud computing	84.1	19.5	106.3	7.62
5	Manual survey	86.3	19.5	107.3	7.15
	Cloud computing	85.7	21.2	104.8	7.56

The camera of the data acquisition equipment continuously collects field images and sends them to the network data transmission module. The network data transmission module conducts preliminary identification of the image to identify whether the picture is a diseased picture. The error coefficient of variation is analysed by formula (1). If there is a suspected diseased part on the image, it will be calibrated and retaken. The Internet of Things technology is used to build parameters including soil temperature and humidity, air temperature and humidity, wind direction and speed, rainfall, radiation, etc., and wireless communication technology is integrated to form a farmland environment monitoring and sensing system with wireless interface, and to build a mobile terminal platform such as crop growth, field management information collection, decision consultation and information inquiry. Fig. 5 shows the installation equipment of rice regional test information collection system.

Fig. 5 - The installation equipment of rice regional test information collection system

In order to highlight the disease part, the image data is segmented before classification, and the disease location is proposed. Refer to Table 1 and Table 2 for segmentation of colour and shape characteristics of diseases and pests. Before segmentation, the image is smoothed and realized with the cvSmooth function to reduce the influence of noise. The role of the application layer is to process and analyse the collected image data and integrate all farmland information and display it on the client software interface. Build the client application program interface, and classify and display the image data classification results together with meteorological information and geographical location information on the client interface. The application layer workflow is shown in Figure 6.

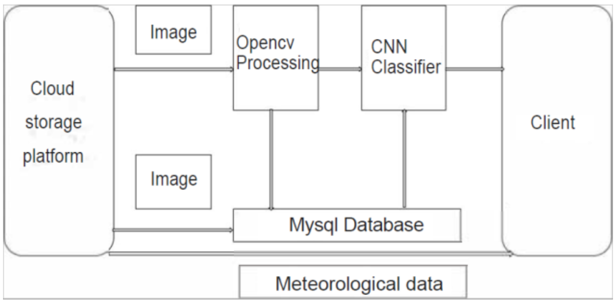

Fig. 6 - Application layer work flow chart

The main sources of test errors are as follows: First, the differences of external conditions and pests during the test. Second, the inconsistency between experiment management and farming operation. Third, the heterogeneity of the test material itself. Selecting suitable test sites, adopting appropriate plot technology, applying good test design and selecting corresponding statistical models can effectively reduce test errors and improve test accuracy. This system establishes database files in the district pilot unit, calls the data in the library through the module program, summarizes and analyses them, so that each point must establish its own data file in a unified format to facilitate the standardized management of the files. This system uses the multi-point repeated linear model that is currently widely used in regional tests for many years:

$$Y=\mu+V_{\mathrm{i}}+S_j+W_k+(VS)_{ij}+(VW)_{ik}+(SW)_{jk}+(VSW)_{\mathrm{ijk}}+R_{jkl}+Ei_{jkl} \quad (4)$$

Where $\mu=\sum Y_{ijkl}/WLVR$ is the total average of traits, Vi is variety effect, Sj is place effect, W_{k} is year effect, $(VS)_{ij}$ is variety and place interaction effect, $(VW)_{ik}$ is variety and year interaction effect, $(SW)_{jk}$ is variety, place and year interaction effect, $(VSW)_{iik}$ is variety, place and year interaction effect, R_{jk} is year and place block effect, Ei_{jkl} is random error. The model evaluates the high yield according to the main effect of varieties, and the varieties with large main effect have better high yield.

For the analysis of variety stability, this system is realized by the following three mathematical models, namely:

Linear regression model：

$$Y=\mathrm{a}+\mathrm{b}X;\quad \mathrm{b}=\frac{\sum(\mathrm{x}-\bar{\mathrm{x}})(\mathrm{y}-\bar{\mathrm{y}})}{\sum(\mathrm{x}-\bar{\mathrm{x}})^2} \quad (5)$$

Y is observed value, $\bar{\mathrm{y}}$ is average value, X is environmental value, $\bar{\mathrm{x}}$ is average value, b is regression coefficient and a is regression intercept.

Model of Eberhart stability parameters:

$$Y_{\mathrm{ij}}=\mathrm{m}+B_iI_{\mathrm{j}}+\sigma_{\mathrm{ij}} \quad (6)$$

where $\mathrm{Y_{ij}}$ represents the average value of the i-th variety in the j-th environment (i=1, 2...v) (j=1, 2...s), and m is the average value of the i-th variety in all environments, σ_1 is the separation regression of i varieties in j environments, B_i is the regression coefficient, used to measure the response of the i-th variety to different environments, I_{j} is the environmental index, which is the average of all varieties in the i-th environment calculated by subtracting the total average number from the number.

Mathematical model of Tai stability parameters:

$$X_{\mathrm{ijk}}=U+\mathrm{g_i}+\mathrm{l_j}+(\mathrm{gl})_{\mathrm{ij}}+\mathrm{b_{jk}}+\theta_{\mathrm{ijk}} \quad (7)$$

In which X_{ijk} is the observed value of the i-th variety in the k-th repeated in the j-th environment, U is the total average of all varieties in all environments, $\mathrm{g_i}$ is the i-th variety effect, $\mathrm{l_j}$ is the j-th environmental effect, $(\mathrm{gl})_{\mathrm{ij}}$ is the interaction effect between the i-th variety and the j-th environment, $\mathrm{b_{jk}}$ is the k-th repeated effect in the j-th environment, and θ_{ijk} is the random error of dispersion of the i-th variety in the k-th repeated in the j-th environment. In ANOVA model, the yield (Y_{ijk}) of the ith variety in the kth repetition at the jth site can be expressed as:

$$Y_{ijk}=\mu+g_i+e_j+ge_{ig}+\rho_{\mathrm{jk}}+\varepsilon_{ijk} \quad (8)$$

As for the model of variance analysis, one view is that the pilot in regional trials is fixed, not randomly selected, so the pilot effect should be regarded as fixed. Some studies are based on the least square principle, and all the sources of variation are regarded as fixed effects. Another point of view is that the pilot is only a group of samples in an ecological region, and the test results should be extended to other environments outside the pilot, so it is more appropriate for the pilot effect to be random. Generally speaking, when the pilot effect is fixed, the standard of significant difference among varieties is lower, and when the pilot effect is random, the standard of significant difference among varieties is higher. Therefore, compared with the ANOVA model and the LR model, this model has a wider range of applications. Wide, and the evaluation of the tested varieties is also relatively accurate. The model is tested by testing sample data. Table 4 shows the classification accuracy rates of different classification models obtained by statistics.

Table 4

Statistical results of model classification accuracy

Edition	Correct number Accuracy	Accuracy	Edition	Correct number Accuracy	Accuracy
Colour V1	469	89.45%	Ordinary V1	432	82.47%
Colour V2	449	85.68%	Ordinary V2	451	86.15%
Colour V3	478	91.25%	Ordinary V3	469	89.5%
Shape V4	490	93.41%	Ordinary V4	463	88.27%
Shape V5	502	95.8%	Ordinary V5	473	90.18%
Shape V6	459	87.65%	Ordinary V6	480	91.56%
Shape V7	442	84.35%	Ordinary V7	443	84.58%
Texture V8	434	82.74%	Ordinary V8	464	88.59%
Texture V9	490	92.47%	Ordinary V9	422	80.58%
Texture V10	474	89.33%	Ordinary V1	450	85.45%

By selecting different sample data from different data sets to train models, different classification models can be obtained, and the model with the highest accuracy rate is selected as the final classification model.

CONCLUSIONS

Assumption of perfecting regional trials of rice varieties: establishing standardized technical operation rules of regional trials, building an independent regional trial network system, implementing the scrapping system of regional trials, and determining the verification results of regional tests. In this paper, the idea of cloud computing and artificial intelligence is combined to design a rice farmland information real-time viewing system, which can realize the collection and transmission of farmland meteorological data and image data as well as the processing and classification of image data. In practical application, the system still needs to be improved, and further research and improvement are needed in the future. The test results showed that the early rice heading date, effective panicle number per panicle, grain number per panicle, and yield obtained by cloud computing are not significantly different from the results of manual investigation, and the estimation of the heading date is the most accurate. Therefore, cloud computing can replace manual collection of rice information, reduce labour costs for regional trials, and improve trial quality. Generally speaking, when the pilot effect is fixed, the standard for significant differences between varieties is lower, and the pilot effect is random, and the standard for significant differences between varieties is higher. Because of the interaction between genotype and environment during the growth of rice, different locations, different cultivation methods and different management may affect the performance and evaluation of varieties. The formulation of scientific and reasonable rice cultivation and management scheme requires not only a large amount of data and advanced technology, but also a long time to adjust, modify and perfect the process, method and mode of formulating the scheme.

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