

Research on Application of artificial Neural Network in econometrics

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Abstract: As a fringe subject of artificial intelligence and systems engineering, artificial neuron network can not only discover more valuable data information, but also accelerate the calculation speed of data information in econometrics. With the rapid development of econometrics, the artificial neural network method has received wide attention of scholars research at home and abroad, compared with the traditional econometric method, artificial neural network algorithm with adjustable parameters and highly nonlinear simulation operation ability, self-learning and self-organization can function in dealing with practical problems, present a're likelier to carry a strong and adaptability. Therefore, on the basis of understanding the research status of econometrics and artificial neural networks, this paper mainly discusses how to apply artificial neural networks in econometrics, and makes clear the future application direction from the perspective of the development of the new era.

Keywords: Artificial neural network; Econometrics; Simulation operation; Minimum point

1. Introduction

Econometrics is a subject that uses the principles of network technology, statistics, mathematics and other disciplines to conduct statistical analysis of sample data on the basis of statistical data and economics. The randomness of econometrics breaks through the restrictions of qualitative analysis of traditional economic data and plays a positive role in modern economic system. Econometrics is mainly divided into two forms, one refers to theoretical econometrics, the other refers to applied econometrics. [1.2.3]The former is the theoretical knowledge of random analysis of economic variables, statistical data, looking for the calculation method of economic variables; The latter should study the effective application of econometric models in many aspects on the basis of theory. Although they have different research directions, they both need in-depth study and master relevant theoretical knowledge and practical experience. According to the econometrics discipline research experience accumulated in recent years, this subject has the characteristics of the cross, in many fields such as computer, statistics, mathematics has strong applied research value, so in the future development of economic construction, must want to learn more about the computer skills, only in this way can the comprehensive observation and analysis of relevant information. Although econometrics contains a lot of knowledge, there are great differences between the practical application model and the mathematical model, which have different applications in many aspects. According to the accumulated experience of econometrics research in recent years, the actual research objects can be divided into two aspects: cross-sectional data on the one hand and time series data on the other. The former is to analyze whether there is correlation between various economic behaviors, while the latter focuses on the data of different time of agreeing economic behaviors, showing the different behaviors of the research objects. Among them, the current research system of econometric models is shown in Figure 1 below:[4.5.6]

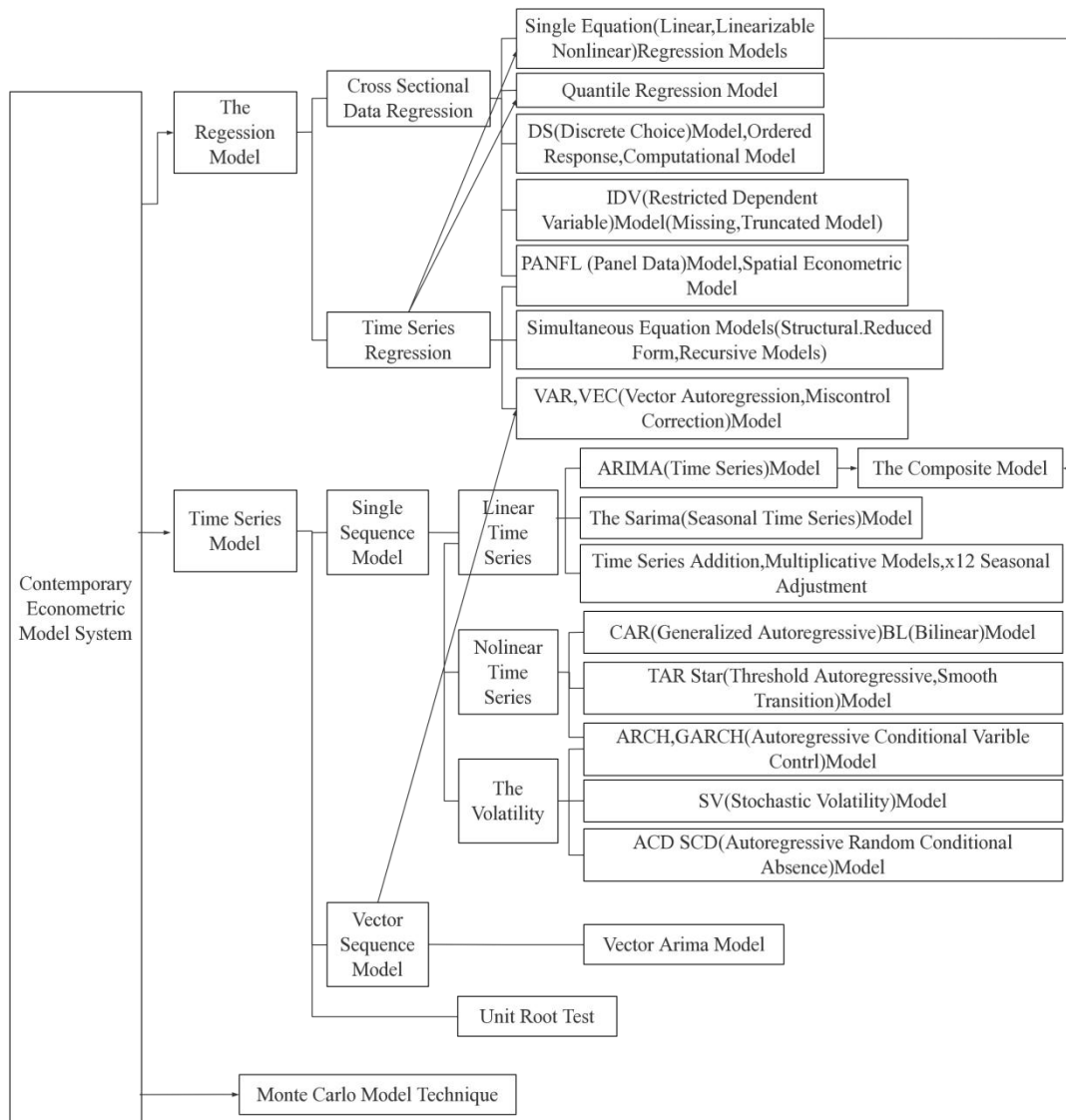


Figure 1. Research systems related to econometrics

From the perspective of economic forecasting, econometrics plays an important role in short-term forecasting. It should be noted that with the continuous development of theoretical technology, the forecasting function and related forms of econometrics have also changed. For example, Hal Van Rien, Google's chief economist, applied Google Trends data to economic forecasting for the first time, effectively solving the inflection point problem of econometric models, which proves that the situation of economic forecasting has changed completely in the era of big data. Nowadays, in addition to satellite remote sensing data, media text data, search engine trend data and other widely used in financial market change prediction, but also changed the traditional economic statistics is the only source of data indicators. In order to adapt to the work demand of economic forecasting more quickly, the econometric model in the new era should be integrated with other mathematical models, and only in this way can it play its forecasting role.

Artificial neural network algorithm as the main problems of the new age of artificial intelligence research, the combination of the following is shown in figure 2, the principle of structure analysis shows that the related content development has already received people's attention, the theory of technology research includes the computer science, informatics, philosophy, physiology, and other areas of the different subjects, different areas will scholars from different angles study of neural network, Therefore, the application research in econometrics is a huge project. In the field of mathematics, artificial neural network, as a special operation system, basically meets the requirements of the brain nervous system; In the field of physics, artificial neural network refers to

a complex network system consisting of a large number of simple components and connected with each other. The components refer to neurons simulated by optical and electronic devices. In the field of biology, artificial neural network is composed of nerve cells, used to realize a certain function of the brain nervous system content; In the field of information engineering, workers will regard the process of artificial neural network processing information as the autonomous activity of neurons and the mutual connection between neurons, which directly affects the effect of information processing. Therefore, after understanding the basic concepts of econometrics and artificial neural network, this paper mainly discusses how to apply artificial neural network algorithm in econometrics and clarify the development direction of future econometrics research.

2. Method

2.1 Analysis of econometric applications

Econometrics is the ultimate goal of using statistical methods to process economic data. This objective involves the following: first, the analysis of the relationship between various economic variables; Secondly, test the economic theory and hypothesis conditions; Finally, verify the predictive economic variables. Common data processing steps and forms are as follows:

On the one hand, it is assumed that the economic variables studied are closely related to each other, so corresponding economic models should be constructed. For example, Becker et al. constructed an economic model related to criminal markets in the late 1960s. Assuming that the criminal market is based on people maximizing their needs, the following formula can be obtained:

$$y=f(x_1,x_2,x_3,x_4,x_5,x_6,x_7)$$

According to the above formula analysis, it can be seen that y should be assumed to be related to $x_1, x_2, x_3, x_4, x_5, x_6, x_7$, where $x_1, x_2, x_3, x_4, x_5, x_6, x_7$ represent the independent variables in the formula, which are deduced according to the assumption of "satisfaction maximization", not imaginary. At the same time, each variable represents different meanings: y refers to the duration of the crime; x_1 is the payoff from crime; x_2 is the income from lawful labor; x_3 is other income; x_4 is the likelihood of being caught; x_5 is the probability of being put in prison after being caught committing a crime; x_6 is the expected length of the story after being caught; x_7 is the age.

On the other hand, to construct econometric model, we should discuss the functional relationship between them. For example, Becker obtained the following formula when constructing the econometric model related to the criminal market:

$$\text{Crime}=\beta_0+\beta_1\text{wagem}+\beta_2\text{othinc}+\beta_3\text{freqarr}+\beta_4\text{freqconv}+\beta_5\text{avgsen}+\beta_6\text{age}+\mu$$

In the above formula, β represents the model coefficient, which refers to the positive and negative correlation and correlation strength between the dependent variable and the independent variable. The letter abbreviations stand for the abbreviations of the variables in the model, and μ stands for the error coefficient, which refers to the effect of other possible independent variables not considered on the criminal market.

Thus, the general form of the econometric model is as follows:

$$y=\beta_0+\beta_1x_1+\beta_2x_2+\beta_3x_3+\beta_4x_4+\beta_5x_5+\beta_6x_6+\dots+\mu$$

2.2 Artificial neural network method and holographic association model

In the artificial neural network algorithm, the most common research method is the black box method, which models the internal mechanism and specific structure of the human brain based on its response pattern to external stimuli. According to the following figure 2 artificial neural network structure analysis, in order to better simulate the human thinking mechanism, the current scholars put forward many kinds of effective mathematical model, this study mainly discusses the mathematical model of associative memory, mainly analyzes the holographic associative model of artificial neural network algorithm, the specific process is as follows:

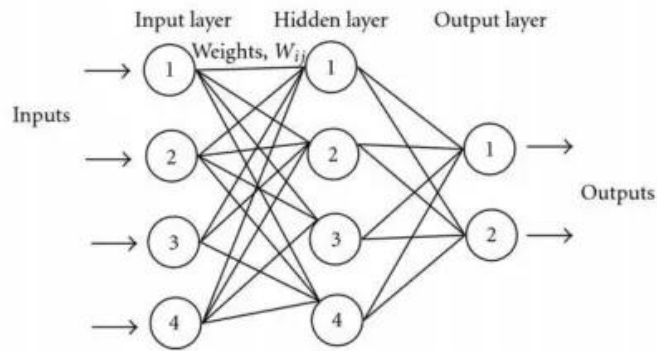


FIG. 2 Structure diagram of artificial neural network

First, the
$$Ax'_i = \sum_{i=1}^l (y_i, x_i^T) (\alpha x_i + P) = x \cdot y_i + Q \Delta y_i^*$$

First, the

Second, comparative analysis, obtain y_i , and get $\min_i \|y_i - y_i^*\|$

From this, it can be shown that under the condition $\alpha \sim 1, P - X_i$, it is possible to extend from x_i to y_i by the above associations.

In the case of large distortion of input stimulus, in order to ensure the effectiveness of association, holography principle should be combined to analyze.

2.3 "Pseudo" minimum point

Nowadays, artificial neural network method in the network training is backward diffusion method most used way, although there are a lot of practical application form, but their common theory is in dealing with nonlinear least squares index, the minimal value calculated by using the steepest descent method, but in the process of research problems of local minimum point easily. Nowadays, a variety of simulation experiments have proved that "fake" minima will cause ill-health problems in the network, so scholars from various countries have gradually strengthened the research efforts of this content. The artificial neural network is applied to econometrics, and the modeling process is shown in Figure 3 below:

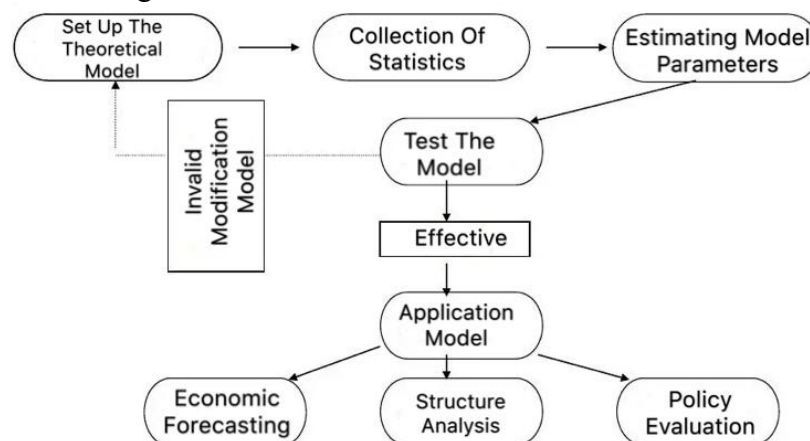


FIG. 3 Flow chart of econometric modeling

3. Result analysis

According to the traditional econometric research methods, neither the planning and guidance department nor the production personnel of the enterprise have the ability to fully grasp all the

performance of the complex system, and it is difficult to use the model to show the changing economic environment and adaptability. And in this paper, we study the artificial neural network can use a large number of nonlinear parallel processor to simulate human brain nerve system, using the simple structure of the processor and the intricate connection relations, to represent economic harmonious relations between the subject and the external environment, use the form of fixed structure to adjust parameters, to simulate the characteristics of consolidation of system, More emphasis on the relationship between the input and output of the system represented by the stimulus response will simulate the image thinking of economic agents. According to recent years, domestic and foreign research data show that the application of artificial neural network algorithm in traditional econometric models can not only master more valuable content in practice, but also meet the development needs of the economic system itself.

Combination of the following is shown in figure 4 the econometric analysis research process, along with our country social economy and science and technology to improve the technical level, the artificial neural network algorithm in econometric application scope is more and more widely, the information resources more and more, so in applied econometric study hours, should fully consider the polytropy of economic variables, Pay attention to integration of different subjects such as economics, statistics, mathematics knowledge, the theory of economic subject knowledge system, image into a more specific equation, and mathematical statistical methods such as calculations, such already can master more theoretical knowledge, and can be reasonable in practice to explore the use of different types of econometric model.

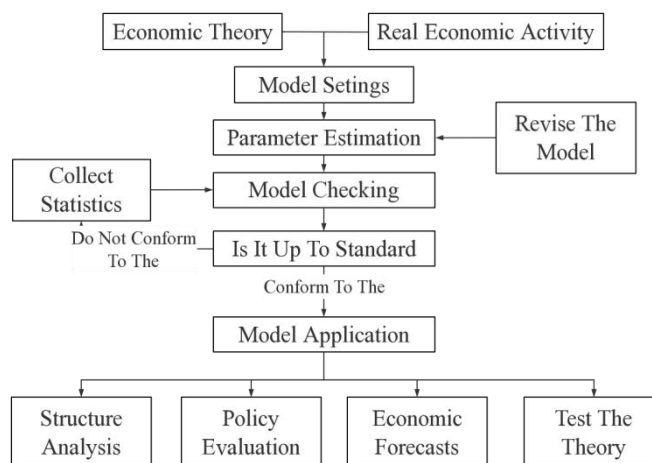


Figure 4. Research process of econometrics

4. Conclusion

To sum up, according to the economics and artificial neural network algorithms studied in this paper, econometric models can quantitatively analyze complex realistic problems and deeply explore the basic connotation of the research problems. Econometrics as part of the basis of modern economics, is mainly used to analyze the real economic activity and the changing trends of the number, so the staff mastering the multi-discipline theoretical knowledge and application experience, and actively learn from foreign research scholars to discuss the main topics and research achievements, and applied to the econometric research project in our country, Fully demonstrate the application value of artificial neural network algorithm. At the same time, to strengthen the training of professional and technical personnel, the econometric model of the application of traditional ideas, pay attention to the combination of artificial neural network algorithm to optimize the innovation, in order to clear all the variables in practice to explore the close relationship between, the continuous development of the theoretical knowledge of econometrics and application practice, the rich research scholars to discuss the problems in our country, Contribute to the construction and development of a harmonious social environment.

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