Study on the US Presidential Election Based on Neural Network

Chongzheng Huang, Wenxuan Liu, Lina Hu, Jiaying Zhang Xi'an Eurasia University, Yanta District, Xi'an City,710000, China

Abstract

The world's most watched U.S. election is in a state of anxiety, with Republican candidate Donald John Trump and Democratic candidate Joe Biden will compete for the presidency this month. The two candidates will show different political positions and administrative options in different areas of development and domestic and foreign policy. The election of different candidates will have a great impact on the United States economy and the global economy, and will have a great impact on the trend of international relations. In response to question one, we need to analyze the possible impact of election of different candidates on the United States economy. We first quantitatively analyze the policy data of the two candidates obtained in the network in different fields. By merging the quantitative models of different fields, the AHP is used to calculate the weights of different fields, and the comparison between two candidates in each field and the impact on the American economy. According to the large data set collected, we do cluster analysis, and analyze and predict the impact of different fields by BP neural network model. For the second question, in order to analyze the impact of different candidate is elected to the Chinese economy, according to the problem a model for analysis, in order to improve the accuracy of the model, this part adds more considerations variables, at the same time, higher precision, based on genetic algorithm neural network model, after finishing the data concentration, 80% of the data used in the model, variables to determine index weight and threshold, the remaining 20% of the data by residual error calculation is used to model accuracy test. In view of question three, through the analysis of question one and question two and the actual situation, we can get the final winning candidate. And through the analysis of its economic and policy means to give China's economic countermeasures and policies in related fields. By referring to a large amount of data, this paper finally obtains the influence of different candidates on the united states, china and the global economy and politics through data visualization analysis of different candidates' policy claims in different fields. In order to further improve the model accuracy and computational efficiency, this paper also proposes to use Levenberg-Marguardt-based algorithm to solve the problem.

Keywords

American election; Global economy; Neural network; International relations.

1. INTRODUCTION

1.1. Background of the Problem

As the 2020 presidential election officially kicked off, Republicans fought for re-election under current President Donald Trump, and former Vice President Joe Biden (Joe Biden) became Democratic presidential candidate after the Democratic primary defeated rival Sanders. Observing the economic policies of the Biden and Trump campaigns essentially reflects in part the differences in political and economic ideas between the Democratic (Democrat) and the Republican (Republican) sides. The national general election of the President of the United States was held on November 3,2020, and the Electoral College voted on December 14,2020 to elect the new President and Vice President. The new president will take office on January 20,2021. The article discusses the possible impact of the election of two candidates on global economic policy.

1.2. Restatement of the Problem

The U.S. presidential election is held every four years. In 2020, the year of the U.S. presidential election, Republican candidate Donald Trump and Democratic rival Joe Biden will run for president. Candidates from both parties have different political stands and administrative programs in finance and trade, economic and financial governance, and other different key development areas (such asCOVID-19 fighting measures, infrastructure, taxation, environmental protection, medical insurance, employment, trade, immigration, education, etc.). The election of different candidates will shape different global economic and financial development strategies, with greater impact on the U.S. economy and the global economy, including China's economy. How will different policies affect the U.S. and Chinese economies? How should China respond? Our team needs to collect candidates' policy ideas, policy guidelines, and related data in different areas and answer the following questions:

1.Establish a mathematical model that use data to quantify the possible impact of the election of different candidates on the United States economy. (We can choose one or more areas to answer this question separately, or we can answer it in a comprehensive way)

2. Establish a mathematical model that use data to quantify the possible impact of the election of different candidates on China's economy. (We can choose one or more areas to answer this question separately, or we can answer it in a comprehensive way)

3. Suppose we were members of the China Economic Development Think Tank, combined with the mathematical models of Questions 1 and 2, in both cases, what advice do we have on economic countermeasures and policies in China-related areas (which party wins)? Illustrate our points specifically.

2. PROBLEM ANALYSIS

2.1. Analysis of Question I

The first question requires us to establish a mathematical model for quantitative analysis using relevant data, which can be answered from one or more fields or in a comprehensive way. We need to analyze the possible impact of the election of different candidates on the U.S. economy. Consequently, We first quantitatively analyze the policy data of the two candidates obtained in the network in different fields. Analytic hierarchy process is used to calculate the weight of different fields, to analyze the contrast between two candidates in each field and the impact on the American economy. According to the large data set collected, we do cluster analysis, and analyze and predict the impact of different fields by BP neural network model.

2.2. Analysis of Question II

The second question still requires us to establish a mathematical model and make quantitative analysis with relevant data, which can be answered from one or more fields or in a comprehensive way. In order to analyze the impact of the election of different candidates on China's economy, according to the problem one model to analyze and predict, in order to improve the accuracy of the model, this part adds more consideration variables, while using a more accurate, genetic algorithm-based neural network model, the organized data set, 80% of the data is used for model solving, to determine the weight and threshold of variable indicators, the remaining 20% of the data through residual calculation for model accuracy testing.

2.3. Analysis of Question III

The third question requires us to combine the mathematical model of Question 1 and Question 2, and assume that I am a member of China's economic development think tank. In the two cases, I will specifically explain my Suggestions on China's economic countermeasures and policies in relevant fields. Through the analysis of question 1 and question 2 and the actual situation, we can predict the final winning candidate, and give some suggestions on China's economic countermeasures and policies in related fields through the analysis of its economic and policy means.

3. ASSUMPTION

(1) Assume that the statistical information collected from the network is true and reliable;

(2) Assume that the principal factors are independent of each other and do not affect each other;

(3) Assume that in the model, minor correlations between variables are ignored;

4. SYMBOL DESCRIPTION

Table 1. Symbols and Definitions					
Symbols	Definitions				
К	Asset-liability ratio				
r	Price				
I1	Current ratio				
R	Revenue				
	Medicare				
1	Capital Construction				
	Trade				
Р	Weight				

5. ESTABLISHMENT AND SOLUTION OF PROBLEM 1 MODEL

We need to analyze the possible impact of the election of different candidates on the U.S. economy. We first quantitatively analyze the policy data of the two candidates obtained in the network in different fields. Analytic hierarchy process is used to calculate the weight of different fields, to analyze the contrast between two candidates in each field and the impact on the American economy. According to the large data set collected, we do cluster analysis, and analyze and predict the impact of different fields by BP neural network model.

5.1. Data Analysis

We first analyze the different data and political opinions of the two candidates in the fields of taxation, infrastructure, health care, trade policy, employment policy, financial regulation, immigration policy, energy policy, foreign policy, military policy and so on. According to the data, we give priority to the five electoral issues that the two parties are most concerned about, as shown in Figure 1 below.



Figure 1. Top Five Concerns of Major American Political Parties

For further analysis of the United States economic situation, we have obtained the total GDP and fiscal revenue of the United States for nearly 20 years, as shown in Figures 2 and 3 below.



Figure 2. Total GDP in the United States for nearly 20 years



Figure 3. U.S. revenue for nearly 20 years

5.2. Establishment of Neural Network Model

After processing and analyzing the data, in the neural network model, the neural network can be divided into feedforward neural network, feedback neural network and self-organizing neural network according to the differentiation of neural network interconnection mode. The structure diagram is shown in Figure 4 to 6.



Figure 6. Self-organized neural networks

BP neural network is used in this paper, because in the neural network model, thefeedback neural network model has stronger correction. In order to improve the accuracy of this model, feedforward neural network is selected as the basis of modeling.

5.2.1 Genetic Algorithm Based Model Solution

Calculation of input and output of Step 1: neurons

The data of each input layer and output layer are defined separately. After calculating the input and output of neurons in each layer, we can get:

(1) Implicit layer input vectors are:

$$hi_h(k) = \sum_{i=0}^{7} w_{hi} x_i(k) h = 1, 2, \dots, 13$$
 (1)

(2) The hidden layer output vector is:

$$ho_h(k) = f(hi_h(k))$$
 $h = 1, 2, ..., 13$ (2)

(3) The input vector of the output layer is:

$$yi_o(k) = \sum_{h=0}^{13} w_{oh} ho_h(k) = 1$$
 (3)

(4) The output vector of the output layer is:

$$yo_{o}(k) = f(yi_{o}(k)) \quad o = 1$$
 (4)

Calculation of Partial Derivation of Neurons in Output Layer by Step 2: Error Function.

After obtaining the input and output function, it is necessary to obtain the partial derivative of the error function to each neuron in the output layer by mathematical operation. The concrete solution is as follows:

$$\frac{\partial e}{\partial w}_{oh} = \frac{\partial e}{\partial yi} \frac{\partial yi_o}{\partial w}_{oh}$$
(5)

Among them, the partial derivative can be obtained by calculation:

$$\frac{\partial e}{\partial y_{o}} = \frac{\partial \left(\frac{1}{2}\sum_{s=1}^{1} (d_{o}(k) - yo_{o}(k))\right)^{2}}{\partial y_{o}}$$

$$= - (d_{o}(k) - yo_{o}(k)) y_{o}(k)$$

$$= - (d_{o}(k) - yo_{o}(k)) f'(y_{o}(k)) - \delta_{o}(k)$$

$$\frac{\partial y_{o}(k)}{\partial w_{oh}} = \frac{\partial \left(\sum_{h=0}^{7} w_{oh} ho_{h}(k)\right)}{\partial w_{oh}} = ho_{h}(k)$$
(6)
(7)

Calculation of the Step 3: error function on the partial derivative of each neuron in the hidden layer

When calculating the partial derivative of the hidden layer neurons, we need to use the connection weight from the hidden layer to the output layer, the function of the output layer and the function of the hidden layer to calculate and solve the problem, which is as follows:

$$\frac{\partial e}{\partial w_{oh}} = \frac{\partial e}{\partial y_{io}} = -\delta(k) ho(k)$$

$$\frac{\partial e}{\partial w_{oh}} = -\delta(k) ho(k)$$
(8)

$$\frac{\partial e}{\partial w_{hi}} = \frac{\partial e}{\partial hi(k)} \frac{\partial hi_h(k)}{\partial w_{hi}}$$
(9)

$$\frac{\partial h_{i_h}(k)}{\partial w} = \frac{\partial (\sum_{i=0}^{7} w_{hi} x_i(k))}{\partial w} = x_i(k)$$
(10)

$$\frac{\partial e}{\partial h_{i}(k)} = \frac{\partial \left(\frac{1}{2} \sum_{s=1}^{1} \left(\left(d_{o}(k) - f(\sum_{k=0}^{7} w_{ho} ho_{h}(k))^{2} \right) \right)}{\partial ho(k)} \frac{\partial ho(k)}{\partial hi(k)} \frac{\partial ho(k)}{\partial hi(k)}$$
(11)

Step 4: Fixed Connection Weight Using Output Layer By using each neuron output to modify the connection solution is as follows:

Step 5: use input layer to modify connection weight

By using the input of each neuron to modify the connection weight, the specific solution is as follows:

$$\Delta w_{k}(k) = -\mu \frac{\partial e}{\partial w_{hi}} = \delta_{k}(k) x(k)$$

$$w_{hi}^{N+1} = w_{hi}^{N} + \mu \delta_{k}(k) x(k)$$
(13)
(13)

Calculation of Step 6: Global Error

$$E = \frac{1}{2m} \sum_{k=1}^{m} (d_o(k) - y_o(k))^2$$
(14)

Step 7: judgement

In the judgment, it is necessary to compare the accuracy with the maximum number of times of budget. When the accuracy and the number of times of budget do not meet the requirements, the cycle of the above steps should be carried out until the requirements are met.

5.2.2 Icon results

After adjusting the neural network model, the neural network regression figure is shown in the following Figure 7:



Figure 7. Regression Image

The weights and thresholds obtained at this time are the relationship values between the various levels of the neural network model under the current accuracy. Through the weights and thresholds between the levels, the remaining 20% of the data can be predicted. At the same time, the accuracy of the model is tested. We can get the following Figure 8:



Figure 8. Ratio of debt to GDP of two candidates over the next decade

Before COVID-19, Trump had an average annual deficit of nearly \$800 billion. The Trump administration's fiscal deficit reached a record \$3.1 trillion this fiscal year. Even by the standards of the 2009/10 recession, the deficit is huge.

Although government spending accelerated during Trump's administration due to COVID-19 influence, if Biden were elected, we should be able to foresee a similar trend. He said he would add another \$5 trillion to his current forecast. Trump is more likely to focus on defense spending, while Biden is more likely to focus on infrastructure and social undertakings.

Our analysis suggests that Trump's re-election could dampen the pace of US economic recovery. According to the policy baseline assumption that Trump is re-elected, the Republican Party controls the Senate, and the Democratic Party controls the House of Representatives. Under the action of short-term fiscal stimulus, the real GDP growth rate in 2021 is expected to be 3.7%; if Trump's fiscal agenda, immigration restrictions and protectionist policies are fully implemented, the GDP growth is expected to be only 2.3% in 2021.It will have a positive impact on the local economy and financial markets. Further tax cuts will follow the 2017 tax reform bill, benefiting the rich and large businesses. And Trump is likely to nominate more doves to the Fed, which could lead to another four years of loose fiscal and monetary policy; and the Trump administration has no good control over the COVID-19 epidemic, which will have a great impact on the US economy.

Biden's short-term success in the U.S. economy, whether the rapid recovery of the U.S. economy depends on two factors: epidemic prevention and economic stimulus. From these two factors, Biden's election will be more conducive to economic ecovery than the election of Mexico; the high probability of the epidemic will continue until next year, when Biden comes to power, the high probability will implement more stringent epidemic prevention measures, especially more encouraging social isolation and other policies, which will curb demand in the short term. According to China's anti-epidemic and recovery experience, the economy will soon recover quickly after the epidemic has been effectively controlled. In the long run, the US economy is more vulnerable to the policy direction of the ruling party. Renewing to globalism is an important strategy for Biden and the Democratic Party, and it is also the historical tradition of the Democratic Party. This is quite different from Trump's successive withdrawal from the

World Scientific Research Journal				
ISSN: 2472-3703				

League during his tenure. But that does not mean that Biden will be more welcoming to global free and fair trade than Connecticut, but will continue to push manufacturing back and industry chain localization along Trump's path.

6. ESTABLISHMENT AND SOLUTION OF PROBLEM 2 MODEL

In order to analyze the impact of different candidate election on China's economy, according to the problem one model to analyze and predict, in order to improve the accuracy of the model, this part adds more variables, and adopts the neural network model based on genetic algorithm.

6.1. Analysis of China's Economic Impact

Through the problem one model, we can analyze the economic situation of China through the analysis of two candidates in the fields of trade policy, financial supervision, energy policy, foreign policy, military policy and so on.

First of all, according to the data, China's economic data this year analysis, can be obtained as follows:





Figure 10. Growth of different industries in the past five years



Figure 11. China's total import and export of goods in the past five years

Next, in order to improve the accuracy of the model, this part adds more variables, and adopts the neural network model based on genetic algorithm with higher accuracy.

6.2. Genetic Algorithm Optimization BP Neural Network Prediction Model

BP neural network has the defects of slow convergence speed, low efficiency and easy to fall into local optimal solution, and genetic algorithm has fast training speed and strong ability of global optimization. Therefore, genetic algorithm can be used to optimize BP neural network. The new algorithm has both good learning ability and robustness, and strong ability of comprehensive random search and fast convergence.

The optimization of BP neural network by genetic algorithm includes three parts: the determination of topology of BP neural network, the global optimization of initial weight threshold of BP neural network by genetic algorithm, and the training and prediction of BP neural network. The algorithm is shown in Figure 12 below.



Figure 12. Algorithm Process

GA optimized BP network to predict output





6.3. Model Improvement Based on Levenberg-Marquardt Algorithm

In order to improve the accuracy of model prediction and the speed of operation, another algorithm is used to solve the BP neural network model, which is devoted to reducing the residual error and reducing the number of iterations. hence, Levenberg-Marquardt algorithm is introduced in this paper for model solving.

LM algorithm based on numerical optimization not only uses the first derivative information of the objective function, but also uses the second derivative information of the objective function. LM iterative formula of the algorithm is:

$$X_{k+1} = X_k - (J_k^T J_k + \mu I)^{-1} * J_k * F(X_k)$$
(15)

Jk The formula is a Jacobin matrix containing the first derivative of the weight and threshold of the network error, I is a unit matrix and the µ is a damping factor. According to the result of iteration, the LM algorithm dynamically adjusts the damping factor to reduce the value of each iteration error function. It is a combination of gradient descent method and Newton method, and its convergence speed is faster.

6.4. Analysis of results

If Trump is re-elected, the U.S. government will be more likely to restart a trade war with China, and Trump will impose tariffs on products imported from China on the grounds that China's imports from the United States are not up to the level specified in the first phase agreement. The United States is expected to raise import tariffs on \$110 billion of Chinese consumer goods from 7.5 percent to 15 percent, on \$250 billion of imported goods from 25 percent to 30 percent, and on \$160 billion of previously duty-free imports. These measures will cause China to take trade countermeasures.

When Biden takes office, he is likely to restore ties with traditional allies to press China together. Biden is expected to eliminate tariffs on imports of steel and aluminum from countries outside China during his first term. Under pressure from Democrats, most tariffs on Chinese goods may remain. Biden also said it would remove tariffs on foreign produce.



Figure 14. Total GDP in China/total GDP in the United States

We believe that although the US election situation has caused some fluctuations in the external situation of China's economic operation, the election results will not reverse the tone of the US's competition-oriented policy towards China. At present, China's economy is still in the process of recovery. Under the background of constructing a new development pattern dominated by domestic large circulation, economic growth depends more on the domestic industrial chain, the smooth flow of supply chain and the domestic market. The impact of external uncertainty brought by the US election on China's economy is relatively controllable.

Overall, the current Chinese economy is still in a smooth repair process. Although the restoration of policy factors will slow with the gradual withdrawal of the anti-epidemic policy and the complete recovery of market factors will take some time, the recovery space and sustainability of market factors are higher. Under the background of internal cycle, the economic plugging point is expected to provide new support for economic growth, and the recovery is expected to continue, with a GDP growth rate of about 2.5% in 2020.

7. ANALYSIS OF QUESTION III

Through the analysis of question 1 and question 2 and the actual situation, we can get the final winning candidate, and through the analysis of its economic and policy means to give China's economic countermeasures and policies in related fields.

7.1. United States Election Forecast

According to the analysis of question 1 and question 2, combined with the actual situation of the United States, before the election, the Democratic poll is far ahead

DOI: 10.6911/WSRJ.202106_7(6).0048

STATE	DEMOCRATS' POLLING LEAD OR DEFICIT				
	CLINTON 2016		BIDEN 2020		
	POLLING AVERAGE	FINAL MARGIN	POLLING AVERAGE	WITH THE 2016 ERROR	
Arizona	-2.3	- 3 . 5	+3.1	+1.9	
Colorado	+3.8	+4.9	+13.8	+14.9	
Florida	+0.5	-1.2	+2.1	+0.4	
Georgia	-4.0	-5.1	+1.6	+0.5	
lowa	- 3 . 4	-9.4	+0.1	-5.9	
Maine	+6.9	-3.0	+13.8	+3.9	
ME-2	-0.4	-10.3	+2.6	-7.3	
Michigan	+4.0	-0.2	+8.8	+4.6	
Minnesota	+5.9	+1.5	+8.9	+4.5	
NE-2	-0.7	-2.2	+6.2	+4.7	
Nevada	+0.7	+2.4	+5.8	+7.5	
New Hampshire	+3.4	+0.4	+11.1	+8.1	
New Mexico	+5.3	+8.2	+11.0	+13.9	
North Carolina	+0.7	-3.7	+2.4	-2.0	
Ohio	-2.0	-8.1	-0.9	-7.0	
Pennsylvania	+3.7	-0.7	+5.1	+0.7	
Texas	-8.5	-9.0	-1.0	-1.5	
Virginia	+5.4	+5.3	+11.4	+11.3	

Figure 15. Pre-election state polls

Americans' Views on Whether They're Better or Worse Off Than Four Years Ago





As the polls show, during Trump's administration, American people were more and more satisfied with their lives, but with the outbreak of the covid-19 epidemic, as well as the Democratic Party's continuous claimed health care policy and the policy of facing the epidemic, Biden's approval rating is getting higher and higher.





Figure 17. Support for two candidates

To sum up, we can see that Biden has a higher number of votes than Trump in poll support, and after the release of Biden's series of policies, we can predict that Biden will win more than Trump.

7.2. Recommendations to China

(1) In the first three quarters of the year, China's economy experienced a sharp downturn in the first quarter under the impact of the epidemic, with the first negative growth since quarterly statistics; since the second quarter, industrial production, infrastructure, real estate and state-owned investment have rebounded rapidly with the gradual control of the epidemic and the resumption of production and production; and in the third quarter, with the further emergence of the effect of stable growth policy and the further improvement of the confidence of enterprises and residents, the market factors have also improved significantly, and the endogenous momentum of economic improvement has increased. It is worth mentioning that in the context of the global epidemic, China's export "wrong peak" growth, becoming the biggest highlight of China's economic operation in the third quarter. Therefore, the later stage must be in the control of the new crown epidemic under the premise of steadily improving the Chinese economy.

(2) Regardless of the outcome of the election, the United States Government will continue its protectionist policy towards China, and the United States Government will continue to take great power competition as the main diplomatic theme and lead the overall work. China should now strive to develop itself in an indisputable way and avoid falling into the trap of confrontation with the United States. Do not take the initiative to provoke disputes, do not increase the intensity of confrontation, do not open up a new front, do not fear war, do not love war, do not seek to replace the United States, do not seek to eliminate the United States, struggle to leave room, adhere to the competition between power and interests, Avoid life and death.

(3) China should strive to improve relations between China and Japan, China and South Korea, deepen ASEAN's "10+1" cooperation, close relations with friendly countries in South Asia, such as Pakistan, control the border conflict between China and India through political dialogue, and close the ties of interest between China and neighboring countries. While continuing to abide by the non-aligned policy and strive to expand domestic demand, we should continue to expand

the new path of "Belt and Road" construction to ensure that the road of China's overall rejuvenation remains unchanged.

(4) It is necessary to further reduce the external dependence of China's economy; accelerate the correction of the international trade imbalance, reduce the trade surplus with the United States, while reducing the trade deficit with other countries; implement import substitution in key industries and products; make corresponding adjustments to the policies of attracting investment, foreign trade and exchange rates, so that the exchange rate can float freely as soon as possible; and do its best to avoid falling into the overseas debt trap.

8. ADVANTAGES AND DISADVANTAGES

8.1. Analysis of the Advantages

(1) A number of factors were analyzed, and the BP neural network was used to ompare and analyze the influencing factors, and the prediction conclusion was obtained.

(2) A more accurate genetic algorithm-based neural network is used in the process of problem two, and then a Levenberg-Marquardt algorithm is selected.

8.2. Analysis of the Disadvantages

The data used in this paper are collected from the network. According to the simple processing and analysis of the model, there are more influencing factors that are not taken into account. The addition of multiple data and influencing factors in model building will significantly improve the accuracy of model calculation. More accurately predict the economic and political impact of the two candidates.

REFERENCES

- [1] Liping Zhang. Analysis of the Electoral System in the United States History of the Party: documentary Edition 2005(2):4-11.
- [2] Qi Zhou, Suixin Fu. Deep analysis of "Trump phenomenon" and "Sanders
- [3] phenomenon"[J]. in American election International Economic Review, 2016, 000(003):9-25.
- [4] Jia Liu. The Relationship between Social Media and Politics —— A Case Study of Barack Obama's Winning[J]. US Election Young Journalists, 2009(02):20-21.
- [5] Yaqin Wang. Electoral and Related Rights Study: A Case Study of the United States Elections [M]. Shandong people's Publishing House, 2004.
- [6] Runze Wang. Extending the Media Party Tradition in the US General Election [J]. International Press, 2004.
- [7] The yellow profile. Research on the political Communication function of Social Media —— take the social media strategy of the 2012 American election as an example. 0.
- [8] Huiyun Tang. America's Election and the Tea Party's Future [J]. In 2016 American problem Studies, 2017(2).
- [9] Ruize Wang. American Election Television Debate Set Yilin Publishing House ,2012.
- [10] Yiliang Zhang. "Critical elections" and changes in American electoral politics [J]. American Studies, 2004(03):7-29.
- [11] The fields. A Media Factor in Electoral Politics in the United States [J]. Journal of the Institute of International Relations, 2000(04):24-28.