Design of Agricultural Credit Guarantee Risk Prediction Model Based on PSO-SVM in Wireless Network

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Design of agricultural credit guarantee risk prediction model based on PSO-SVM in wireless network

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Abstract: In recent years, big data and deep learning technology have been extensively applied in the field of financial risk identification. Many scholars have used deep learning technology to provide early warning of the time series of the risk in agricultural credit guarantee. The traditional model training mainly relies on the evaluation of the financial and non-financial situation of new agricultural business entities to identify the risk in agricultural credit guarantee. Therefore, the selection of influencing factors, model construction and the optimization algorithm are usually highly subjective. And the model is built on the basis of wired network to analyze the risk data, the risk data can not be long-distance transmission. Improving these influencing factors can help to provide more scientific suggestions on the training of the model for the identification of risk in agricultural credit guarantee, and it can also significantly enhance the risk identification accuracy of the model. In this paper, under the wireless network, PSO-SVM was used to model the real data of 510 types of new agricultural operating entities in the agricultural credit guarantee system of L province from 2017 to 2019, and to identify the risks. Finally, a high precision risk identification model of agricultural credit guarantee based on PSO-SVM under wireless network was established, and its accuracy of the identification results was compared with that of the unimproved SVM model. With 14 influencing factors in the test set as input, and a test ratio of 0.3, the following conclusions were obtained: first, after improving the parameter selection and algorithm of the model for the identification of the risk in agricultural credit guarantee based on the traditional SVM, the accuracy of the improved model is higher than that of the traditional model. Second, after adding the influencing factor, namely the cognitive bias of the new agricultural business entities in agricultural product market forecasting, the accuracy of agricultural credit guarantee risk identification model based on PSO-SVM under wireless network reached 92.2%, indicating that the model is well trained and can accurately identify the risk of agricultural credit guarantee in practice.

Keywords: New agricultural business entities; Cognitive bias in agricultural product market forecasting; Agricultural credit guarantee risk; PSO-SVM

1. Introduction

It was clearly pointed out at China Rural Work Conference that the implementation of rural revitalization strategy requires the consolidation and improvement of the basic rural management system, so as to ensure the institutional supply for rural revitalization. Especially, the establishment and improvement of mechanisms and policy systems for cultivating new types of agricultural business entities is of great significance for achieving the organic connection between small farmers and modern agricultural development. At present, what urgently needs to be solved in the systems and mechanisms for cultivating new type of agricultural business entities is the

shortage of funds in agricultural industrialized management, the outflow of talents in agricultural production and management, and the fragmentation of agricultural land. In terms of institutional supply, the shortage of agricultural financial support is a major issue. To solve the problem of the shortage of funds in the industrialization of agriculture, first, the system for guaranteeing the financial investment in the implementation of rural revitalization strategy should be established and improved, and the public finance should support more "agriculture, rural areas and farmers". Second, it is necessary to expand investment and financing channels, improve the rural financial system that adapts to the characteristics of agriculture and rural areas, and innovate the way the financial system serves the "agriculture, rural areas and farmers", so as to enhance the ability and level of the financial system to serve rural revitalization. In this context, China has built a financially supported agricultural credit guarantee system, hoping to draw financial capital to invest in "agriculture, rural areas, and farmers" to solve the "difficulty in obtaining loans" and the issue of "high loans" for new types of agricultural business entities.

After three years of operation of the agricultural credit guarantee system, all provinces and municipalities with independent planning status across the country have encountered the default risks, such as new agricultural business entities delay repayment, have default interest, and are unable to or refuse to repay loans from financial institutions such as banks. Why "risks" appear in the implementation of the mechanism for fiscally and financially supported agricultural development carefully designed by policy-makers? In the top-level design by the decision-makers, whether the imperfect design of the mechanism of agricultural credit guarantee system for the new agricultural business entities is the reason for the failure of the system to better resolve the problem of "difficulty in financing" and "high financing" for the new agricultural business entities? To explore whether the mechanism of the agricultural credit guarantee system is complete, it is necessary to judge the prerequisites for the transformation of traditional agriculture by introducing new production factor, namely financial capital, into "agriculture, rural areas and farmers" based on the agricultural credit guarantee system. This is the main content in the theory of the transformation of traditional agriculture.

Moreover, the traditional risk prediction of agricultural credit guarantee is improved in the context of wired network, which cannot realize long-distance data transmission and covers a narrow range. And the wireless network, refers to the network that can realize the interconnection of all kinds of communication equipment without wiring. Wireless networking technologies range from global voice and data networks, which allow users to establish wireless connections over long distances, to infrared and radio frequency technologies optimized for short-range wireless connections. Wireless network can effectively achieve network work extension and configuration Settings. Credit guarantee users will also be able to access information more efficiently and easily on a wireless basis, this study used PSO-SVM to model the real data generated by 510 new types of agricultural business entities in the agricultural credit guarantee system of L Province during 2017-2019, and to identify risks. The influencing factor, the cognitive bias of new agricultural business entities in the prediction for agricultural product market was incorporated into the original influencing factors, thereby improving the influencing factors in three dimensions that affect the accuracy of model's risk identification. Finally, a high-precision model for risk identification of agricultural credit guarantee based on PSO-SVM under wireless network was established, hoping to provide a reference for further research and the sustainable development of the agricultural credit guarantee system in practice.

2. Literature review

There are abundant researches on the cognitive bias in the prediction for agricultural product market and the risks of agricultural credit guarantee. Some scholars have conducted a large number of researches on the cognitive bias in agricultural product market forecasting; some scholars have analyzed the causes of the risks in agricultural credit guarantee from multiple perspectives.

2.1Exploration of the cognition of agricultural product market forecasting

The existing studies mainly analyzed the cognitive bias in the prediction for agricultural product market from different aspects such as the concept and definition of cognition and cognitive bias. Some scholars believe that the exclusive resources (such as personal endowments) of the managers of the new agricultural businesses determine the establishment, organizational behavior mode and nature of the new agricultural business entities [1]. These exclusive resources are generally owned by managers, and others have no access to use [2]. The managers of the new agricultural businesses allocate their own exclusive resources to agricultural production and operation activities in accordance with the macroeconomic policies developed by the government, so that the new agricultural businesses can achieve sound development [3].

With the research results obtained by Schultz (2006), Luo Xing et al. (2019) and Yang Xiaoguang et al. (2019) [1] [4-5] used for reference, the exclusive resource owned by the managers of the new agricultural business entities, that is, the ability of managers to adjust their own decision-making to adapt to the changes in the economic situation of the agricultural product market caused by the macroeconomic policies, was used as the definition of the cognition of agricultural product market forecasting.

In recent years, the cognition of the managers of new agricultural business entities for agricultural product market forecasting has been gradually incorporated into the analysis framework of the decision-making behavior and macroeconomic policies, and has gradually become an important element explaining managers' behavior and decision-making [6]. When the mangers' cognition of agricultural product market forecasting does not match the macroeconomic policy, it produces cognitive bias [7-9], that is, the distance between the manager's cognition of macroeconomic policies and the macroeconomic policy standards [10]. The cognition bias in agricultural product market forecasting is a kind of "limited subjective cognition" which "comes from past experience, and it will only be modified when there is a major change in the form of the market economy or an internal crisis in cognition"[11].

2.2Discussion on the causes of agricultural credit guarantee risks

The existing researches mainly investigated the factors triggering risks in agricultural credit guarantee from three aspects: agricultural industry chain financing guarantee, information asymmetry between "guarantee institutions-agricultural business entities" and contractual relations. First, some scholars believe that compared with ordinary farmers, new types of agricultural business entities that are at the core status of financing guarantee in the agricultural industry chain do not have the advantages in information and supervision, and the decline in operations will trigger risks in agricultural credit guarantee [12-13]. Second, some scholars hold the view that the main reason for the compensation risk of agricultural credit guarantee institutions is the information asymmetry between the new agricultural business entities and agricultural credit guarantee institutions [14-17]. Third, some scholars argue that in the classic contract coupling

mechanism, the single type of the contract of agricultural credit guarantee institutions, the expectation of the managers of new agricultural businesses for relief, the single arrangement of the contract of upstream and downstream industrial chains, and the lack of penalty mechanism for breach of contract have all expanded the risks in agricultural credit guarantee [17-19].

The existing studies have enriched the research results on the cognitive bias in agricultural product market forecasting and agricultural credit guarantee risks, but there are still some limitations: first, the existing researches focus more on the impact of new agricultural business entities on the risks of agricultural credit guarantee, while less attention has been paid to the key role played by the managers of the new agricultural business entities in the agricultural credit guarantee system. Second, how the cognitive bias of the managers of new agricultural business entities in agricultural product market forecasting affects agricultural credit guarantee risks has rarely been explored, let alone the transmission mechanism of such influence. Third, limited by the data available, most of the existing studies only conducted theoretical analysis and empirical test using the data of ST listed companies, and the results obtained are not convincing. Fourthly, due to the limitation of the wired network, it is impossible to carry out long-distance and wide range data transmission, which leads to the deviation of the risk prediction results of agricultural guarantee and the delay of data update.

3 The theory of research

Theoretically speaking, the managers of the new types of agricultural business entities are the decision-makers of the production and operation of new agricultural business entities, and the accuracy of their cognition of agricultural product market forecasting and the judgments made based on such cognition are vital for the survival and development of the new agricultural business entities [20]. If these managers need to effectively use the new element, namely financial capital, they should have the corresponding cognitive ability to predict the agricultural product market [4]. The reason is that under the premise of bearing certain controllable risks, only when the managers of the new agricultural business entities can adjust the decision-making for future agricultural production and management based on the economic situation of the agricultural product market and their own operating conditions, can the new agricultural business entities improve production and operation income [5][21].

At present, some of the new agricultural business entities in China are transformed from traditional farmers in the form of legal subjects, rather than the transformation of business philosophy, that is, they still follow the natural person model of individual farmers when making production and management decisions [22]. It is a common phenomenon that in China, farmers' cognition of agricultural product market forecasting lags behind the changes in macroeconomic policies, which is reflected in the low level of farmers' awareness of macroeconomic policies and large deviations in the prediction for agricultural product market [23]. The Chinese government only increases financial capital investment, which is a single method of agricultural relief, subsidies and support, and does not provide the managers of new types of agricultural business entities with the channels to acquire financial, technological, market and other information [24] to enhance the core competitiveness of the managers, that is, their cognition of agricultural product market forecasting. Thus, when the managers of the new types of agricultural business entities use financial capital for agricultural production and operation, the utilization efficiency of the financial capital must be at a low level, which is manifested in the failure of agricultural production and operation projects in practice. This means the managers' cognitive deviation in the agricultural

product market forecasting will trigger risks in agricultural credit guarantee.

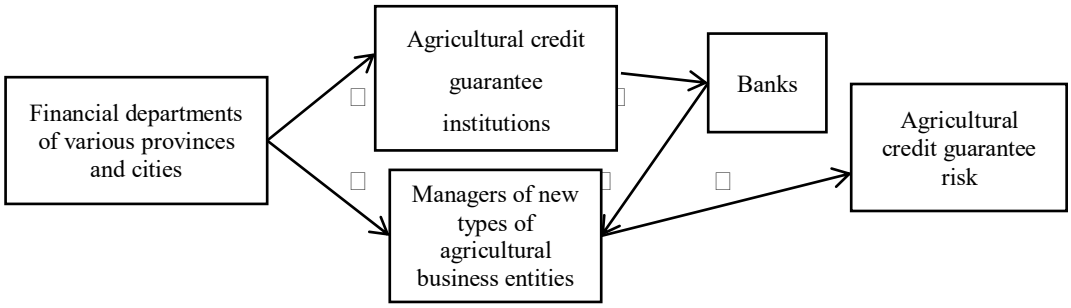

Figure 1 The logic diagram of the agricultural credit guarantee risk triggered d by managers' cognitive bias in agricultural product market forecasting

Figure 1 illustrates the logic of agricultural credit guarantee risk triggered by the cognitive biases of the managers of the new agricultural business entities in the agricultural product market forecasting: "□the financial departments of various provinces and cities provide funding for the establishment of agricultural credit guarantee institutions to offer policy support for attracting financial capital investment in the "agriculture, rural areas and farmers"--□the financial departments of provinces and cities have not made additional investment in the cognitive ability of the managers of new agricultural business entities to predict agricultural product market --□agricultural credit guarantee institutions provide guarantees to banks to allow financial capital to flow into "agriculture, rural areas and farmers"--□the managers of the new types of agricultural business entities receive credit guarantee support, but they do not have the cognitive ability to predict the agricultural product market--□the financial capital obtained by the managers of some new agricultural business entities does not match their cognitive ability to predict agricultural product market, which may cause managers to make mistakes in risk decisions and bring risks to agricultural credit guarantee (see Figure 1).

4 Data description and research method

4.1 Data description

(1)Data sources

According to wireless network transmission to obtain the relevant data of agricultural credit guarantee. The data in this paper were derived from the real data generated by the agricultural credit guarantee system in L Province: the data were produced from July 2017 to December 20, 2019. Because D city is a city specially designated in the state plan, it has provincial-level economic management authority, and the agricultural credit guarantee system of L Province does not cover D city. Therefore, 510 new agricultural business entities that have been recommended by 33 banks in L Province (excluding D city) to the agricultural credit guarantee system and obtained guarantee credit lines were selected. Among them, 449 new agricultural business entities fulfilled their contracts normally, and 61 of them had delayed repayment, owed interest, were unable to or refused to repay loans to banks and other financial institutions and resulted in defaults, accounting for 11.96%.

(2)Variable setting

In this paper, variables were set based on the loan risk rating index system of China Postal Savings Bank for family farms (large and specialized agricultural family operations), the loan guarantee risk rating index system of agricultural credit guarantee institutions and related studies.

1. Dependent variable: agricultural credit guarantee risk. The risk in agricultural credit

guarantee is mainly the default risk of the new types of agricultural business entities [25]. Therefore, the situation where the managers of the new agricultural business entities delayed repayment, owed interest, were unable to or refused to repay loans to banks and other financial institutions, and thus have caused default and brought compensatory risk to the agricultural credit guarantee system as the risk in agricultural credit guarantee.

2. The core independent variable: the manager's cognitive bias in agricultural product market forecasting. Yang Xiaoguang and Cheng Jianhua defined the scientific knowledge that should be possessed by the managers of new agricultural business entities as the cognition of agricultural product market forecasting. That is, the managers' cognition of the huge impact of macroeconomic policies on the economic situation of the agricultural product market [5].

3. Mediating variable: information acquisition channels. The government builds or adds channels for managers of new agricultural business entities to obtain information on the development direction of the agricultural product market in the next 3-5 years. Therefore, the evaluation indicators for measuring information acquisition channels in the loan guarantee risk rating index system of agricultural credit guarantee institutions were used for reference, That is, whether the local government has built information acquisition channels to allow the managers of the new agricultural business entities to have a clear understanding of the development direction of the agricultural product market in the next 3-5 years was used for measurement.

4. Control variables: based on the loan risk rating index system for family farms (large and specialized agricultural operations) of Postal Savings Bank of China and the loan guarantee risk rating index system of agricultural credit guarantee institutions, the control variables were divided into two dimensions, namely the non-financial situation and the financial situation of managers.

(1) Non-financial situation of managers, including sales channels, procurement channels, concentration of main business, duration of personal continuous operation, personal orders, business premises, and main settlement methods. The more stable the sales and procurement channels of the managers of new agricultural business entities, the shorter the payment period. The longer the continuous operation in this industry, the more concentrated the main business, the lower the customer turnover rate, and the lower the probability of manager's default. Generally speaking, if the manager has the right to use the business premises and the property rights of housing, with strong liquidity, advance payment as the main settlement method, guaranteed source of repayment, then the guarantee risk is small.

(2) Financial situation of managers, including indicators of five aspects: profitability, asset-liability ratio, gross sales margin, operating cash inflow, and inventory turnover rate. If the managers of new agricultural business entities are engaged in agricultural production and operation projects with high sales margins, low asset-liability ratio, high inventory turnover rate, operating cash inflow (which can be the total inflow from company account and personal account, but needs to be the actual inflow for personal use of business operation) greater than the annual sales, and profitability in the past two years, then the guarantee risk is small.

The meaning of variables, value assignment and descriptive statistics are displayed in Table 1.

Table 1Meaning of variables, value assignment and descriptive statistics

Name of the variable	The meaning and value of the variable	Min	Max	Standard deviation	Mean

Dependent variable	Risk in agricultural credit guarantee		1=risk 0=no risk	0	1	0.325	0.12
Core independent variable	The cognition bias of managers in agricultural product market forecasting		1=bias 0=no bias	0	1	0.347	0.14
Mediating variable	Information acquisition channels		1=Yes; 0=No	0	1	0.342	0.86
Control variables	Non-financial status of managers	Sales channels	2=The downstream customers have strong ability and the settlement is guaranteed (accounts receivable for more than one year accounts for no more than 10%), and the cooperation has been maintained for more than 3 years; 1=The main sales objects are retailers or end consumers, there is a certain period of the collection of sales payment, and the cooperation has been continued for less than 3 years or the main sales objects are end consumers; 0=The main sales objects are retailers or end consumers, with a high customer turnover rate and no fixed cooperation period.	0	2	0.68	0.642
		Procurement channels	2=The main suppliers have considerable strength, but the cooperation has been conducted for less than 3 years, or the main suppliers do not have strong ability, but the cooperation has been carried out for more than 3 years (inclusive); 1=The main suppliers do not have strong ability, and the cooperation period is less than 3 years; 0=There is a high frequency to change suppliers, and there is no long-term cooperative relationship.	0	2	0.77	0.661
		Concentration of main business	The bank's actual measured value	0	1	0.98	0.079
		Personal orders	1=Orders signed with major downstream customers can cover the average sales of more than half a year; 0=Orders signed with major downstream customers cannot cover the average sales of more than half a year	0	1	0.44	0.505
		Duration of personal continuous operation	Duration of actual operation	1	32	8.89	5.530
		Business premise	1=With certificates of land use right and housing property right; 0=Without certificates of land use right and housing property right;	0	1	0.70	0.457
		Main settlement methods	3=Advance payment (the ratio is more than 50%); 2=Pay as you go; 1=Mainly on credit (the period is usually within 3 months); 0=Credit sales	0	3	1.36	1.063
		Profitability	1= Achieving profit in the past 2 years; 0=Operation loss in the past 2 years	0	1	0.96	0.203
	Financial status of managers	Asset-liability ratio	The bank's actual measured value	0	19	0.31	1.121
		Gross profit margin	The bank's actual measured value	-17	1	0.24	1.140
		Operating cash inflow	The bank's actual measured value (10,000 yuan)	0	17100	1091.89	2.273
		Inventory turnover rate	The bank's actual measured value	0	34	2.14	2.725

4.2 Research method

(1) Support Vector Machine (SVM)

The principle of the support vector machine is shown in Figure 1. The hollow and solid circles in the figure represent two different types of samples. H denotes the hyperplane. H_1 and H_2 represent the planes closest to and parallel to the hyperplane H in the two types of samples. The sample points on H_1 and H_2 are called support vectors, which are aimed to maximize the margin between the H_1 and H_2 planes.

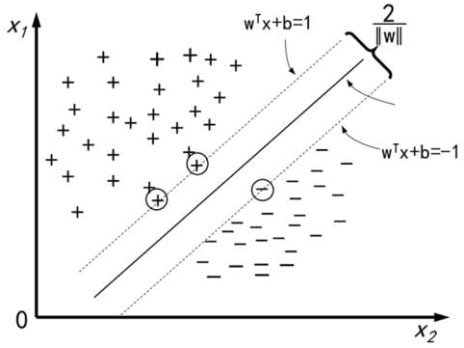

Figure 2 Schematic diagram of support vector machine

Let the training set S be

$$S=\{(x_1,y_1),(x_2,y_2),\ldots,(x_N,y_N)\} \quad (1),$$

Where xi□Rn represents the feature vector, yi□{-1,+1} is the state corresponding to the feature vector x_i, i=1,2,...,N. The goal of the support vector machine is to find the hyperplane H with the largest margin, and the corresponding optimization problem is:

$$\max_{w,b} \frac{2}{\|w\|} \quad (2)$$

$$\text{s.t.} \quad y_i(w^T x_i + b) \geq 1, i = 1,2,...,m$$

Obviously, in order to maximize the margin, we only need to maximize $\|w\|^{-1}$, which is equivalent to minimizing $\|w\|^2$, and the following is obtained:

$$\min_{w,b} \frac{1}{2}\|w\|^2 \quad (3)$$

$$\text{s.t.} \quad y_i(w^T x_i + b) \geq 1, i = 1,2,...,m$$

Solve the above equation to obtain the classification hyperplane H $w^{*T} x + b^* = 0$

The hard margin requires all samples to be divided correctly. However, in real tasks, it is difficult to determine a suitable hyperplane to completely divide the samples. The soft margin allows some samples to not meet the constraints, and a slack variable is introduced to each sample point to make the function margin plus the slack variable greater than or equal to 1, Then, the constraint is transformed into

$$y_i(w^T x_i + b) \geq 1 - \xi_i, i = 1, 2, ..., m \quad (4)$$

The objective function becomes:

$$\min_{w,b} \frac{1}{2} \| w \|^2 + C \sum_{i=1}^{m} \xi_i \, (12) \quad (5)$$

Where C>0 is the penalty parameter. The soft margin support vector machine requires as few samples as possible that do not meet the constraints while maximizing the margin. C is a parameter that reconciles the two.

(2)Particle Swarm Optimization Algorithm

Suppose that in a D-dimensional object search space (that is, a D-ary function), there are N particles constituting a swarm, and the i-th particle is a D-dimensional vector:

$$X_i = (x_{i1}, x_{i2}, \ldots, x_{iD}), \ i = 1,2, \ldots, N \quad (6)$$

The flight speed of the i-th particle is also a D-dimensional vector, denoted as:

$$V_i = (v_{i1}, v_{i2}, \ldots, v_{iD}), \ i = 1,2, \ldots, N \quad (7)$$

The optimal position searched by the i-th particle so far becomes the individual extremum, expressed as:

$$P_{best} = (p_{i1}, p_{i2}, \ldots, p_{iD}), \ i = 1,2, \ldots, N \quad (8)$$

The optimal position searched by the entire particle swarm so far is the global extremum, denoted as:

$$G_{best} = (p_{g1}, p_{g2}, \ldots, p_{gD}) \quad (9)$$

When finding these two optimal values, the particles need to update their speed and position according to the following equation:

$$V_{id} = w * v_{id} + c_1 r_1 (P_{id} - x_{id}) + c_2 r_2 (P_{gd} - x_{id})$$
$$x_{id} = x_{id} + v_{id} \quad (10)$$

Where c_1 and c_2 are learning factors, which are also called acceleration constants, and r_1 and r_2 are uniform random numbers in the range of [0,1]. The equation of speed update is composed of three parts. The first part is inertia, which represents the tendency of particles to maintain their previous speed. The second part is the cognition, reflecting the memory of their own historical experience, representing the tendency of particles to approach their historical optimal position. The third part is the social part, reflecting the group historical experience of collaboration and knowledge sharing between particles.

5 Prediction and result analysis of agricultural credit guarantee risk

5.1 Model construction

In the macro context of wireless networks, this study explored the impact of 14 factors on risk, involving risk awareness, sales channels, procurement channels, concentration of main business, duration of personal continuous operation, business premise (with certificates of land use right and housing property rights), main settlement methods, profitability, asset-liability ratio, gross profit margin, operating cash inflow and inventory turnover rate. These 14 influencing factors were used as the input of the DBN model, and the output is whether there is risk, with 1 meaning risk and 0 denoting no risk.

Then the problem is a supervised learning task, which is to know the relationship between the

input (14 influencing factors) and the output result (whether there is risk) based on the existing dataset.Break through the limitation of space and time through wireless network, transmit the network signal of agricultural credit guarantee.

Support Vector Machine (SVM) is a new type of machine learning algorithm, which is also based on statistical theory and strict mathematical theory. Owing to its simple and clear geometric interpretation and high generalization ability, it has a unique advantage in solving the problem of small samples. Besides, compared with artificial neural networks, it overcomes the problems of local optimal solutions, long learning time and slow convergence speed. However, SVM still has some limitations. For example, the prediction accuracy of the model is greatly affected by the selection of the training learning parameters. Therefore, selecting appropriate parameters is the key to the practical application of SVM. In this study, the PSO algorithm was adopted to optimize the parameters that are difficult to be determined by SVM, so that a PSO-SVM prediction model was established for risk prediction.

5.2 The training process of optimization of SVM parameters by PSO

The application of the PSO algorithm in finding the kernel function suitable for the SVM model consists of the following steps: (pso-svm.py)

Step1: Read the parameter configuration of particle swarm from config and initialize it;

Step2: Set the individual extremum of each particle to be the current position, use fitness function (fitness_function) to calculate the fitness value of each particle, and use the individual extremum corresponding to good fitness as the initial global extremum;

Step3: Perform iterative calculation according to the equations for updating particle's position and speed to update the particle's position and speed;

Step4: Calculate the fitness value of each particle after each iteration according to the fitness function of the particle (fitness_function). If the fitness value of each particle is better than the fitness value of its individual extremum (pbest_fitness_value), update the individual extremum, otherwise the original value is kept; if the updated individual extremum of each particle is better than the global extremum (gbest_fitness_value), the global extremum is updated, otherwise the original value is kept;

Step5: Iterate until the termination condition is met, and the parameter combination that contributes to an optimal model is obtained after reaching the maximum number of iterations.

The pso-svm workflow is shown in Figure2

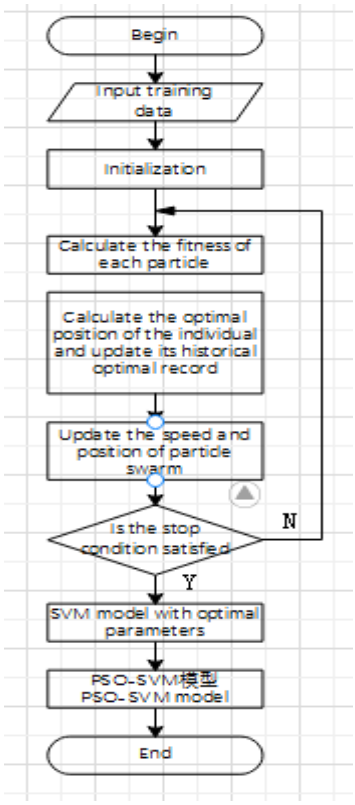

Figure 2 Diagram of pso-svm workflow

In order to train and test the PSO-SVM model, the collected data were divided into two parts: training set, validation set and test set.

A part of the data were randomly selected from all the data as the training set to train the model and allow the model to learn. The performance of the model on the verification set was used as the fitness function to evaluate the performance of the SVM model; the remaining data were used to test the performance of the model, that is, the influencing factors of the data that have not been engaged in the training were used as input to evaluate the advantages and disadvantages of the method proposed in this paper.

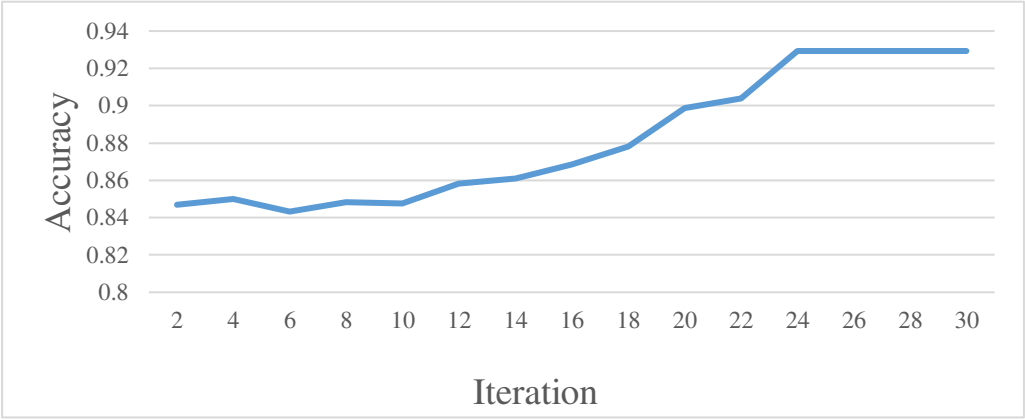

Figure3 The schematic diagram of the training process of PSO-SVM model

The training process of the PSO-SVM model is shown in Figure 3. As the number of iterations increases, the fitness value (accuracy) of the optimal individual in the particle swarm gradually increases and becomes stable, indicating that the model is gradually converging and

becoming stable.

5.3 Comparison between SVM and PSO-SVM

In order to illustrate the superiority of the proposed PSO-SVM over SVM, the test ratio was set to be 0.3 to compare the performance of the two models on the test set. The changes of the accuracy rate were documented, as shown in the figure4 below.

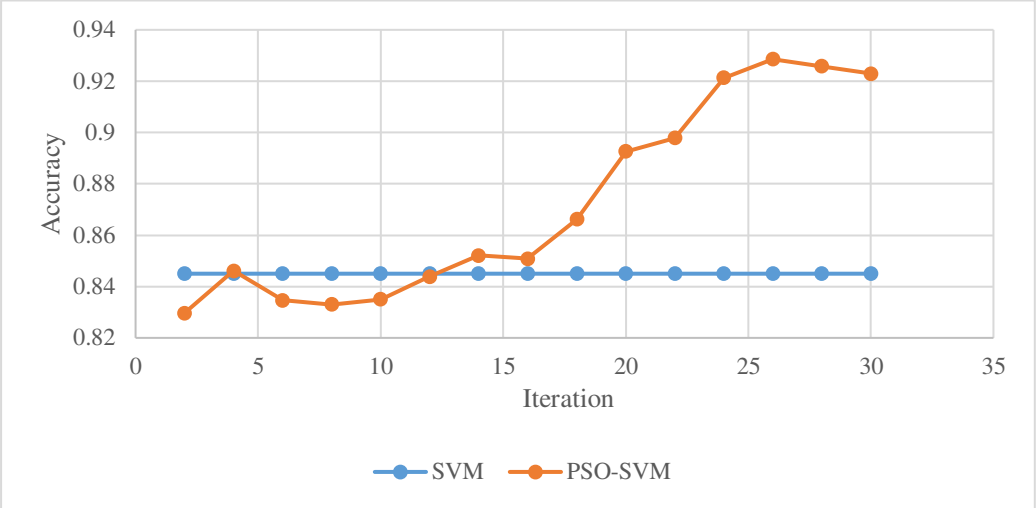

Figure4 Comparison between the accuracy rate of PSO-SVM and SVM

As the number of iteration increases, the accuracy of the SVM method has not changed. This is because SVM uses fixed model parameters, and its model performance is consistent; the accuracy of the PSO-SVM method gradually increases and tends to be stable. Finally, the accuracy of the PSO-SVM-based model for the identification of risk in agricultural credit guarantee reaches 92.2%, and the accuracy of the SVM-based risk identification model is 84.5%. The reason is that during the iterative process of PSO-SVM, the parameters of the SVM are continuously adjusted by the PSO algorithm, which gradually improves the performance of SVM.

6 Conclusion

Based on the wireless network, this study uses PSO-SVM to model the real data of 510 types of new agricultural operating entities in the agricultural credit guarantee system of L province from 2017 to 2019, and identifies the risks. The influencing factor, namely the cognitive bias of the new agricultural business entities in the prediction for the agricultural product market was incorporated into the original influencing factors, thereby improving the factors in three dimensions that affect the accuracy of model's risk identification. Finally, a high-accuracy model for identifying risks in agricultural credit guarantee based on PSO-SVM was established, and its accuracy of the identification results was compared with that of the unimproved SVM model. With 14 influencing factors in the test set as input, and a test ratio of 0.3, the following conclusions were obtained: First, after improving the parameter selection and algorithm of the model for the identification of risks in agricultural credit guarantee based on the traditional SVM, the accuracy of the improved model is higher than that of the traditional model. Second, after adding the influencing factor, namely the cognitive bias of the new agricultural business entities in agricultural product market forecasting, the accuracy of agricultural credit guarantee risk identification model based on PSO-SVM under wireless network reached 92.2%, indicating that the model is well trained and can accurately identify the risks of agricultural credit guarantee in practice.

Conflict of interests:

The authors declare that they have no competing interests in this section.

References

[1]Luo Xing,Ma Jiu-jie.More than good wishes: solving the supply dilemma of financial entrepreneurs and cooperative financial organizations[J].Chinese Rural Economy,2015(12):49-62.

[2]Zhu Qian-yu,Luo Xing.Exclusive resources of organization cost and initiator control of rural fund mutual aid[J].Chinese Rural Economy,2015(12):49-62.

[3]Zhang Hai-feng.Institutional entrepreneurship and long-term economic growth[J].Learning and Practice,2015(05):5-12.

[4]T.W.Schultz.Transforming Traditional Agriculture[M]The Commercial Press，2006.

[5]Yang Xiao-guang,Cheng Jian-hua.Economic For ecasting:Charateristics &ind Quantitative Methods[J].J.Sys.Sci.&6Math.Scis.2019，39（10），pp：1553-1582.

[6]AN Haiyana,HUANG Dajia.Financing of land management right: Farmers' cognition and participate willingness[J].Journal of Hunan Agricultural University (Social Sciences),Apr.2019,20(2):008–015.

[7]Tversky A，Kahneman D．Availability：A heuristic for judging frequency and probability[J]．Cognitive psychology，1973，5(2)，207-232．

[8]M. Aoki.Toward a Comparative Institutional Analysis[M]．Cambridge：MIT Press,2001：467.

[9]Ajzen I.From intentions to actions:A theory of planned behavior[M]// Action Control. Heidelberg：Springer,1985：30-120．

[10]Shelly Taylor, Leticia Anne Peplou, David Sears.Social Psychology[M].Shanghai People's Publishing House，2010：339-381．

[11]Masahi ko Aoki.Comparative Institutional Analysis[M]．Shanghai People's Publishing House，2001.

[12]Liu Zhi-rong.The mode dilemma and development choice of agricultural credit guarantee service system construction[J].Jianghuai Tribune,2016(03):12-18.

[13]XU Li-li,CHEN Dong-ping.Can Reputation Promote Self-performance of Policy-backed Loans?[J].Seeking Truth,2019,46(05):81-90.

[14]Besley T.,and S.Coate,1995,“Group Lending,Repayment Incentives and Social Collateral”,Journal of Development Economics,46(1):1-18.

[15]Tang Yi Fu.Research on Building the Agricultural Credit Guarantee System[J].Rural Finance,2017(01):110-113.

[16]FAN Yali，DING Zhiguo.Policy versus Independence:Study on Dynamic Balance of Agriculture Credit Guarantee Institutions Operating Mechanism[J].Journal of Agrotechnical Economics,2018(11):69-79.

[17]Xu Li-li,Ban Li-li，Chen Dong-ping.Path exploration of the agricultural credit guarantee institutions involve in the external financing of industrial chain[J].Jiangsu Journal of Agricultural．Science,2019,35(04):973-979.

[18]Zhang Jie.Latest Development of Institutional Finance: Review of Literature[J].Economic Research,2011,46(03):145-159.

[19]Xu Li-li，Chen Dong-ping.What is the Alienation Reasons of the Contractual Coupling Mechanism of the Guarantee Agriculture of the Agricultural Credit Guarantee Institution[J].INNER MONGOLIA SOCIAL SCIENCES,2017,38(03):125-131.

[20]Jiang Hao.Conceptual model and empirical analysis of managers' cognitive bias[J].Chinese

Journal of Management Science,2014,22(S1):299-306.
[21]Xiao Wang-xi, Tao Jian-ping.Farmers' sense of controlling endowment risk and their perception of natural risk[J].Statistics and Decision,2020,36(01):76-80.
[22]CUI Jian-gang，SUN Ning-hua.Industrial Relationship，Pairing Poverty Alleviation and Coordinated Development of Regions:An Input — Output Analysis of Jiangsu，Zhejiang，Shanghai and their Supporting Regions[J].Economic Issue,2019(03):95-103.
[23]AN Hai-yan，Zhang Qing-jiao.The measurement and analysis of farmers' cognitions to mortgage loan of land operation rights[J].Journal of Hunan Agricultural University (Social Sciences), Apr. 2018, 19(2):001–007
[24]Wang Ji-ning, Zhao Shun-longExternally constrained cognitive bias behavioral bias and peasant household loan dilemma[J].Management World,2007(09):69-75.
[25]WEI Guo-xiong.The Risk Management of the Credit Strategy of Commercial Banks[J].The Finance Forum,2015,20(11):10-17.

Figures

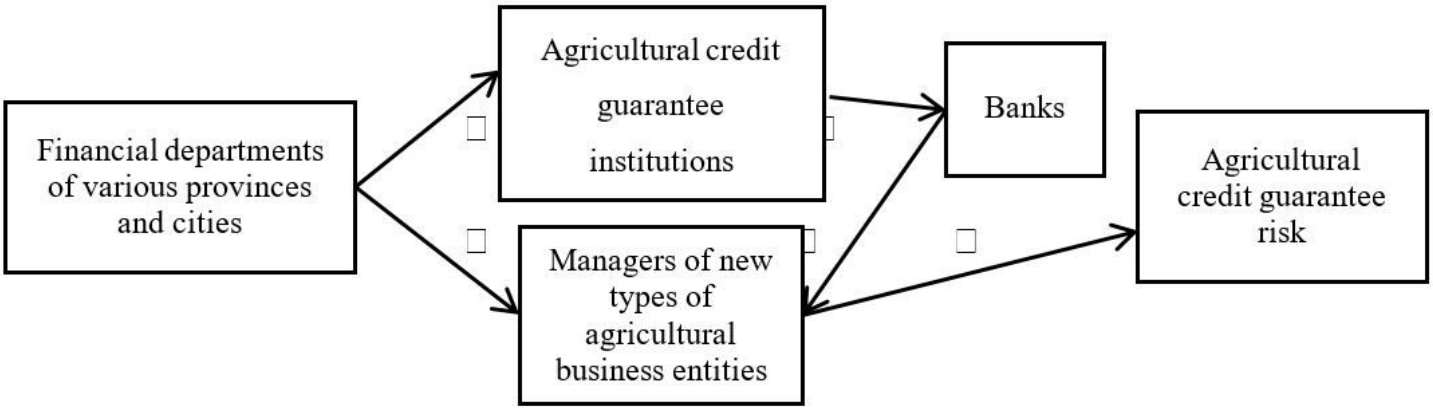

Figure 1

The logic diagram of the agricultural credit guarantee risk triggered d by managers' cognitive bias in agricultural product market forecasting

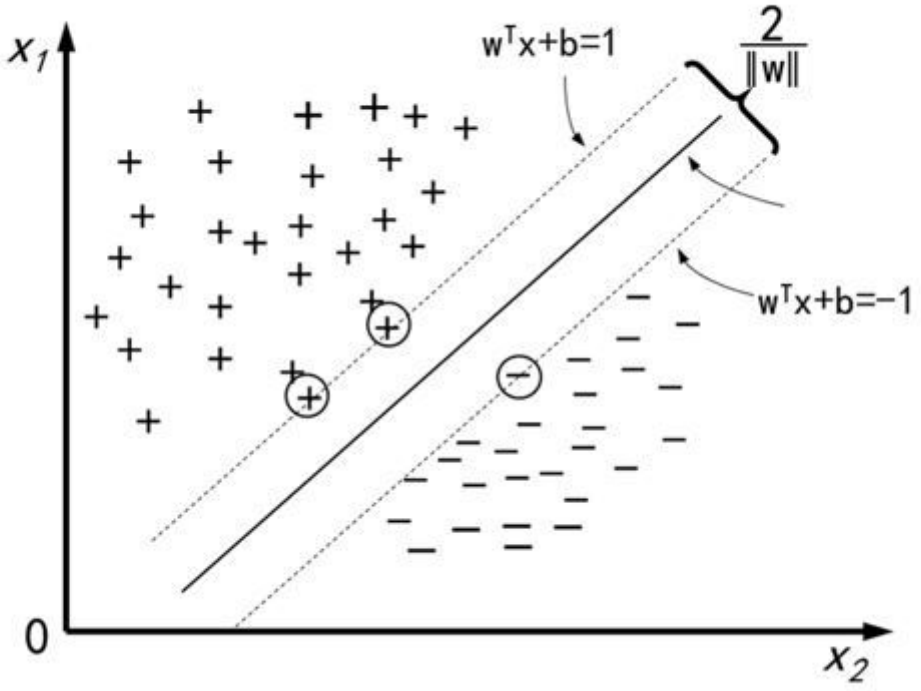

Figure 2

Schematic diagram of support vector machine

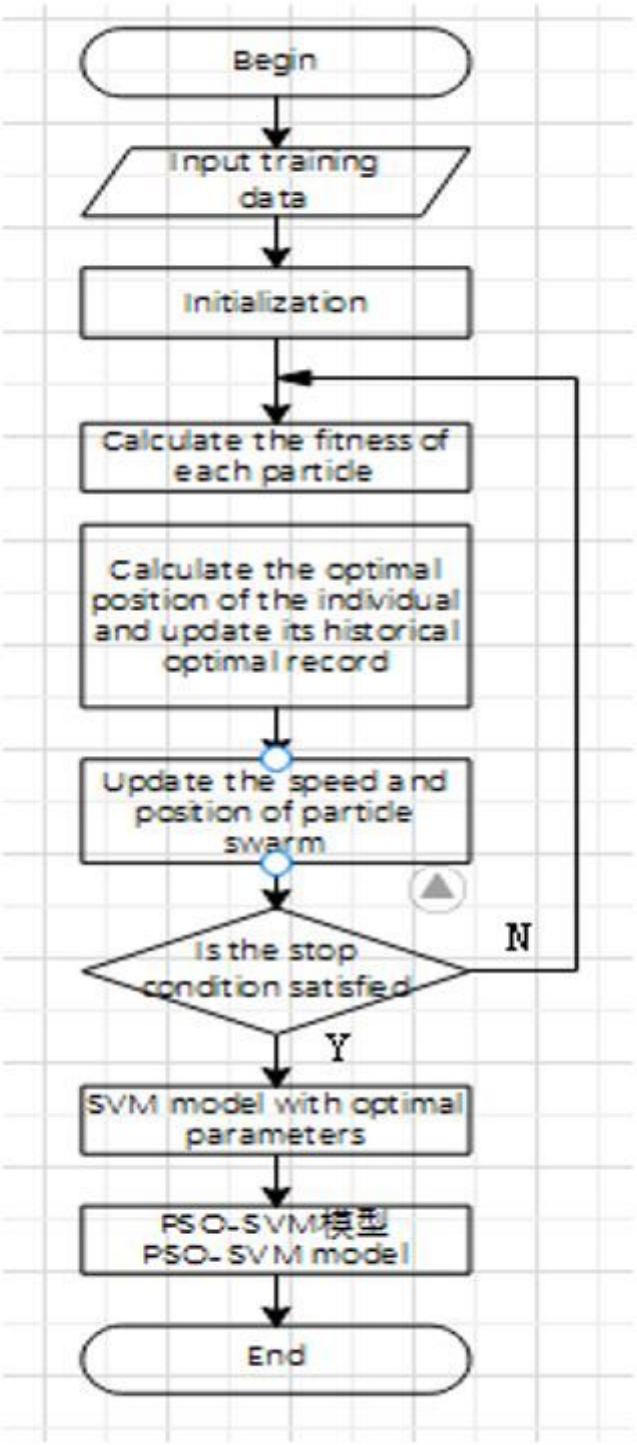

Figure 3

Diagram of pso-svm workflow

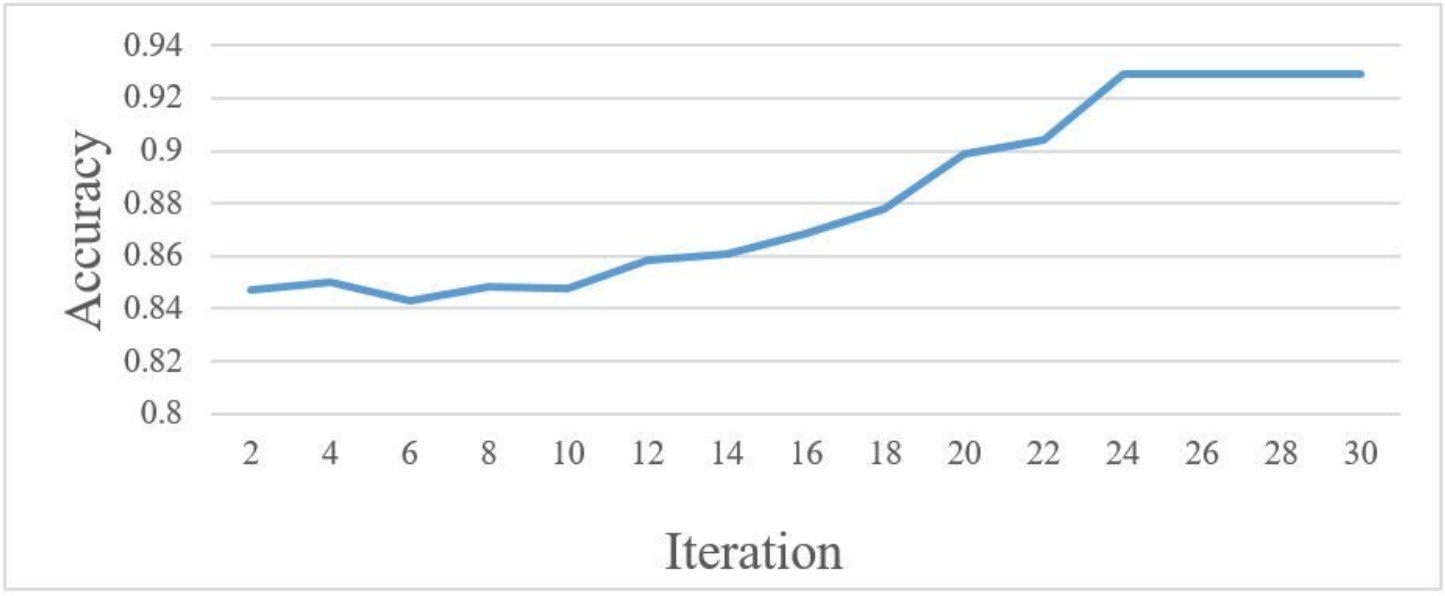

Figure 4

The schematic diagram of the training process of PSO-SVM model

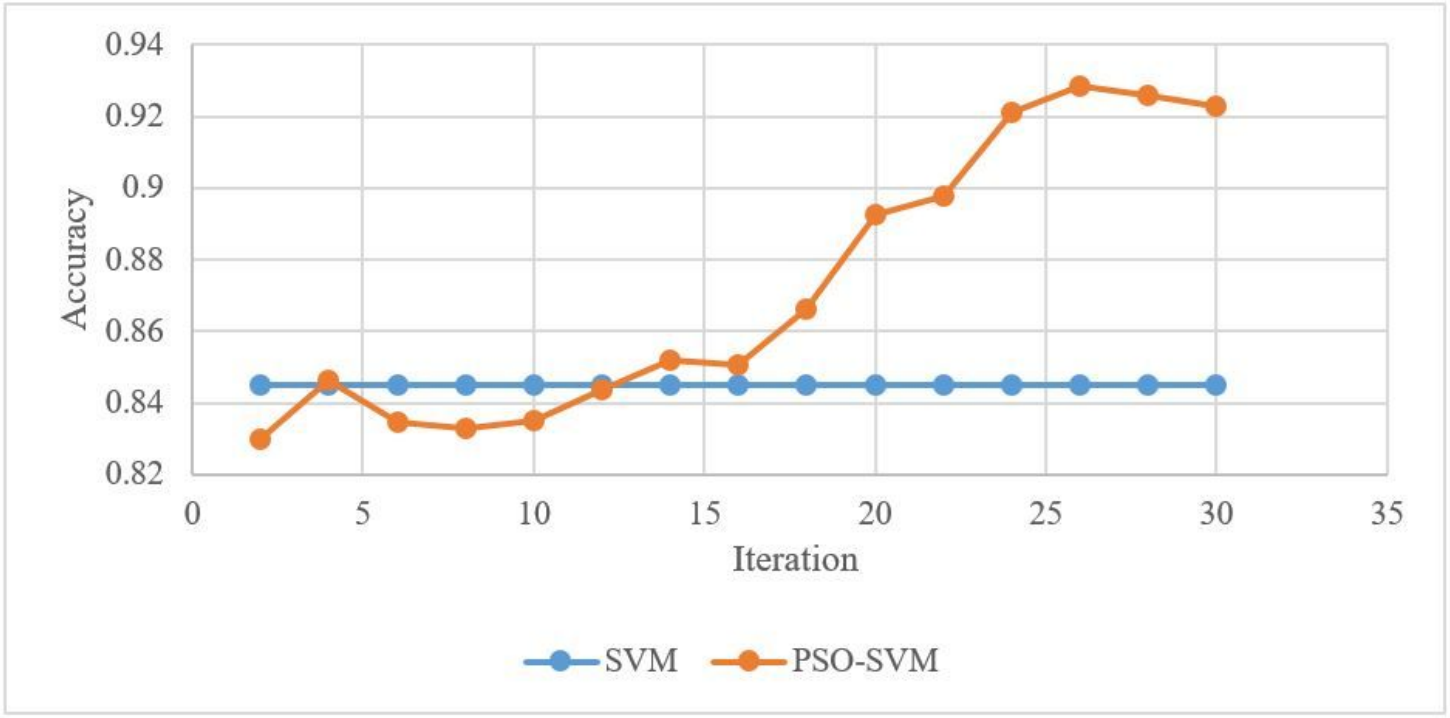

Figure 5

Comparison between the accuracy rate of PSO-SVM and SVM