Prediction of college students' online interaction based on MLP

Kuotai Tang[1,a*], Hailing Duan[2,b], Ying He[2,c], Xiaowei Huang[2,d]

[1]Department of Business Management, Fujian Polytechnic of Information Technology, Fuzhou, China
[2]School of Internet Economics and Business, Fujian University of Technology, Fuzhou, China

[a*]3224243499@qq.com;[b]806110064@qq.com
[c]754216880@qq.com;[d]867575360@qq.com

Abstract. Fuzhou is the capital city of Fujian Province, China. In 2018, "e-Fuzhou APP" was launched as a unified APP portal for Fuzhou citizens, with 70 functions and 184 online services, and was well received and widely used by citizens. As of January 5, 2022, the total number of users exceeded 9 million. The number of daily users has reached 300,000, and the cumulative number of services has exceeded 660 million, ranking at the forefront of the national government convenience APP. In this paper, the MLP method was used to investigate the Internet preference of the teenagers in Fuzhou. First of all, according to the literature, the four fields of e-commerce, artificial intelligence, blockchain and Internet of things were sorted out, and questionnaires were made and distributed. A total of 422 valid questionnaires were recovered. By reliability and validity test, KMO=0.838 (>0.8, P=0.00), close to 1, indicating that the correlation between variables is strong, suitable for analysis as a factor and information extraction, with good structural validity. Cronbach α = 0.852 (>0.8), the Alpha coefficient of each variable is above 0.8, indicating that the internal consistency of the selected measurement indicators is good. This study summarizes four findings: young people like the application of e-commerce in life, young people like the application of AI technology in the field of education, young people prefer the development of blockchain to support the supply chain, and young people expect IoT technology to promote the development of smart agriculture.

Keywords: MLP; e-Commerce; AI; Blockchain; IoT

1 Introduction

Fuzhou is the capital city of Fujian Province in China. In order to build digital government services, the "Digital Fuzhou" plan is proposed to promote the development of digitalization. "e-Fuzhou" APP is the unified mobile Internet entrance of Fuzhou and the means to fully implement the plan of "Digital Fuzhou". It was officially launched in 2018.

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Through the APP, nine livelihood scenarios such as "transportation, life services, culture and education, medical and health care, and housing care" are "one-code universal." As the unified mobile Internet entrance of Fuzhou, it integrates convenience services, government services, public services and third-party commercial services into one, and cooperates with 42 departments, 107 systems and more than 200 self-service terminals for convenience services in the urban area, so as to achieve "handheld office, local office" for citizens through the use of a smart platform. At present, 70 functions have been released in "e-Fuzhou", in which citizens can enjoy 184 convenient services, thus realizing the "handheld office"; Citizens can handle 96 high-use services such as medical and social security, visa application and community service at the self-service terminal, thus realizing "nearby service". In order to prevent and control the COVID-19 epidemic in an orderly and efficient way, the "e Prevention and Control" mini program of "e-Fuzhou" has been put into use for the first time in China, providing information and traffic record registration of people. At the same time, "e-Fuzhou" also builds a service platform for the use of materials, and enables citizens to purchase masks, alcohol and other epidemic protection equipment [1].

From "e-Fuzhou" government APP observation, youth in preference of Internet interaction, general arrangement for e-Commerce, Artificial Intelligence (AI), Blockchain, Internet of things (IoT), in the age of Internet economy, e-Commerce, AI, Blockchain, and promote the development of the IoT all the update in the field of traditional development, also gave rise to more jobs in the field of emerging, to provide more diversified choices for contemporary youth employment and entrepreneurship. At present, e-Fuzhou provides the latest version of v6.7.0 APP to download and carry out many activities, such as: APP for booking exhibitions, free bus and subway for fresh college graduates in 3 years, etc., which is popular among young people. This study makes a literature discussion from these four categories of youth preference information technology.

1.1 Electronic Commerce

Electronic commerce is a process that uses electronic means to realize in production, distribution and marketing services. In recent years, traditional e-commerce has been unable to meet the needs of consumers by displaying products with words and pictures. The application of short video and live broadcast technology has become a new form of commodity media with a lower consumption threshold and richer and vivid content presentation. Creating scarcity is becoming an important driver of consumers' willingness to visit [2]. In the development of Internet economy, e-commerce, as one of the fields with the largest scale and fastest development speed, has developed many application services, including TikTok, QuickHand, RED, Baidu, Octopus-TV, NetEase Cloud, Litchi-FM and other video and audio social applications. Combined with personalized recommendation, it gradually matures and expands its application in e-commerce apps. Based on artificial intelligence technology of clustering and collaborative filtering technology, it establishes a recommendation model by analyzing user interests or historical behaviors through big data mining, and actively matches information of user needs or interests. It has been applied to JD product recommendation, Toutiao news recommendation, TikTok video recommendation, Alipay face payment, Taobao search for the same type of image comparison, WeChat scan similarity comparison, picture aggregation, etc.

1.2 Artificial Intelligence

AI is a new technology based on computer science, that is, the use of human technology and methods, through the research and development of intelligent machines for simulation, extension and expansion of human intelligent thinking, theory and method technology and application. Information and communication technologies are now driving the generation of massive amounts of data, such as the ubiquitous use of social media [3] and the Internet of Things (IoT) [4] [5].

AI technology is widely loved by young people. Swarm intelligence, image recognition, speech recognition, deep learning, machine learning, knowledge engineering, big data intelligence, natural semantic processing, cross-media sensing, edge intelligence, enhanced intelligence, index graph, etc., supported by intelligent mining of big data, and based on the application of artificial intelligence technology, the application fields are wide, including: Smart retail, smart manufacturing, smart finance, smart education, smart agriculture, smart healthcare, smart city, smart security, unmanned driving, digital government, robotics, etc., will open up a wider space for young people to start businesses and find jobs.

1.3 Block Chain

In the power Blockchain technology is put forward in 2008, the development so far, the chain block is not just a single technology, but by the intelligent contracts, consensus mechanism and joint implementation of the core technologies such as cryptography technology, based on the P2P protocol of point to point communication technology to realize data sharing transmission block chain as a new innovative technology has great application value, So far, many fields have been widely used, including: financial field (digital currency, payment and clearing, securities trading credit management, digital bills, etc.); Supply chain (supply chain finance, supply chain logistics, etc.); IoT (IDMoB system, IoT data protection), protection of IoT devices, DDoS attack methods, Defense of IoT devices, etc.) [6]; E-government; Medical field (medical supply chain, data management and storage, medical Internet of Things, etc.) [7]; Education (knowledge currency, global knowledge base, teacher credit system, student credit management, learning contract, etc.) [8], etc.

1.4 Internet of Things

IoT by the international telecommunication union (ITU) is defined as: content and content, between people and people and things are linked together, the IoT as the modern information technology has been widely used in many fields, including: intelligent transportation (car networking, sharing a bike, car share, intelligent transportation) is one of the most promising in the application of IoT domain; Intelligent logistics (RFID technology is applied to warehouse management, supply chain management, vehicle management, etc., and WSN technology is applied to cold chain logistics management) [9]; Intelligent medical field (RFID medical card, self-service registration payment management, intelligent manometer, intelligent blood glucose meter) [10]; Intelligent agriculture (intelligent greenhouse Internet system, intelligent cultivation and control, agricultural remote monitoring system).

2 Method

This study selected questionnaires from the literature structure and distributed them to college students in Fuzhou after revision. After collecting the questionnaires and sorting out the data, before using neural network for analysis, the unused "e-Fuzhou" samples were eliminated. Then, the normality test of all measurement items was conducted by SPSS 23.0 software. The absolute skewness of all items was smaller than 3.0, and the absolute kurtosis was much lower than 10.0, indicating that the questionnaire items basically followed normal distribution. The model is of reference significance.

Secondly, reliability and validity test, descriptive statistics, and neural network analysis were performed. In this paper, SPSS Modeler 18.0 is used to develop the neural network modeling for the collected sample data, and Multi-Layer Perception (MLP) model which can process and construct more complex relations is adopted.

2.1 Questionnaire survey

Questionnaires were distributed online for two weeks from April 19. A total of 500 questionnaires were collected and 465 questionnaires were collected with a recovery rate of 93%. Then the data were checked and tested and redundant information was deleted, that is, the invalid questionnaires were eliminated and the redundant information in the valid questionnaires was deleted to ensure the validity of the data. In this paper, the criteria for determining the invalid questionnaire are as follows: (1) The respondents choose the questionnaire of "never used e-Fuzhou"; (2) The duration of filling in the questionnaire was too short (less than 20 seconds); (3) All the questionnaire options are consistent; (4) The questionnaire with missing filling options. By screening and sorting out the invalid questionnaires, 422 valid questionnaires were obtained, with an effective rate of 90.75%.

2.2 MLP neural networks

Artificial neural network (NNS) is a kind of algorithmic mathematical model, which describes the characteristics of biological brain network in information processing. This model is composed of multiple nodes connected to each other, and the completion of information processing is achieved by the internal nodes by adjusting the connection relationship [11]. The change of human preferences is a complex relationship, and the Technology Acceptance Model (TAM) is a model of user acceptance of information systems. In this paper, the classical neural network model MLP is used, which can handle and construct relatively complex relationships. From the perspective of prediction ability, this paper adopts MLP for modeling.

MLP is a neural network model, which is composed of input layer, multiple hidden layers and output layer, and the neuron nodes in the same layer are not connected, while the neuron nodes in adjacent layers are fully connected through weights. First, we specify the hidden layer, perform iterative calculation on the sample, and obtain the characteristics of the data. Secondly, we adjust the weights between neuron nodes, and repeatedly find a reasonable interpretation process [12].

Step1: The input sample has data $X \in \mathbb{R}^{i \times n}$, whose sample batch size is í and the number of inputs is n. It is assumed that the multi-*layer perceptron has a single hidden layer, where the number of neural units in the hidden layer is d, and the output of the hidden layer is set as H (where $H \in \mathbb{R}^{i \times d}$). The unit number of neurons in the output layer is m, and the output of the output layer is set as O (where $O \in \mathbb{R}^{i \times m}$).*

Step2: According to the characteristics of neural network, both the hidden layer and the output layer are fully connected layers, so Wh (where $Wh \in \mathbb{R}n \times d$) is the weight parameter of the hidden layer, and bh (where $bh \in \mathbb{R}1 \times d$) is the deviation parameter of the hidden layer. Wo (where $Wo \in \mathbb{R}d \times m$) is the weight parameter of the output layer, bo (where $bo \in \mathbb{R}1 \times m$) is the deviation parameter of the output layer, and f is the activation function [9]. The formula is as follows:

$$H=f(XWh+bh) \tag{1}$$

$$O=f(XWh+bh) \tag{2}$$

2.3 Reliability and Validity Test

In this paper, KMO (Kaiser-Meyer-Olkin) value and Baetlett Test were used to conduct construct validity test analysis. The KMO value was 0.838 (>0.8), indicating that the original item has good structural validity and is suitable for factor analysis. And by observing the significance level of Baetlett Test P=0.000<0.05, indicating significant differences between the correlation matrix and the identity matrix, as shown in Table 1.

Cronbach α was used for reliability analysis, and the overall reliability was 0.852 through SPSS, higher than 0.8, indicating that the reliability of the survey data was very high. As can be seen from "Cronbach's α based on standardized items", after deleting any subitem, α coefficient was no higher than 0.1 compared with the original value and did not increase significantly, so all the original items were retained.

Table 1. KMO and Bartlett test.

Validity Test		***Reliability Statistics***	
KMO	Bartlett's Test P-value	Cronbach α	Cronbach's α based on standardized items
.838	.000	.852	.872

2.4 MLP model

In this article, through SPSS Modeler 18.0 software to create "neural network" model, first import sample data, the e-Commerce, AI, Blockchain and IoT four fields as target and set the predictor variable "tag", "like/look forward to" code 1, "don't like/don't expect" code 0; Then select the "partition" node. In order to avoid excessive reciprocation between model training and model deployment, 70% of the data sets are used as training and 30% are used as testing data sets for model evaluation and parameter optimization. Then select the "neural network" node, the specific parameters under the node are as follows (1) Objective: choose "build a new model" to establish the classifier; The main goal is to "build the standard model"; (2) Basic: MLP is selected as the neural network model; (3) Stop rule: use the system default value (maximum training time is 15 minutes); (4) Overall: adopt the system default value (vote; Average value); (5) Advanced: Use the default value (overfitting prevents 30%). The MLP model is established, as shown in Figure 1.

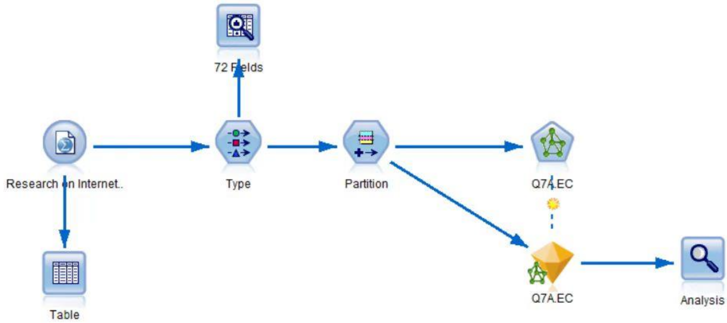

Fig. 1. MLP model

2.5 Evaluation of confusion matrix model

In data mining, in order to quantify the prediction performance of a model, it is necessary to evaluate the performance of model indicators. In this paper, confusion matrix is used as the evaluation index of MLP classification model, and Accuracy, Precision and Recall models of e-commerce, AI, blockchain and IoT models are used to evaluate the index results. The results show that the accuracy is more than 50%. As shown in Table 2, formulas (3)-(5) are as follows:

Table 2. Confusion matrix model evaluation.

Indicators	*Accuracy*	*Precision*	*Recall*
e-Commerce	50.0%	100.0%	50.0%
AI	73.8%	65.9%	78.2%
Blockchain	58.9%	28.7%	72.5%
IoT	50.0%	0.0%	0.0%

The Accuracy rate is determined by the proportion of all predicted real samples in the whole sample data, and the calculation formula is as follows:

$$Accuracy = \frac{TP+TN}{TP+FP+FN+TN} \quad (3)$$

The Precision rate is determined by the proportion of true samples with correct prediction among all positive samples, calculated using the following formula:

$$Precision = \frac{TP}{TP+FP} \quad (4)$$

The Recall rate is determined by the proportion of true samples with correct prediction among all actual positive samples, calculated using the following formula:

$$Recall = \frac{TP}{TP+FN} \quad (5)$$

3 Results and discussion

Through MLP analysis of e-Commerce, artificial intelligence, blockchain and Internet of Things, this paper finds out the preferences and life-oriented e-commerce applications of urban youth in Fuzhou. I like artificial intelligence close to the field of education, prefer the supply chain field supported by blockchain, and look forward to the development of intelligent agriculture promoted by Internet of things technology. The statement is as follows:

3.1 MLP predicts youth life e-commerce preference

With e-Commerce as the target variable output, analyze the application of e-commerce and expect "e-Fuzhou" application as the predictor variable. After several tests, when the number of neuron nodes in the hidden layer is 7, the model with e-commerce as the output has a high accuracy of 92.7%. MLP was used to predict young people's preferences for e-commerce applications. The most common e-commerce related applications used by young people are video and audio social networking (15%), sharing economy (13%), online shopping (11%) and livelihood security (9%).

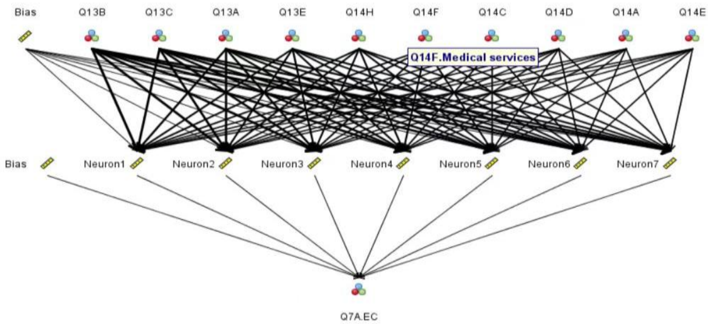

Fig. 2. MLP predicts youth life e-commerce preference

Fuzhou youth expect that the maximum ratio of "e-Fuzhou" to explore the relevant applications in emerging markets is 8%, the proportion of medical services is 8%, sharing economy is 6%, used goods trading is 5%, video and audio social networking is 5%, and catering is 5%. In the neural network formed by e-commerce as the output, the number of neuron nodes in the input layer is 11, the number of neuron nodes in the hidden layer is 8, and the number of neuron nodes in the output layer is 1. It can also be seen that the lines from the video and audio social to the hidden layer are the thickest, until the food and beverage service lines taper off. As shown in figure 2. Fuzhou youth expect "e-Fuzhou" in the field of e-commerce applications, the most is video social, followed by sharing economy and online shopping; They are most eager to explore applications in emerging markets, followed by applications in medical services and the sharing economy.

3.2 MLP predicts Youth AI Preferences

With AI as the predictor variable, when the hidden layer neuron node is 11, the model accuracy is relatively high, reaching 74.8%. Young people on "e-Fuzhou" for the development of machine learning 14%, cross-media perception 13%, swarm intelligence 10%, image recognition 7%; Hope to explore smart education application 11%, smart finance 7%, smart city 6%, driverless 6%, smart security 5%, smart medical 5%. As shown in figure 3.

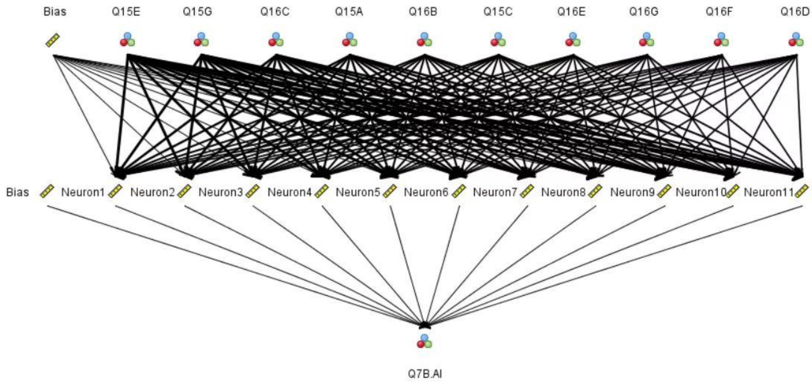

Fig. 3. MLP predicts youth AI Preferences

3.3 MLP predicts youth blockchain preferences

Blockchain technology was used as a predictor variable. When the hidden layer neuron node is 3, the model accuracy is relatively good, reaching 69.2%. Youth "e-Fuzhou" developed blockchain IoT technology for 29%, supply chain 3%, education 18%, finance 16%, medical 14%. The number of neuron nodes in the input layer is 6, the number of neuron nodes in the hidden layer is 4 and the number of neuron nodes in the output layer is 1. As shown in figure 4.

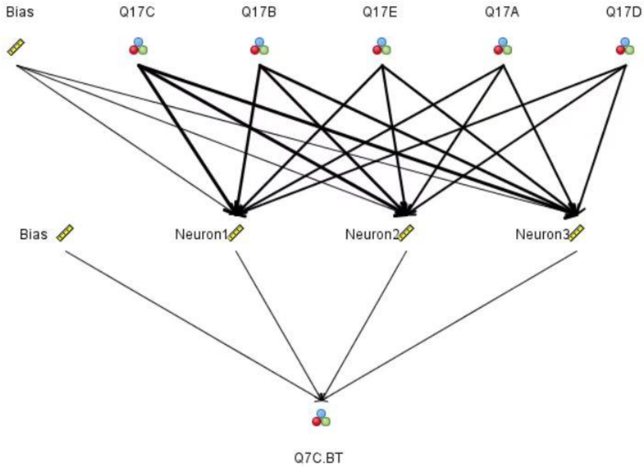

Fig. 4. MLP predicts youth blockchain preferences

3.4 MLP predicts youth IoT Preferences

Taking IoT as the target variable, when the neuron node of hidden layer is 7, the model accuracy is relatively high, reaching 76.9%. Young people expect "e-Fuzhou" to develop intelligent agriculture, intelligent logistics, intelligent transportation, and intelligent medical services supported by the IoT, accounting for 51%, 27%, 12%, 0%, and forming a neural network with the output of the IoT. The number of neuron nodes in the input layer is 5, the number of neuron nodes is 8, and the number of neuron nodes in the output layer is 1. As shown in figure 5.

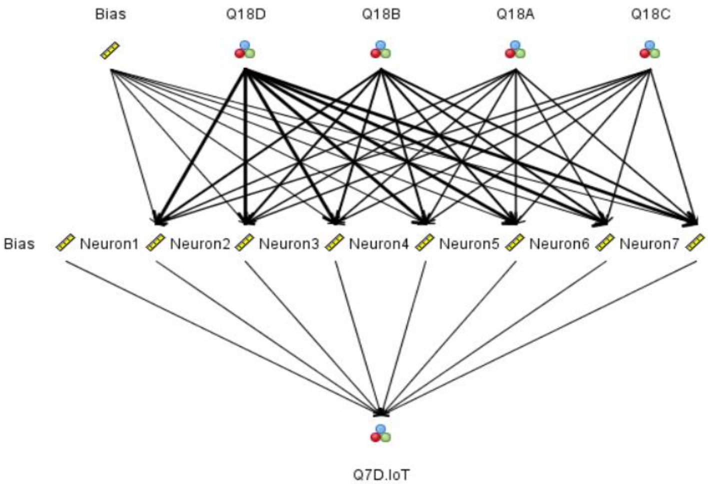

Fig. 5. MLP predicts youth IoT preferences

4 Conclusion

Based on the accuracy of four MLP models, e-Commerce (92.7%) > IoT (76.9%) > AI (74.8%) > Blockchain (69.2%), indicating that the preference of Fuzhou youth is decreasing in turn. There are four points in the conclusion: (1) young people are more interested in the novel application of e-commerce, video and audio social has become a necessary for young people to make friends; Young people can share the right to use in the sharing economy and maximize the use value. (2) Young people tend to explore the application of smart education to meet the needs of young people for digital education. (3) Young people prefer to explore the Internet of things, supply chain and education applications, which can stimulate economic vitality and develop related applications. (3) Young people are looking forward to the development of intelligent agriculture, intelligent logistics and intelligent transportation applications. They attach importance to the improvement of the quality of intelligent agriculture and logistics to meet the pursuit of speed.

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