

# Performance Evaluation of Modern Agricultural Management Main Body in Anhui based on BP Neural Network Algorithm

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## **Abstract**

*Artificial neural network is a comprehensive evaluation model which is established by imitating the function of biological neural network. In this paper, the author makes the performance evaluation of modern agricultural management main body in Anhui based on BP neural network algorithm. With the development of agriculture and rural economy in our country, the agricultural management main body has already presented the characteristic of diversification. The construction of new agricultural management main body should strengthen institutional innovation, as land property right system reform, trade organization system reform and income distribution system reform. At the same time, we evaluate the performance of Anhui modern agricultural park, and put forward the relevant suggestions.*

**Keywords:** *Neural Network, SVM, Modern Agricultural Management*

## **1. Introduction**

The development of modern agriculture, is to achieve a comprehensive well-off society and realize the modernization of the system of engineering, is the basic point to solve “three rural issues”, dual economic structure and the urban and rural economic development, which is of great significance to promote the overall development of economy and society [1]. Comprehensive and objective understanding and evaluation are the key factors to affect the construction of agricultural modernization in china. In recent years, the domestic and foreign research results about agricultural modernization are introduced, and the main component analysis, factor analysis and artificial neural network technology are widely used in the comprehensive evaluation system. Principal component analysis method can reduce the number of system variables to simplify the complexity, but also retain the most useful information of the original system characteristics. Artificial neural network can learn and store a lot of information, adapt to the environment, summarize the rules and complete recognition and computing ability, is the most widely used neural network model [2-3]. Namely the principal component analysis method can simplify the prediction difficulty and simplify the prediction. Neural network method can imitate a certain standard, and give the system a comprehensive and objective evaluation. Whether the principal component analysis method and artificial neural network combined for comprehensive evaluation of agricultural modernization, mimicking some experts grading characteristics, unified standard for the comprehensive evaluation of a system and effect evaluation of how to be a subject worthy of study.

Central Rural Work Conference: to speed up the construction of peasant household based, cooperative and joint as a link, social services for the support of the three-dimensional complex type of modern agricultural management system. In this big background to deepen rural reform, correctly understand the essence of complex agricultural management system, clarify the construction difficulty, and then explore the construction of complex agricultural management system strategy, has important significance. In recent years, with the more in-depth evaluation of the field, the evaluation

system is more complex and the accuracy of the evaluation of higher requirements, if only using an evaluation method, the results are difficult to convince [4]. The combination of evaluation methods, such as the combination of subjective and objective weighting method, can give full play to the advantages of various evaluation methods, and try to avoid their shortcomings, so as to make the evaluation object more comprehensive evaluation, obtained more satisfactory effect evaluation [5]. Modern agriculture is a modern agricultural display window, is the transformation of agricultural science and technology incubator, is eco safe food production base, is a modern agricultural information, technology, varieties of exposition, is inevitable choice to improve the efficiency of the rural economy and farmers income. The main business is the cornerstone of the development of modern agriculture park, with the park's soft power level, the advantages and disadvantages of accurate diagnosis and scientific analysis of park management subject, management efficiency to make full use of the existing business entities, the smooth realization of the park system innovation, promote the construction of modern agricultural Park in China's sustainable development is of great significance.

## 2. BP Neural Network

### 2.1. Neural network method

The artificial neural network by imitating the function of biological neural network, comprehensive evaluation to establish close to the human thinking mode of the combination of qualitative and quantitative model, which is characterized in that the distributed information storage and parallel collaborative processing, adaptive and fault-tolerant have strong ability in data processing, non linear relationship with other methods cannot match advantage [6-7]. The back-propagation (BP) neural network is one of the most famous multi-level feedback network, comprehensive evaluation of the network method has fast calculation speed and high efficiency of problem solving, self-learning ability, wide applicability, *etc.*, based on generally is composed of input layer, hidden layer and output layer between layers the neural connection with the whole Internet connected through the network, the corresponding weighting coefficients, can be regarded as a highly nonlinear mapping from input to output, the BP neural network has been widely used in pattern recognition, prediction, control and other fields.

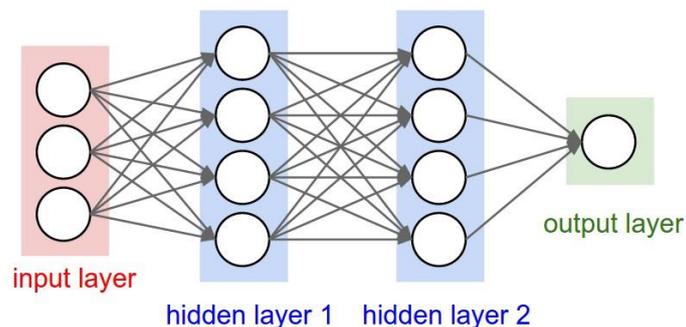


Figure 1. BP neural network

(1) **the number of network layers:** Under certain conditions, for any  $\varepsilon > 0$ , there are 1 of 3 neural networks, it can nonlinear continuous function, the mean square error of approximation accuracy of arbitrary square integral and therefore used here consists of 3 layers of BP network with 1 hidden layer.

(2) **network node:** The input layer has 15 nodes: the evaluation model of the evaluation index, the corresponding input layer nodes is 15; hidden nodes: determining the number

of hidden layer neurons is still not mature in theory; the output layer node: output for the comprehensive evaluation of the rural modernization region, which has an output node.

(3) **transfer function:** The transfer function of the hidden layer neurons by tangent function, the output layer is made of pure linear transfer function.

(4) **training function:** The adaptive learning rate momentum gradient descent back propagation algorithm, this method combines the gradient descent method and adaptive learning rate gradient descent algorithm, so that the training speed of the network and further improve the stability, can effectively inhibit the local minima.

(5) **network model:** According to the BP neural network model designed by the agricultural management evaluation system, the P is the input vector of the neural network, the B is the threshold vector of the hidden layer and the output layer neuron; the n is the result of the middle operation between the hidden layer and the output layer.

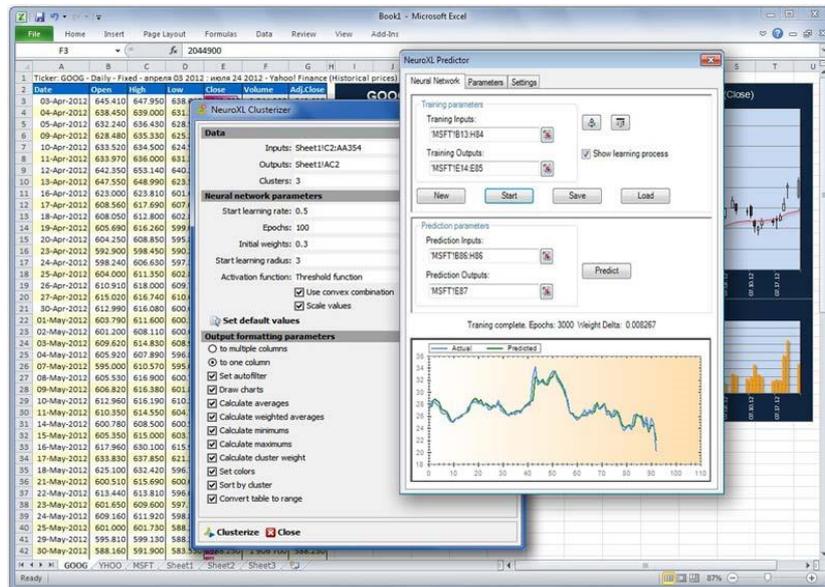


Figure 2. Neural network prediction

## 2.2. Support Vector Machine algorithm

In the middle of 1990s, the support vector machine based on statistical learning theory proposed by Professor Vapnik, SVM can be used for pattern classification and regression estimation. The method of pattern classification, support vector machine and traditional machine learning such as artificial neural network, compared with its significant advantages, such as strong generalization ability, global optimization, so it is more and more widely used [8]. In essence, the support vector machine is a kind of two kinds of classifiers, which can solve all kinds of two kinds of classification problems.

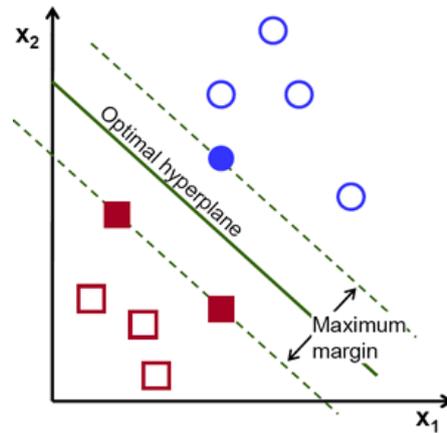
Given an independent and identically distributed sample set. For linearly separable training sets:

$$T = \{(x_1, y_1), (x_2, y_2), K, (x_n, y_n)\} \quad (1)$$

Hypothesis existence discriminate function:

$$f(x) = \text{sgn}((\omega \cdot x) + b) \quad (2)$$

Linear case, the optimal classification of the idea of the super plane can be described in Figure 3.



**Figure 3. The optimal hyper plane**

Based on the structural risk minimization principle, the training set is constructed with the objective function:

$$\min \quad \frac{1}{2} \|\omega\|^2 + c \sum_{i=1}^n \xi_i \quad (3)$$

$$s.t. \quad y_i (\omega \cdot x + b) \geq 1 - \xi_i \quad (4)$$

C is a penalty term constant, used to weigh the intensity of punishment, the greater the C, the more severe the punishment of false classification; B is a constant term. Finally, using decision function:

$$f(x) = \text{sgn} \left( \sum_{i=1}^n \alpha_i y_i (x_i \cdot x_j) + b \right) \quad (5)$$

Although the local support vector machine to reduce the number of the modeling samples, but the number of test samples in more cases, local support vector machine time complexity is very high, because the number of models need to construct more growth. Therefore, how to improve the test efficiency is one of the main research contents of local support vector machine in recent years. In the local support vector machine, the most intuitive improvement idea is to reduce the need to train the support vector machine model, the specific improvement method as shown in algorithm 1.

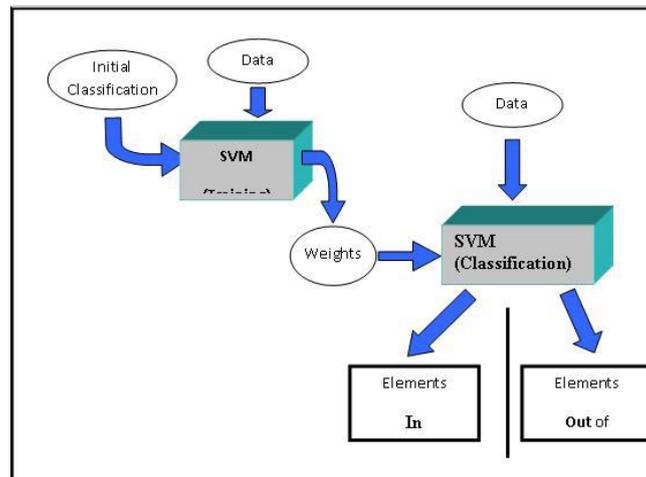
Algorithm 1 local support vector machine improved algorithm

**Step 1** will be trained in a sample based on some principles into the K class, and find the K center;

**Step 2** for each center to construct a support vector machine;

**Step 3** for each test sample  $\bar{x}$ , find the closest one to the center;

**Step 4** using the support vector machine  $\bar{x}$  corresponding to the center of the label.



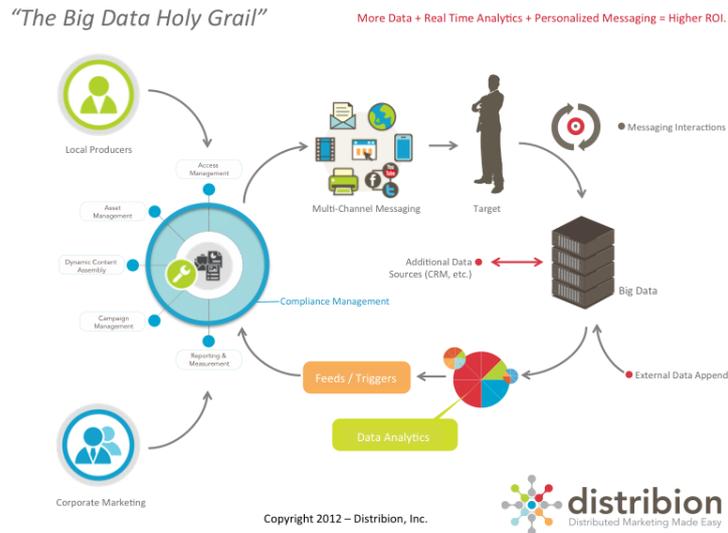
**Figure 4. Support vector machine (SVM)**

### **3. Modern Agricultural Management Main Body**

#### **3.1. New agricultural management main body**

"Agricultural management" means a wide range, covering agricultural production, processing and sales of various links, including all kinds of productive services, is the general term for various activities of prenatal, prenatal and postnatal. Generally speaking, the main body of agricultural management refers to any person or organization directly or indirectly engaged in the production, processing, sales and service of agricultural products. With the continuous development of China's agricultural economy, agricultural enterprises have shown the characteristics of diversity, pattern change from family farmers at the beginning of reform relative homogeneity dominant pattern to the coexistence of multiple types of business entities at the present stage, especially the new agricultural business entities to professional large, family farms, farmers and agricultural cooperatives as the representative of the enterprise is increasingly showing a broad development space and market potential [9]. The main body of the new agricultural management refers to the establishment of the family management system, with a relatively large scale of operation, and the modern agriculture and the market economy to adapt to the farmers or agricultural economic organizations [10]. Different scholars have made different classifications of new agricultural business entities, such as family farms, farmers' cooperatives and agricultural enterprises three, professional large, family farms, farmers' cooperatives and agricultural enterprises four, and planting large, family farms, farmers' cooperatives, leading enterprises and management of agricultural service organization five. These different types of new agricultural business entities constitute the micro basis of the construction of modern agriculture.

Compared with the traditional agricultural subject, new agricultural business entities in the scale of operation, radiation has obvious advantages in driving, profitability, capital source, market orientation, product certification, brand building, sales channels and other aspects. Plays an important role in improving the specialization, standardization, scale, intensive management level of agricultural production. The variation tendency of the various subjects by the local natural resources, economic development and land circulation. To produce new agricultural business entities is the main market to conduct a comprehensive comparison of all kinds of labor transaction cost according to their actual situation, choose the optimal organizational structure of residual rights in order to achieve different Lai results, provides a theoretical explanation for the variety the form of new agricultural business entities coexist.



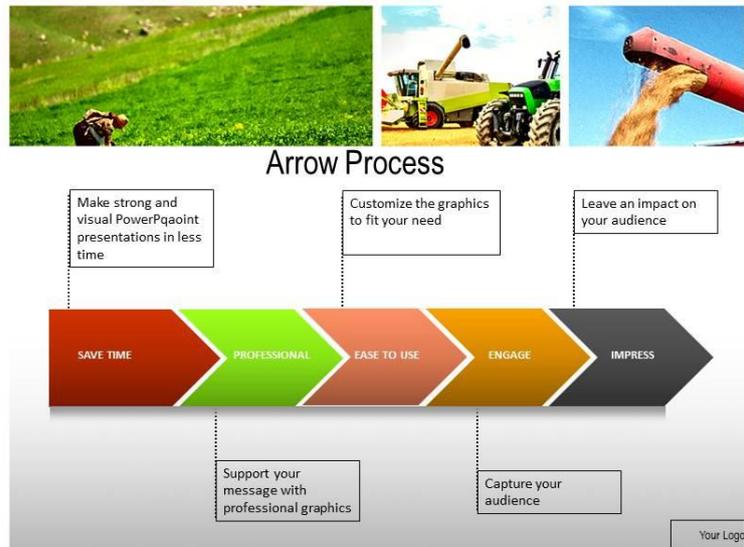
**Figure 5. Diversified channels of agricultural products**

### 3.2. Agricultural management organization mode

The organization of agricultural management to organize the dispersed farmers, help to improve the agricultural management organization and social level, to strengthen the information collection and transmission, the popularity of the production technology, providing social services, organizations to guide farmers to carry out production and sales in accordance with market demand play an important role, is the bridge and link to realize the docking of small "farmers" and "big market". To compare what kind of organization of agricultural management depends on the cost and benefit of farmers and farmers, production cost and transaction cost in comparison before and after the organization of agricultural management, become the determinants of farmers organization. The two forms of organization of cooperatives and "leading enterprises + farmers" have some shortcomings, the former is mainly due to lack of funds and lack of mortgage assets, the latter is not form an effective constraint on the contract parties. In order to overcome these defects, it is necessary to introduce the intermediary organization, the formation of a new form of organization, leading enterprises + cooperatives + farmers. In view of the above different modes of development, from the perspective of institutional economics, the leading enterprise, intermediary organization coordinated and cooperative integration of three kinds of agricultural industrialization were analyzed. The cooperative integration thought model is the optimal mode of agricultural industrialization, agricultural industrialization model shows the path by the leading enterprise evolution model to intermediary linkage mode and cooperative mode of successive integration.

The international experience in the development of agriculture, agricultural management generally take two roads: one is mainly based on specialization, commercialization, mercerization and mechanization based on large scale farm economy; two is mainly based on biological technology, and protection, on the basis of intensive farming economy. In the new stage of agricultural development, our country should establish a self-sufficient and innovation of peasant economy and business of agricultural economy closely, parallel development of new agricultural "dual track" system. The innovation of agricultural management system innovation, to develop professional investors as the main body of agricultural production; the development of leading enterprises as the innovation of agricultural market; the development of innovative agricultural professional cooperatives as the main service; innovation will develop industry association as the main body of agricultural management. The reform and

innovation of agricultural management system is a long-term development strategy, to adhere to a foundation, which adhere to the family management of agriculture for agricultural micro organizations based on the common development of the coexistence of various forms of property right organization and various economic compositions; around a center, namely agricultural reform and development must focus on agricultural household management efficiency of the continued growth in this center especially, in order to improve the efficiency of agricultural family management system, in order to effectively save and reduce the transaction costs of the majority of farmers in the market; to deepen the reform of the top three, namely the reform, the reform of land property rights system and Trade Organization System of income distribution system reform.



**Figure 6. New agricultural model**

## 4. Performance of Modern Agricultural Management in Anhui Province

### 4.1. Operating main body performance

According to statistics, the current demonstration area of modern agriculture in our province has reached 80, per capita net income of farmers in the core area of the demonstration area of 10321 yuan, 27.5% higher than the level of the province; grain yield of 770.3 kg, agricultural scientific and technological progress contribution rate of 58%, higher than the Provincial level. Project capital integration demonstration area, and vigorously promote the construction of agricultural infrastructure, the core area of more than 90% of farmland standard farmland, the main crop mechanized farming income rate reached 87%, high-yield demonstration area reached 2 million 474 thousand and 700 mu, the core area of 38 demonstration area rate using agricultural IOT technology. It is understood that, in order to better play the leading role of modern agricultural demonstration zone, the province will further improve the scientific construction of the demonstration zone, highlighting the demonstration, good co-ordination of industrial planning, to become a regional modern agriculture model and innovation of agricultural management system in the test area. The performance evaluation scores of 80 modern agricultural parks are analyzed and the results are shown in Table 1.

**Table 1. Performance evaluation score of agricultural demonstration zone**

type	Score	2014	2015	Average
Government led	Section	75.24 ~ 91.02	74.28 ~ 95.75	82.46
	average value	83.53	81.42	
R&D institutions Leading	Section	73.10 ~ 86.45	72.56 ~ 90.10	85.28
	average value	84.39	87.66	
Enterprise leading type	Section	64.13 ~ 82.10	67.18 ~ 89.15	80.32
	average value	81.53	79.52	
Farmer oriented	Section	84.18 ~ 92.04	72.32 ~ 82.13	82.18
	average value	88.13	75.32	

Economic benefit analysis of economic investment and benefits of modern agricultural park were analyzed, the results are shown in Table 2, with a strong financial support to enterprises, so the investment amount and turnover were the highest, far higher than other types. And farmers' professional cooperatives to farmers, in the economic disadvantage, so the investment, turnover, profit, the 3 indicators are the lowest. The investment amount and turnover of the government led park were significantly lower than that of the enterprises, but the yield and profit rate was the best, which was significantly higher than other types. Scientific research institutions in the economic benefits of the leading park performance is weak, the output rate is only 79.04%.

**Table 2. Economic benefit analysis**

type	Investment	Turnover	profit margin	Output rate	Profit rate
Government led	3836	4359	1158	112.17	34.06
R&D institutions Leading	3572	4345	825	78.14	17.13
Enterprise leading type	5061	6712	971	85.62	8.42
Farmer oriented	2412	2513	524	82.28	16.57

#### 4.2. Cultivation of new agricultural management main body

The current and future periods, to focus on the areas around the complex type agricultural management system and key links, in order to reinforce the microcosmic foundation, promoting mechanism innovation, play organizational ties, strengthen the service support as the focus, accelerate the construction of composite type modern agricultural management system flexible and efficient operation.

##### (1) Actively cultivate new agricultural business entities

The focus of building a modern agricultural management system is to speed up the cultivation of new agricultural business entities, and lay a solid foundation for the construction of modern agriculture. The new business entities in different areas, different industries and different sectors, with their adaptability and development space, should highlight the characteristics and advantages of all kinds of subjects, play a leading role model for small farmers. First, to foster new business entities. The research and development of professional farmer identification standard, broaden the professional farmer training channels, accelerate the cultivation of new professional farmers. Two is to strengthen the interaction and cooperation between the main business. To guide the industrial and commercial enterprises, industrial and commercial enterprises, scientific

research institutions and farmers, through the land, capital, technology shares, or contract system, *etc.*, to carry out cooperation in production and service,

(2) Promote land circulation and moderate scale management

The moderate scale management of land, not equivalent to the land mass transfer, should adjust measures to local conditions, take advantage of the opportunity, grasp the principle of proportionality, steady walk Chinese characteristic scale road. One is to accelerate the development of rural land ownership registration certification work. Gradually expand the scope of the pilot, including speeding up the rural collective construction land, rural collective land ownership registration certification is indeed the right to work, to accelerate the contracted management of rural land ownership registration certification work, through the land of farmers' land ownership certification stable expectations, to avoid disputes arising from land ownership is not clear, accounts inconsistent. Two is to establish land open trading platform, strengthen the land transfer services and management.

(3) Actively explore the innovation of agricultural management organization mode

To improve the organization degree of small farmers, the key is to promote the development of farmers' professional cooperatives, to play the role of the organization of farmers' cooperatives, and to improve the ability of cooperative service and industrial management. First, efforts to explore the whole process of agricultural production cooperation. The whole process of cooperation means that farmers in the entire production process to achieve a full range of cooperation, cooperation throughout the whole process of agricultural production. Two is to actively promote the cooperation of all elements of agricultural production. Agricultural production involves many factors such as manpower, land, capital, technology, management, information and so on.

(4) Speed up the construction of new agricultural social service mechanism

To strengthen the construction of agricultural social service system, to strengthen the agricultural public service system, and actively cultivate the market service organization, innovative service means, support all kinds of market service organizations to provide low cost, convenience for farmers, a full range of services. First, efforts to optimize the public service system of agriculture. Two is to actively foster business services organizations. By reducing the access threshold, strengthen supervision and management, increase operational services to support the development of the organization. Specializing in the delivery of this short board service, focusing on supporting the development of specialized agricultural service companies, professional services, *etc.*.

## 5. Conclusions

Through the comparative analysis we can see that although the enterprise leading park has a strong advantage in the capital, played a leading role in the modern agricultural park, but in the aspect of demonstration and scientific research, there are still many shortcomings; and government leading research institutions, leading in the park demonstration and research and development were doing well. The integration of all aspects of government, research institutions and enterprises such as power, explore the establishment of diversified management system, play a dominant role and the various entities in the construction and management of modern agricultural park in the complementary cooperation, will be the overall direction of the development of modern agricultural park operators. With the development of farmers' professional cooperatives, farmers' leading park plays a more and more important role in the construction of modern agricultural park. Although the lack of investment in the scale, but because of its close to the farmers, often have a more obvious effect of the demonstration. As a supplement of other types, the farmer led park has become an important part of the construction of

modern agricultural park. To strengthen the construction of farmers' leading Park, improve the policy and financial support, and give full play to the role of professional cooperatives in agricultural modernization.

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