Hindawi
Mobile Information Systems
Volume 2022, Article ID 1778469, 10 pages
https://doi.org/10.1155/2022/1778469

Research Article

Big Data e-Commerce Economic Development by Using IoT and Support Vector Machine

Jie Zheng [1] and Guohua Yang [2]

[1] *Business Administration Department, Zhanjiang University of Science and Technology, Zhanjiang 524255, China*
[2] *Shipping Management Department, Guangdong Ocean University, Zhanjiang 524088, China*

Correspondence should be addressed to Guohua Yang; yghua@gdou.edu.cn

Received 18 August 2022; Revised 20 September 2022; Accepted 3 October 2022; Published 13 October 2022

Academic Editor: Shadi Aljawarneh

The development of e-commerce economy is closely related to the progress of computer technology, which provides an effective data basis for the development of e-commerce economy. Support vector machines are not only used to analyze and solve the second-class classification problems but also can analyze and solve the first-class classification problems. The rise of the e-commerce economy is not only conducive to increasing people's income but also conducive to the realization of income increase in some economically backward areas and the improvement of various infrastructures, thus breaking the characteristics of inconvenient transportation in some areas and promoting the development of regional economy. Therefore, this study introduces the concept of Internet of Things and robust support vector machine technology, which are more advanced in computer technology, into the e-commerce system to optimize the existing e-commerce platform and knowledge mode. From the regression results of the fixed effect model, the e-commerce economy will have a certain positive impact on the regional economic gap, although the magnitude of the impact is not large. From the overidentification test and the regression results of the dynamic panel, the sign of the variable regression coefficient has been relatively stable, which means that the dynamic panel model described in this study not only does not have the problem of overidentification but also has stability.

1. Introduction

Support vector machine is a kind of machine learning method. Because it can realize the optimization problem, it has not only made major breakthroughs in theory but also advanced in algorithms. Especially, in these years, the research and analysis in this field have been paid attention to worldwide [1]. The use of support vector machines can obtain more accurate classification results because this method obtains the optimal partition hyperplane through the maximum interval method. However, the traditional support vector machine has certain drawbacks. In the original problem, the noise will have a great influence on the regularization term based on the L2 norm, which will cause the robustness of the support vector machine to decrease [2]. The higher the robustness of the support vector machine, the better the effect can be achieved in pattern recognition and machine learning, so it is necessary to strengthen the research on robustness [3]. The basic network architecture of the Internet of Things is as follows: perception layer, which generally collects and processes information, network layer, whose task is to transmit information, and application layer, which first analyzes and processes information and then makes control and decision-making [4]. The three layers are arranged in the order of the perception layer, the network layer, and the application layer. The network layer in the middle has the role of a bridge between uploads and releases and is the information exchange center between the first and third layers. The application layer can not only process the transmitted information but also realize information sharing, which can provide better support for the business processing of the e-commerce economy and can also promote the informatization and intelligence of various industries to a large extent [5]. The e-commerce economy has injected new vitality into China's overall economy, which is conducive to the adjustment of China's industrial structure and the transformation of economic development, but it also has the same problem as all industries [6]. We can see from the development model of the e-commerce economy in the current era that this is a broader economic model than the traditional economy, which can realize the participation of all people. So, this economic form has a great effect on increasing the personal income of residents [7]. Literature analysises and discusses on regional economic development and differences, as well as the role of e-commerce in the middle [8].

2. Related Work

Since the support vector machine method began to appear, it has shown very good performance in pattern recognition and machine learning, and the research on support vector machine has become more and more mature in recent years. Standard support vector machines are good at handling two-class classification problems, but in people's production and life, in addition to two-class classifications, there are also single-class classifications [9]. Therefore, to solve this problem, a smooth support vector machine method is proposed. This new method is correct. The standard support vector machine has been improved. By expanding the smooth strategy, the unsolvable constrained optimization problem in the standard support vector machine has been turned into a smooth unconstrained optimization [10]. The literature describes the training process of the SVM algorithm as follows: first solve the convex quadratic programming problem (with linear constraints) and then continue to solve the dual problem through this result. Generally speaking, the calculation method of smooth support vector machine is used most of the time because this algorithm can solve the optimization problem with strong convexity and differentiability [11]. Looking at the research conclusions of various countries around the world, it can be seen that if the parameters in the sliding support vector machine model tend to be infinite, the unconstrained optimal solution it solves is more convergent [12]. The literature points out that OC-SVM, a type of support vector machine, are also a special form of SVM. In training, it is generally only necessary to carry out training operations on normal data, which are mostly used in anomaly detection. However, based on many experimental results, it can be seen that this algorithm has the disadvantage of being very sensitive to the reflection of abnormal points [13]. Therefore, in order to overcome the influence of noise on it, a more robust type of support has been studied and analyzed. The literature points out that the main areas of the Internet of Things can not only be balanced through relevant research and analysis but also use an extended general model. So, it can be concluded that it is very important to use the extended ecosystem to improve the analysis capabilities of the device itself [6]. The literature shows that there have been many relatively large changes in the e-commerce economy in recent years, and these changes may have a very large impact on the development of the service industry in the future. For example, the functions of the e-commerce economy in all aspects are becoming more and more independent, and their division of labor is becoming more and more precise and efficient [14]. Independence and precise division of labor are more obvious in the logistics industry and electronic payment. The scale of development in these two fields has grown rapidly, and the competition has become more and more fierce, which provides a strong support for the better and faster development of the electronic economy. The e-commerce economy has become an indispensable part of the current overall economic development [15]. In recent years, various relevant departments have formulated some policies that are conducive to the sound and sustainable development of the e-commerce economy according to their different functions. This has made China's e-commerce economy more effective [16].

3. Robust Support Vector Machine

3.1. Support Vector Machine, First-Class Support Vector Machine, and Smooth Support Vector Machine. We have studied and analyzed nonlinearities in these situations. When the sample set can be accurately divided by a straight line, there will be an optimal dividing hyperplane under the condition of the largest interval. This hyperplane will divide the two different samples on two sides:

$$(w \cdot x) + b = 0. \tag{1}$$

The original problem is solved first, and then, the dual problem is obtained as

$$\begin{aligned} &\min_{\alpha} \frac{1}{2} \sum_{i=1}^{l} \sum_{j=1}^{l} y_i y_j \alpha_i \alpha_j \left(x_i, x_j\right) - \sum_{j=1}^{l} \alpha_j \\ &s.t. \sum_{i=1}^{l} y_i \alpha_i = 0 \\ &\alpha_i \geq 0, i = 1, l. \end{aligned} \tag{2}$$

In $\alpha^* = (\alpha_1^*, \alpha_l^*)^T, w^* = \sum_{i=1}^{l} \alpha_i^* y_i x_i$, the corresponding component α_j^* of α^* is selected:

$$b^* = y_j - \sum_{i=1}^{l} y_i \alpha_i^* \left(x_i, x_j\right). \tag{3}$$

The training sample points are mapped from the original low-dimensional space to the high-dimensional space to obtain a new convex quadratic programming problem:

$$\begin{aligned} &\min_{\alpha} \frac{1}{2} \sum_{i=1}^{l} \sum_{j=1}^{l} y_i y_j \alpha_i \alpha_j \left(\varphi\left(x_i\right) \cdot \varphi\left(x_j\right)\right) - \sum_{j=1}^{l} \alpha_j \\ &s.t. \sum_{i=1}^{l} y_i \alpha_i = 0 \\ &0 \leq \alpha_i \leq C, i = 1, l. \end{aligned} \tag{4}$$

Using this method, we can solve some nonlinear classification problems in real life, but, at the same time, there are difficulties in determining the mapping function. There are many types of kernel functions, and we also have a lot of basis in the selection process. In the actual use process, the following are more commonly used. The linear kernel function is shown as

$$K(x, y) = x \cdot y. \tag{5}$$

The radial basis function kernel function is shown as

$$K(x, y) = \exp\left(-\frac{\|x-y\|^2}{2\sigma^2}\right). \tag{6}$$

The sigmoid kernel function is shown as

$$K(x, y) = \tanh[v(x \cdot y)+c]. \tag{7}$$

The effect of the radial basis function among these kinds of kernel functions is better and relatively ideal. Therefore, this study selects the radial basis function as the kernel function. A type of support vector machine generally only needs to perform training operations on normal data during training and is generally used in anomaly detection. This algorithm is based on the establishment of the optimal partition hyperplane to achieve classification. The decision function is shown as

$$f(x) = sign((w \cdot \varphi(x)) - \rho). \tag{8}$$

The sample point with a value of 1 represents a normal sample, and the sample point with a value of −1 represents an abnormal point.

The optimization problem is solved first, and then, the dual problem is obtained as

$$\begin{aligned} &\min_{\alpha} \frac{1}{2} \sum_{ij} \alpha_i \alpha_j K(x_i, x) \\ &s.t. 0 \le \alpha_i \le \frac{1}{vl}, \sum_i \alpha_i = 1. \end{aligned} \tag{9}$$

Finally, the decision function can be expressed as

$$f(x) = sign\left(\sum_i \alpha_i K(x_i, x) - \rho\right). \tag{10}$$

It can be seen from formula (13) that if you want to solve the decision function of a type of support vector machine, you do not need a very accurate mapping function, but only need to use a kernel function.

The smooth support vector machine is improved on the basis of a class of support vector machines. It can solve the constrained optimization problems that cannot be solved in the traditional class of support vector machines through smooth technology and can obtain smooth unconstrained optimization problems.

If α and ξ are the normal vector and the slack variable and $C > 0$ is the compromise parameter, then the nonlinear classification hyperplane is shown as

$$K(x', A')D\alpha = b. \tag{11}$$

ξ can be rewritten as

$$\xi = (e - D(K(A, A')D\alpha - eb))_+. \tag{12}$$

The result of the optimization problem obtained by the smoothing strategy is unique.

The function $p(\Delta, \lambda)$ is introduced to replace Δ_+ approximately. When $\lambda \longrightarrow \infty$, it converges to Δ_+. The expression of $p(\Delta, \lambda)$ is shown as

$$p(\Delta, \lambda) = \Delta + \frac{1}{\lambda} 1n\left(1 + e^{-\Delta\lambda}\right), \lambda > 0. \tag{13}$$

(16) can be expressed as

$$\min_u \frac{c}{2}\left\|p(e - DKD_1 u, \lambda)\right\|_2^2 + \frac{1}{2}\|u\|_2^2. \tag{14}$$

Among them, $K = (K(A, A'), -1), D1 = \begin{pmatrix} 1, 0 \\ 0, D \end{pmatrix}$, an d $u = (b, \alpha)$.

3.2. Robust Support Vector Machine. M-estimators can be expressed by the potential function Φ, and instead of the regularization term based on the L2 norm in formula (14) and (15),we can obtain

$$L(u) = \min_u \frac{c}{2}\left\|p(e - DKD_1 u, \lambda)\right\|_2^2 + \frac{1}{2}\Phi(u). \tag{15}$$

Proposition 1. *Based on the theory of conjugate convex function, potential function Φ will get a conjugate convex function ϕ:*

$$\Phi(u) = \min_v \left\{(u-v)^2 - \phi(v)\right\}, \tag{16}$$

where $v = (v_0, v_1, v_m)^T$ is an auxiliary variable.

When different Φ functions are selected, the minimum value function v obtained by formula (16) is also different. According to Proposition 1, it can be concluded that the optimization problem (18) can be rewritten as

$$L(u, v) = \min_{u,v} \frac{c}{2}\left\|p(e - DKD_1 u, \lambda)\right\|_2^2 + \frac{1}{2}\left[(u-v)^2 - \phi(v)\right]. \tag{17}$$

We solve the optimization problem (20), make the derivative equal to 0, and combine with equation (16) to get

$$\frac{\partial L}{\partial u_j} = c\sum_{i=0}^{l} (\Delta_i)_+ \times \frac{\partial \Delta_i}{\partial u_j} \times \frac{e^{\lambda\Delta_i}}{1 + e^{\lambda\Delta_i}} + \left(u_j - v_j\right). \tag{18}$$

Let the derivative be equal to 0, and the expression for u is $u = v - h$. Therefore, the optimization problem (20) can be solved through the following iterative process as

$$\begin{aligned} v^\tau &= u^{\tau-1} - \frac{u^{\tau-1}}{\sqrt{\theta + \left(u^{\tau-1}\right)^2}} \\ u^\tau &= v^\tau - h, \end{aligned} \tag{19}$$

Table 1: Parameter settings of SSVM and RSSVM on two artificial datasets.

Dataset	SSVM		RSSVM		
	c	σ	C	θ	σ
Two-Moon	0.001	0.005	0.001	10^{-3}	0.25
Ripley	0.02	0.01	0.003	10^{-2}	0.25

Note. C is the penalty parameter, θ is the parameter greater than 0, and σ is the width parameter.

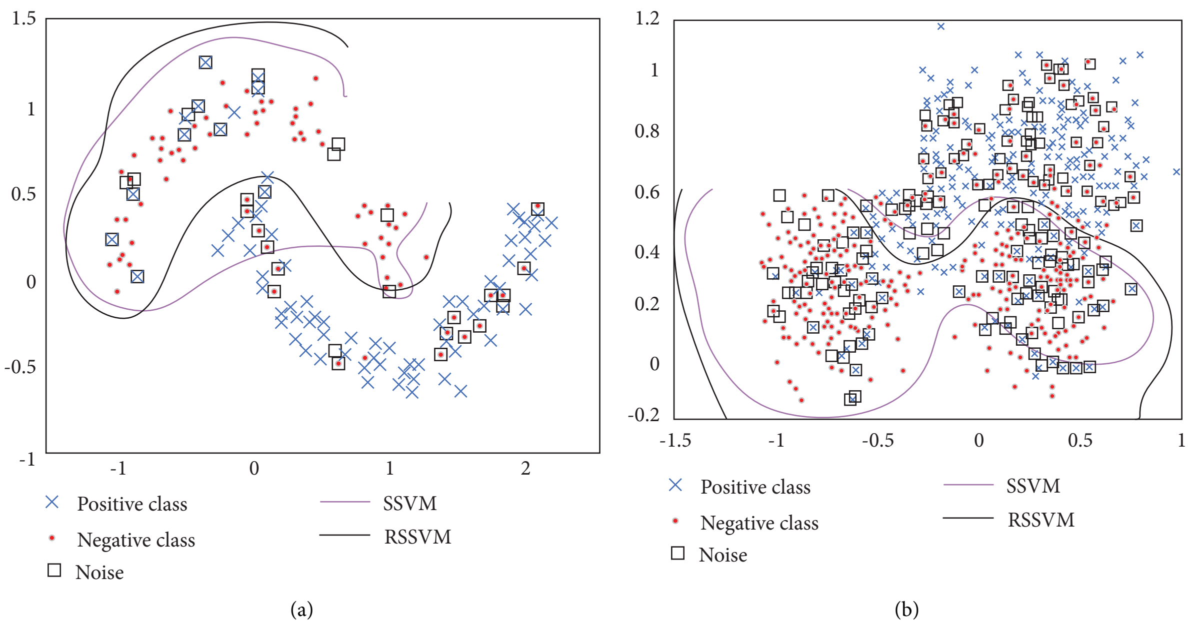

Figure 1: Classification effect of SSVM and RSSVM on two artificial datasets. (a) Two-Moon. (b) Ripley.

where τ represents the τth iteration and $h = (h_0, h_1, \ldots h_m)^T$, v is determined by the potential function Φ; this study selects $\Phi(u) = \sqrt{\theta + u^2}$ so that the potential function Φ obtains the minimum value of $v(u) = u - u/\sqrt{\theta + u^2}.u$, which is obtained by deriving formula (19).

Both the SSVM and RSSVM methods use Gaussian kernel functions. The parameters of the two algorithms in the two artificial datasets are shown in Table 1.

50% of the sample dataset is randomly selected as the training sample, and the other 50% as the test sample. SSVM and RSSVM, respectively, conduct 100 experiments in two types of samples, analyze 100 experimental results, and obtain the average accuracy of training samples and test samples. Take this average value as the accuracy of the final training sample and test sample, as shown in Figure 1.

In this study, the two algorithms are tested on the standard dataset. The detailed description of the standard dataset is shown in Table 2.

3.3. A Robust Support Vector Machine. A robust support vector machine introduces the function $p(\Delta, \lambda)$ to replace Δ_+ approximately. When $\lambda \longrightarrow \infty$, $p(\Delta, \lambda)$ converges to Δ_+. The expression of $p(\Delta, \lambda)$ is shown as

$$p(\Delta, \lambda) = \Delta + \frac{1}{\lambda} 1n\left(1 + e^{-\Delta\lambda}\right), \lambda > 0. \tag{20}$$

The optimization problem of a smooth type of support vector machine SOC-SVM is shown as

$$\min_{\alpha,\rho} \frac{1}{2vl} \sum_{i=1}^{l} \left\| p\left(\left(\rho - \sum_{j=1}^{l} \alpha_j K\left(x_i, x_j\right)\right), \lambda\right)\right\|_2^2 + \frac{1}{2}\alpha' \alpha - \rho. \tag{21}$$

M-estimators can be expressed by the potential function Φ, and then, replacing the regularization term based on the L2 norm in Equation (21), we can obtain

$$\begin{aligned} L(\alpha) = \min_{\alpha,\rho} \frac{1}{2vl} \sum_{i=1}^{l} \left\| p\left(\left(\rho - \sum_{j=1}^{l} \alpha_j K\left(x_i, x_j\right)\right), \lambda\right)\right\|_2^2 \\ + \frac{1}{2}\Phi(\alpha) - \rho. \end{aligned} \tag{22}$$

The optimization problem (22) is solved by the semi-quadratic minimization optimization method.

According to Proposition 1, the optimization problem (22) can be rewritten as

$$\begin{aligned} L(\alpha, v) = \min_{\alpha,v,\rho} \frac{1}{2vl} \sum_{i=1}^{l} \left\| p\left(\left(\rho - \sum_{j=1}^{l} \alpha_j K\left(x_i, x_j\right)\right), \lambda\right)\right\|_2^2 \\ - \rho + \frac{1}{2}\left[(\alpha - v)^2 - \phi(v)\right]. \end{aligned} \tag{23}$$

Table 2: Information about the standard dataset.

Dataset	Number of samples	Feature number
Banana	5300	2
Banknote authentication	1372	4
Breast cancer	263	9
Checkdata	345	7
Curie 1 data	35	25
Fertility	100	9
Titanic	24	3
Transfusion	748	4
Planning relax	182	12
Wpbc	194	33

Two sets of artificial datasets are selected to carry out comparative experiments. The two sets of data are defined as Line_noise and Square_noise. The experimental comparison of OC-SVM and RSOC-SVM on the Line_noise dataset is shown in Figure 2.

The experimental comparison between OC-SVM and RSOC-SVM on the Square_noise dataset is shown in Figure 3. We can see from it that, on the two artificial datasets of Line_noise and Square_noise, the generalization performance of RSOC-SVM is better than that of OC-SVM Better.

4. The Internet of Things in the Economic Application of Big Data e-Commerce

4.1. Big Data Technology Framework in the Internet of Things. An agreement is a set of standard regulations and requirements, which allows two electronic products to connect and exchange information with each other. The protocol makes corresponding specifications for the data transmission of different devices in a network connection and then realizes the corresponding functions. They stipulate not only how to carry out error checking but also how to carry out other specifications such as compressing data. The main task of the Internet of Things is to process some problematic network signals, such as frequently interrupted network signals and slower network signals. This study introduces a more appropriate protocol that has been used in the IoT world.

The AMQP model includes producer, exchange, binding, and queue. The producer creates the message and then transmits it to the exchange. If the exchange determines that the received information meets the binding standards after analysis, it is transmitted to the queue. The message queue saves the information and transmits the message to the consumer queue that has completed the subscription. The specific principle diagram of the AMQP protocol is shown in Figure 4.

Before transmitting the established message, the producer in the model can set the attributes of the message, such as the persistence of the message. MRG is an open standard application message with both high-speed and low-latency characteristics. MRG also has lasting properties, which means that even if the broker's hardware fails, the message will not disappear and can be restored.

Generally, edge devices are used for data collection in the Internet of Things. Edge devices refer to devices that often reside at the edge of the network. Radio frequency identification is a mechanism that has been used to collect data relatively early. At the same time, there are more and more devices that use other mechanisms, including some devices that use sensors, such as MEMS and mobile phones. The Internet of Things will be driven by the economic value. At the same time, the development of the Internet of Things will not only promote the improvement of social and economic benefits but also reduce production costs. M2M, or machine-to-machine technology, refers to the communication between devices of the same type, which can be wired or wireless, and then uses applications to capture and transmits sensor data. M2M generally cannot achieve complex communication and can often only meet the communication requirements between an enterprise's own devices. In the current Internet of Things, M2M technology is widely used and almost everywhere. It is an important part of the Internet of Things. The M2M terminal bears the responsibility of connecting the sensing extension layer and the network layer in the Internet of Things structure. The basic task is to collect data and process data. The system architecture of the Internet of Things is shown in Figure 5.

The terminal of M2M technology generally has two forms: one is a single-node terminal, which is a terminal device that can not only be directly connected to the telecommunication network but also has a sensing function; the other is a sensor gateway, which generally needs to be integrated transfer data, then process, and store it.

If you want a more suitable method to obtain data on edge devices, you must have a consistent protocol to achieve it. However, currently, there is no fully consistent protocol in the entire field, and only a part of the special field is implemented. However, at the same time, more and more IoT standardization organizations have begun to appear and contribute to the standardization of the Internet of Things, such as OIC and AllSeen Alliance. Some related standardization organizations and the main research areas of these organizations are shown in Figure 6

The data of the Internet of Things are obtained from multiple directions and channels. The versatility of this data source is also a significant feature of the Internet of Things. It is precisely because of this universality that the task of data quality and management becomes more onerous, and processing heterogeneous data is a very important task.

To achieve the increase in the number of data collections, it is necessary to have a basic technical framework that matches it. A powerful framework can not only provide support in storage and query but also increase the percentage of effective data obtained. Because the data are not necessarily in the same network or the same machine, it is very complicated to collect and process the data in different networks and machines. Therefore, we must pay attention to the research and analysis of distributed data analysis, including how to conduct high-speed and efficient search and indexing.

4.2. Current Status and Characteristics of e-Commerce Economic Development. The beginning of China's e-commerce development can be said to be in 1997. Both China's

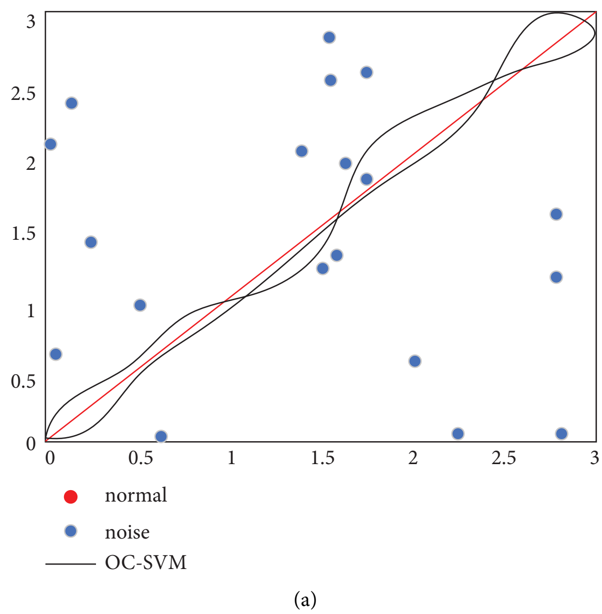

Figure 2: The classification effect of OC-SVM and RSOC-SVM on the line_noise dataset.

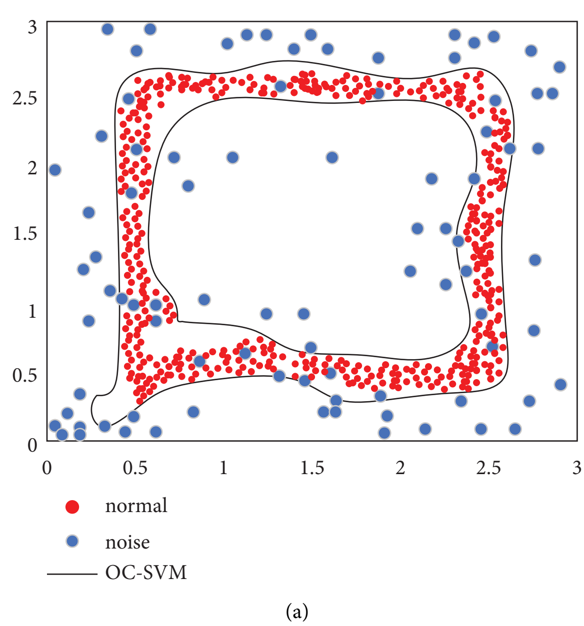

Figure 3: The classification effect of OC-SVM and RSOC-SVM on the square_noise dataset.

e-commerce and China's overall economic development are very fast. The development of e-commerce economy has injected new vitality into the overall economy, and the sound development of the overall economy has also given electronics. Business provides a good development environment. China's e-commerce transaction volume ranked second in the world as early as 2012. Not only the volume of transactions is large but also the compound growth rate of e-commerce is even more impressive. As early as 2003, it achieved a growth of 120%. Although the Internet was developed by learning from other countries, it is very important in people's hearts, especially for the younger generation. Many e-commerce websites in China are developing rapidly, such as China Chemical Network, Alibaba, and Dangdang. Compared with other countries, it has also achieved better growth. Basically, it can achieve a growth of more than 30% in all years. From the economic development in recent years, it can be seen that e-commerce occupies a high proportion in the economic development of some relatively backward areas. This paper conducts a study on it, using the static panel effect model and the dynamic panel model to carry out a comparative analysis, and found that

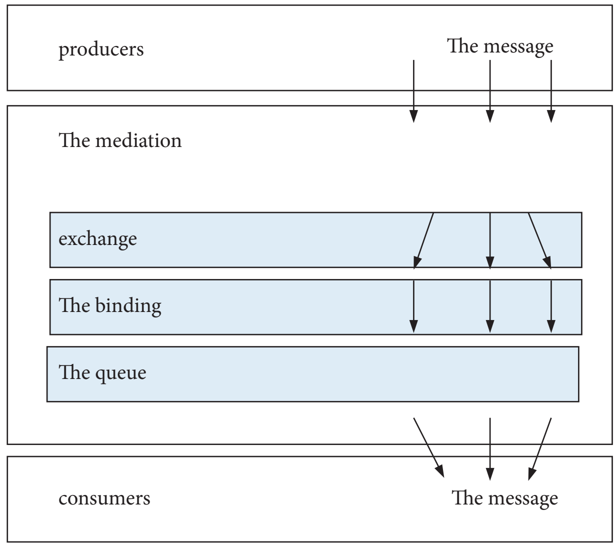

Figure 4: Schematic diagram of AMQP protocol.

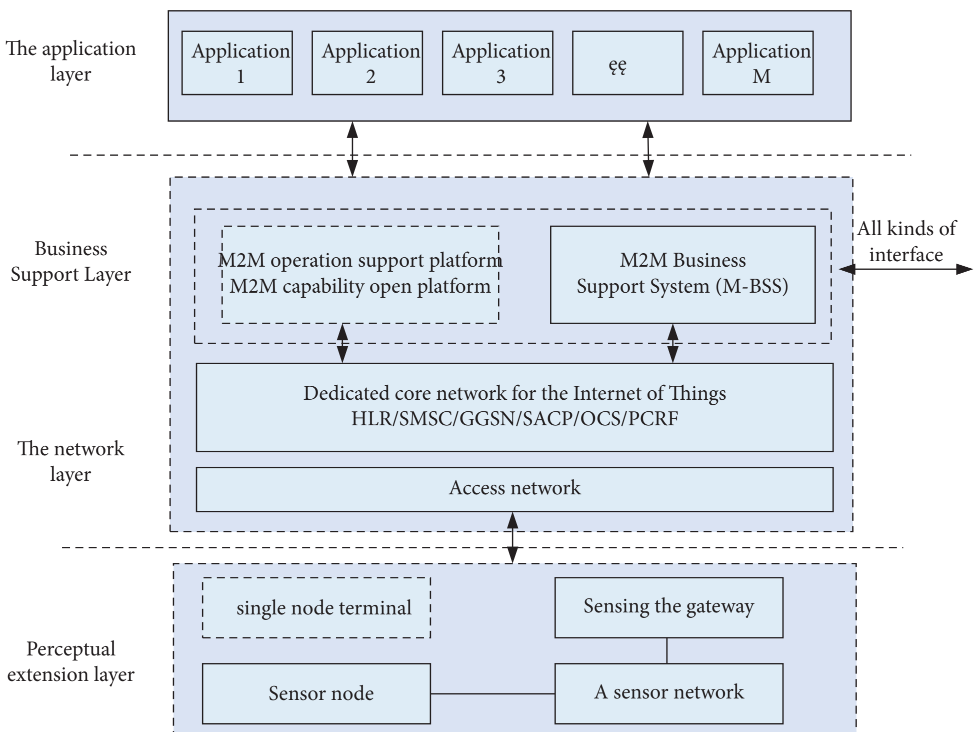

Figure 5: IoT system architecture.

the regional economic gap is not static, but dynamic. The economic development of e-commerce also has a very positive effect on the improvement of infrastructure in relatively backward areas. This way can indirectly enable some regions with relatively late economic development to get more development opportunities and narrow the gap between them and economically developed regions. This also requires the government to pay attention to the industrial cluster development of e-commerce economy, focus on establishing and cultivating some advantageous enterprises, and continue to strengthen regional construction. The cooperation between them will strengthen investment in various facilities, logistics, and distribution in the agglomeration area and continuously improve the competitiveness of the agglomeration area.

In recent years, China's e-commerce has developed very fast, and the growth rate of transaction volume has continued to increase. Especially, in the online retail market, it has achieved even more gratifying results. In 2012, it has already achieved a transaction volume of 1,311 billion yuan in the online retail market. According to the exchange rate at the time, it was equivalent to 206.8 billion U.S. dollars, and it

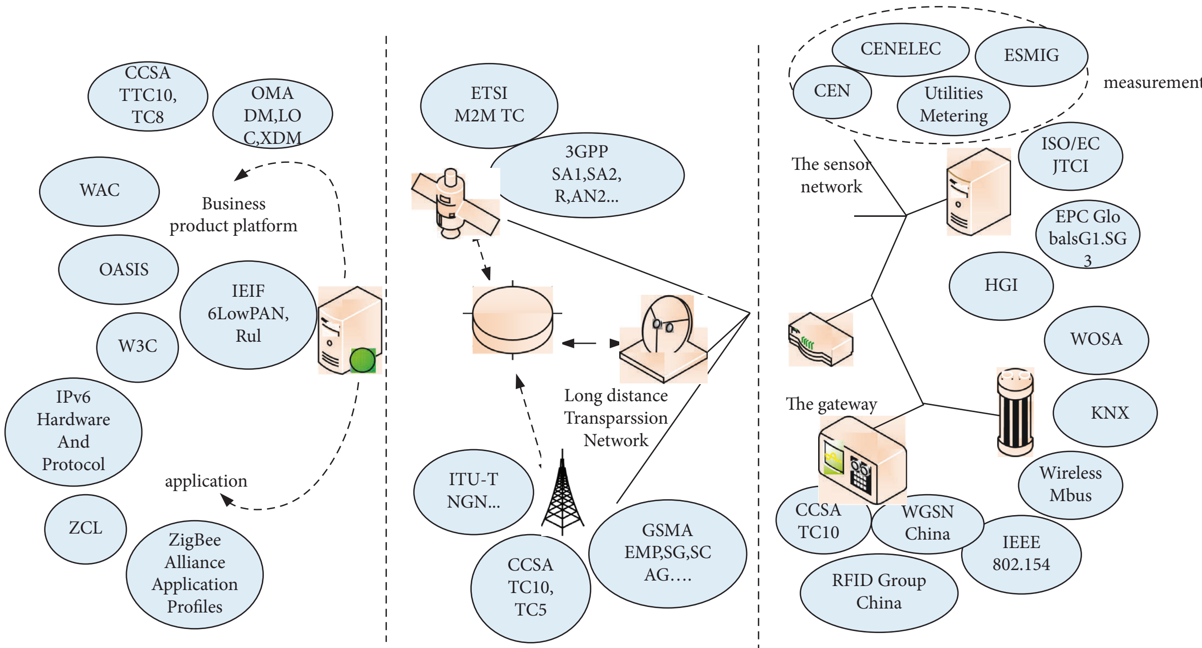

Figure 6: Standardization organizations related to the Internet of Things and their general research scope.

became the country with the largest transaction volume in the online retail market in 2013. In the online retail market, Alibaba is an e-commerce website with a relatively large market share. There will be large-scale promotions on November 11 every year, and consumers rush to buy. On the day of the "Double Eleven" event in 2018, the transaction volume was 19.1 billion yuan, and it increased every year for the next two years. This allowed people to see the rapid development of the online retail market. E-commerce is a new economic situation generated in accordance with the development requirements of the times. It provides an important guarantee for the rapid and sustainable growth of the overall economy and is an indispensable part of the overall economy. Researching and analyzing the survey results of the National Bureau of Statistics, we can see that, in 2011, it has reached the level of 0.67 websites on average for an enterprise. Many traditional retail companies in China have seen the huge potential of e-commerce and have begun to vigorously develop e-commerce. Since 2012, 60% of China's top 100 chain companies have begun to enter online retail. Research and analysis of the development of e-commerce transactions over the years shows that e-commerce has some new development models. However, from the perspective of the retail market, although C2C is still the main part, the market share of B2C is also gradually increasing.

4.3. The Influence of e-Commerce Economy on Regional Economic Development. Before the operation of regression analysis, the stationarity verification of each variable must be performed first, so as to ensure that the model will not have the problem of pseudoregression. Because of the use of panel data, it is not possible to simply use only one test method. Therefore, the LLC and PP methods are used to test the stationarity of the variables, respectively. The test results are shown in Table 3.

From the stationarity test in Table 4, under the two test methods, all variables are stable in the 5% significance test. Therefore, this study determines that there is no false regression problem based on the test results, so the data can be processed.

According to the analysis of the results of the Hausmann test, the model test value is 8.23, which means that the 1% significance test can be passed, so the fixed effects' model should not be used. From the regression results of the fixed effects' model, the e-commerce economy will have a certain positive impact on the regional economic gap, although the impact is not large. At present, there is still a certain economic gap between different regions in China, which has a lot to do with the previous inter-regional economic gap, which means that the economic gap can be self-adjusted. So, this study will conduct a dynamic panel model regression analysis. To obtain more accurate experimental data, this study conducts regression analysis on the two models. From the overidentification test and the regression results of the dynamic panel, the sign of the variable regression coefficient has been relatively stable, which means that the dynamic panel model described in this study not only has no overidentification problem but also has stability. From Table 4, we can see that different regional economic gaps have the function of self-regulation. It also shows from another angle that there is no problem using the dynamic panel model for analysis. From the regression results of the variables in the dynamic panel model in Table 4, it can be seen that the development of the e-commerce economy has a significant effect on reducing the regional economic gap. According to the analysis of the relevant regression results of the control variables, there are many factors that can have a positive impact on the regional economic gap, such as the level of economic development and the rate of urbanization. Table 4 shows regression result.

Table 3: Variable stationarity test.

Variable	LLC	Is it stable"	PP	Is it stable?
lntheil	−7.9602***	Yes	169.8863***	Yes
lndian	−8.2476***	Yes	168.6589***	Yes
lnurban	−11.7795***	Yes	416.0828***	Yes
lngdp	−6.5019***	Yes	87.5478**	Yes
lnroad	−8.3762***	Yes	72.4722**	Yes

Note. ***, **, and * indicate that they have passed the 1%, 5%, and 10% significance test, respectively.

Table 4: Regression result.

Variable	Static panel effect		Dynamic panel GMM	
	Random	Fixed	Difference	System
$\text{Lntheil}_{i,t-1}$	—	—	0.43*** (8.25)	0.37*** (9.12)
lndian	−0.23*** (−3.62)	0.20 (0.28)	−0.16** (−1.98)	−0.13*** (−4.14)
lnurban	0.12*** (5.20)	0.07*** (4.36)	0.08** (2.21)	0.04* (1.82)
lngdp	0.48*** (6.83)	0.52*** (8.20)	0.23*** (4.92)	0.35*** (8.45)
lnroad	0.07** (2.46)	0.04** (2.38)	0.03*** (4.08)	0.04*** (6.30)
Constant term	1.04* (1.87)	1.02* (1.92)	2.53*** (15.94)	2.51*** (20.06)
Hausman	8.23***	—	—	
Sargan test	—	—	268.29***	424.34***

Note. The values in parentheses in the table represent the t statistic, and ***, **, and * represent passing the 1%, 5%, and 10% significance test.

5. Conclusion

The current Internet can be said to have changed people's life, and people have enjoyed the convenience of the Internet in all aspects. In the field of electronic commerce, the existing pattern has been relatively mature; people can use e-commerce software to buy products for free. However, from the perspective of economic development, the existing model pays more attention to services. Therefore, it is necessary to systematically analyze the data of economic development and electric power Daqu and also to take certain technical optimization. In terms of technology optimization, this study puts forward the idea of Internet of Things and the technology of robust support vector machine. In recent years, the support vector machine method has not only been widely used and promoted in machine learning but also often used in pattern recognition. The application of these two fields and their related research are hotspots in the academic world. However, the traditional support vector machine has certain drawbacks. The noise in the original problem will have a great influence on the regularization term based on the L2 norm, which will cause the robustness of the support vector machine to decrease. The higher the robustness of the support vector machine, the better the effect will be achieved in pattern recognition and machine learning. Therefore, the research on robustness has been strengthened, and the new method proposed has obtained a type of support through some experiments. The robustness of vector machines has been improved to a certain extent. In recent years, China's e-commerce has developed very fast, with the growth rate of transaction volume. It keeps getting bigger, especially in the online retail market, and has achieved more gratifying results.

Data Availability

The data used to support the findings of this study can be obtained from the corresponding author upon request.

Conflicts of Interest

All the authors do not have any conflicts of interest.

Acknowledgments

This work was supported by Scientific research start-up project of Guangdong Ocean University: The Study on the Development Path of Shipping Financial Derivatives in Guangdong Province (Grant no. R19096).

References

[1] W. S. Noble, “What is a support vector machine?” *Nature Biotechnology*, vol. 24, no. 12, pp. 1565–1567, 2006.

[2] A. Widodo and B. S. Yang, “Support vector machine in machine condition monitoring and fault diagnosis,” *Mechanical Systems and Signal Processing*, vol. 21, no. 6, pp. 2560–2574, 2007.

[3] X. Wang, N. Fan, and P. M. Pardalos, “Robust chance-constrained support vector machines with second-order moment information,” *Annals of Operations Research*, vol. 263, no. 1-2, pp. 45–68, 2018.

[4] V. Aleksandrovičs, E. Filičevs, and J. Kampars, “Internet of things: structure, features and management,” *Information Technology and Management Science*, vol. 19, no. 1, pp. 78–84, 2016.

[5] B. W. Jo, R. M. A. Khan, and Y. S. Lee, “Hybrid blockchain and internet-of-things network for underground structure health monitoring,” *Sensors*, vol. 18, no. 12, p. 4268, 2018.

[6] H. Yu and L. Cui, “China’s e-commerce: empowering rural women?” *The China Quarterly*, vol. 238, pp. 418–437, 2019.

[7] S. Geng, T. Z. Ren, and M. H. Wang, “Technology and infrastructure considerations for e-commerce in Chinese agriculture,” *Agricultural Sciences in China*, vol. 6, no. 1, pp. 1–10, 2007.
[8] H. Zhang and J. Dong, “Prediction of repeat customers on e-commerce platform based on blockchain,” *Wireless Communications and Mobile Computing*, vol. 2020, no. 12, Article ID 8841437, 15 pages, 2020.
[9] R. Zhang and J. Ma, “An improved SVM method P-SVM for classification of remotely sensed data,” *International Journal of Remote Sensing*, vol. 29, no. 20, pp. 6029–6036, 2008.
[10] T. Xiong and V. Cherkassky, “A combined SVM and LDA approach for classification,” *Proceedings. 2005 IEEE International Joint Conference on Neural Networks*, vol. 3, pp. 1455–1459, 2005.
[11] A. Sun, E. P. Lim, and Y. Liu, “On strategies for imbalanced text classification using SVM: a comparative study,” *Decision Support Systems*, vol. 48, no. 1, pp. 191–201, 2009.
[12] M. Hu, Y. Chen, and J. T. Y. Kwok, “Building sparse multiple-kernel SVM classifiers,” *IEEE Transactions on Neural Networks*, vol. 20, no. 5, pp. 827–839, 2009.
[13] R. Velazquez-Pupo, A. Sierra-Romero, D. Torres-Roman et al., “Vehicle detection with occlusion handling, tracking, and OC-SVM classification: a high performance vision-based system,” *Sensors*, vol. 18, no. 2, p. 374, 2018.
[14] A. M. Purnamasari, “E-commerce product recommendations using xgboost with user clusters and clickstream,” *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 9, no. 4, pp. 5942–5948, 2020.
[15] M. G. Martinsons, “Relationship-based e-commerce: theory and evidence from China,” *Information Systems Journal*, vol. 18, no. 4, pp. 331–356, 2008.
[16] S. Ma, Y. Chai, and H. Zhang, “Rise of cross-border E-commerce exports in China,” *China and World Economy*, vol. 26, no. 3, pp. 63–87, 2018.