

# *Supply-side Reform of University Ideological and Political Education Based on Big Data*

Xiaoyong Zhang<sup>a\*</sup>, Xiaokai Deng<sup>b</sup>

*College of Economy and Banking, Zhanjiang University of Science and Technology,  
Zhanjiang 5240006, Guangdong, China*

*<sup>a</sup>xiaoyong\_909@163.com, <sup>b</sup>191601333@qq.com*

*\*Corresponding author*

**Keywords:** Big Data, Campus Culture, IPE, Supply-side Structural Reform, Collaborative Innovation

**Abstract:** With the development of science and technology, people use more and more data, so big data plays a key role in the problem of excessive capacity. This article mainly introduces the collaborative innovation research on the supply-side reform of ideological and political education (IPE) of university campus culture based on big data, and intends to provide some ideas and directions for the collaborative innovation research on the supply-side reform of university IPE. This paper proposes a collaborative innovation research method based on big data for the supply-side reform of IPE on university campus culture, including document retrieval method, interview method, questionnaire survey method, multidisciplinary research methods and big data-based research methods. The experimental results of this article show that the average value of the correlation coefficient  $\alpha$  of the questionnaire reliability is 0.91, indicating that the reliability of the questionnaire in this article is relatively high, and it can provide relevant references for this research.

## 1. Introduction

As an important branch of socialist culture, campus culture is a special culture that takes rich and diverse campus cultural activities as the main manifestation, takes the campus spirit of freedom, equality, independence, and openness as its core soul, and relies on the existence of campus. IPE in universities is an important part of IPE work in universities.

Su Z found that due to the rapid development of mobile social networks, mobile big data plays an important role in providing mobile social users with various mobile services. However, This research step is relatively cumbersome and is not conducive to popularization in practice [1]. Baccarelli E researched and proposed that big data stream mobile computing is a paradigm that relies on the integration of broadband Internet mobile networks and real-time mobile cloud computing. But this study lacks experimental data to support it and is not persuasive [2]. From the perspective of knowledge management research, Xu Jie explained the core knowledge activities and

important connections in the process of university-industry-research (UIR) joint innovation. But it is not supported by data and is not practical [3].

The innovations of this paper are: (1) proposed a multi-disciplinary research method; (2) proposed a big data research method; (3) proposed a big data-based clustering algorithm for the reform of big data education analysis.

## 2. Collaborative Innovation Research Method of Supply-Side Reform of University Campus Culture IPE Based on Big Data

### 2.1. Method

(1) Document retrieval method. In order to deeply understand and study the collaborative innovation of the supply-side reform of university campus culture and IPE, the research content of this article is through Duxiu, Baidu Academic, SpringerLink, CNKI, International Philosophy and Social Science Documentation Center, Wanfang Data knowledge service platform, etc.

(2) Interview method. Taking advantage of the convenient conditions of working in colleges and universities, by interviewing representative ideological and political educators and related experts and scholars in domestic colleges and universities, conducting in-depth interviews with them, listening to their understanding and ideas about the era of big data and educational development [4].

(3) Questionnaire survey method. Learn from the traditional questionnaire survey method and follow the design-distribution-recovery-statistics process to initially grasp the first-hand data of college students' online ideological and political research, and start from the data evaluation and analysis of each choice to fully understand the current college students [5-6].

### 2.2. Clustering Algorithm

Clustering algorithm is an algorithm of data mining, and it is an advanced method of data mining [7-8]. Clustering is a process of dividing a set of data objects into multiple groups or clusters, so that the objects in each cluster have a high similarity, but are very different from the objects in other clusters. The clustering algorithm is an unsupervised learning algorithm [9].

(1) Distance in clustering algorithm

1) Euclidean distance

Usually, the straight-line distance between two points in m-dimensional space is used to describe the Euclidean distance [10-11]. The distance between each other can be expressed as:

$$dis(a, b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + \dots + (a_n - b_n)^2} = \sqrt{\sum_{i=1}^n (a_i - b_i)^2} \quad (1)$$

The Euclidean distance between points  $U(a_1, b_1)$  and  $V(a_2, b_2)$  of two two-dimensional vectors is:

$$dis_{12} = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2} \quad (2)$$

The Euclidean distance between the points  $U(a_{11}, a_{12}, \dots, a_{1n})$  and  $V(a_{21}, a_{22}, \dots, a_{2n})$  of two n-dimensional vectors is:

$$dis_{12} = \sqrt{\sum_{k=1}^n (a_{1k} - a_{2k})^2} \quad (3)$$

## 2) Chebyshev distance

Suppose the Chebyshev distance between two points p and q is defined as:

$$d(p, q) = \max_i (|p_i - q_i|) \quad (4)$$

In the n-dimensional plane, the Chebyshev distance between two coordinate points  $U(a_{11}, a_{12}, \dots, a_{1n})$  and  $V(a_{21}, a_{22}, \dots, a_{2n})$  is:

$$dis_{12} = \max_i (|a_{1i} - a_{2i}|) \quad (5)$$

The extreme value Lp is measured according to the Lp mentioned above [12], so another equivalent formula of this formula is:

$$dis_{12} = \lim_{k \rightarrow \infty} \left( \sum_{i=1}^n |p_i - q_i|^k \right)^{1/k} \quad (6)$$

## (2) Selection method of clustering criteria

1) Heuristic method: For specific data sets, according to their own judgment, define a method of dissimilarity measurement by themselves, and then cluster according to the principle of nearest neighbor [13-14].

2) Objective function method has the following formula:

$$J = \sum_{j=1}^c \sum_{S_j} \|x - m_j\|^2 \quad (7)$$

$$m_j = \frac{1}{N_j} \sum_{S_j} a \quad (8)$$

## (3) BIRCH clustering algorithm

The cluster feature CF vector can be expressed by the following formula:

$$CF = \langle n, DI, II \rangle \quad (9)$$

The data sum of n d-dimensional data points is represented by DI, and the sum of squares of n d-dimensional data points is represented by II [15].

The centroid of the cluster, as the name suggests, is the quantitative center point of the data in the cluster, which is the average value of the sum of the data [16-17]. The following formula exists:

$$a_0 = \frac{\sum_{i=1}^n a_i}{n} = \frac{DI}{n} \quad (10)$$

The following formula exists:

$$R = \sqrt{\frac{\sum_{i=1}^n (a_i - a_0)^2}{n}} \quad (11)$$

The diameter refers to the average distance between every two points in the cluster [20]. The following formula exists:

$$D = \sqrt{\frac{\sum_{i=1}^n \sum_{j=1}^n (a_i - a_j)^2}{n(n-1)}} = \sqrt{\frac{2nI - 2DI^2}{n(n-1)}} \quad (12)$$

Both the radius and the diameter can reflect the tightness of the data in the cluster, and can be used as a classification of the clustering effect. According to multiple clustering results, the optimal clusters are selected [18-19].

The whole process of this method is shown in Figure 1:

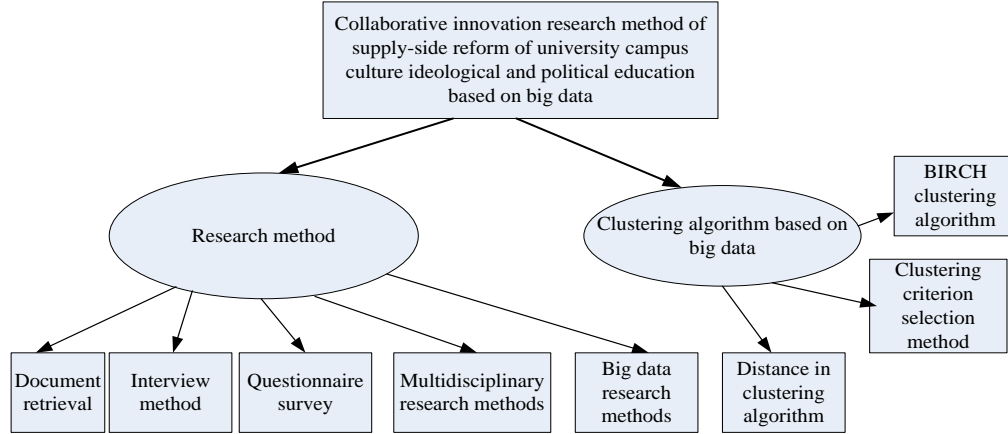


Figure 1: Part of the technical process of this method

### 3. Practice of Collaborative Innovation on the Supply-side Reform of University Campus Culture and IPE Based on Big Data

#### 3.1. Innovation Path of University IPE

(1) Optimize the main body of supply and improve the quality of education supply

The university should strengthen the governance and rectification of the internal structure, strengthen the team building of the main body of supply, improve the ideological and political professional level of all in-service teachers, and actively guide the relevant student associations, student management and service departments to participate [21]. Giving full play to the charm of language in IPE can have a multiplier effect [22-23].

(2) Integrate supply content and reduce production capacity to achieve precise supply

According to the characteristics of the content of IPE, rebuild the teaching supply system, such as textbook system, knowledge system and teaching system, including ideological and political, moral quality, psychology and legal system, and establish different training goals [24].

#### 3.2. Operating Strategy of the Collaborative Innovation Mechanism in the IPE of University Students

(1) Establish and improve the joint force mechanism of university party and government departments, leading cadres, teachers, etc.

(2) Establishment and improvement of teacher-student interaction mechanism

Teachers should take the initiative, communicate with students as much as possible, understand students' ideas and needs, and achieve guidance and teaching in accordance with their aptitude. In addition, we should strengthen the guidance and enlightenment work so that students can discover, analyze and solve problems autonomously[25].

In the experimental part, it is proposed to apply the above steps to the collaborative innovation research practice process of IPE supply side reform of university campus culture based on big data, as shown in Table 1.

Table 1: Experimental steps in this article

Research and practice	3.1	University IPE Innovation Path	1	Optimize the main body of supply
			2	Integrate supply content and reduce production capacity
			3	Change supply methods and methods
	3.2	Operation strategy of collaborative innovation mechanism	1	Establish and improve the joint force mechanism
			2	Establish an interactive mechanism
			3	The interaction mechanism between family and society

## 4. Collaborative Innovation on the Supply-side Reform of University Campus Culture and IPE

### 4.1. Results of Questionnaire Survey

(1) The respondents of this questionnaire are college students of a certain university. A total of 742 students are selected for the survey. Among them, freshmen to seniors and boys to girls all participate in the questionnaire survey. Table 2, Figure 2 shows the specific distribution:

Table 2: Distribution of students participating in the questionnaire

Sex	Freshman	Sophomore	Junior	Senior
Boys	109	119	106	33
Girls	122	107	121	35
Total	231	226	217	68

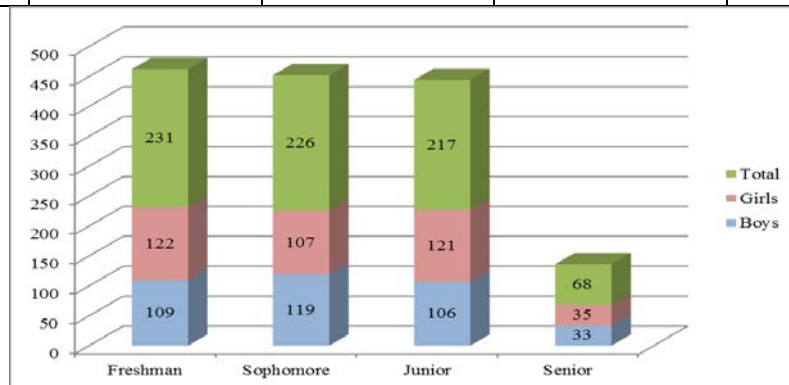


Figure 2: Distribution of students participating in the questionnaire

It can be seen from the chart that the selection of research objects is relatively average. Except for the small number of senior students due to graduation and internship, the gap between the total number of university students selected by freshmen, sophomores, and juniors is small.

(2) This research conducted a survey on the media frequently used by students (each person can choose more than one) in the questionnaire, collected statistics, and plotted the results into tables and graphs, as shown in Table 3 and Figure 3.

Table 3: Media frequently used by university students

Media used	Number of students	Percentage
Computer	689	92.86%

Mobile phone	731	98.52%
TV	581	78.30%
Radio broadcast	407	54.85%
Newspapers and magazines	256	34.50%

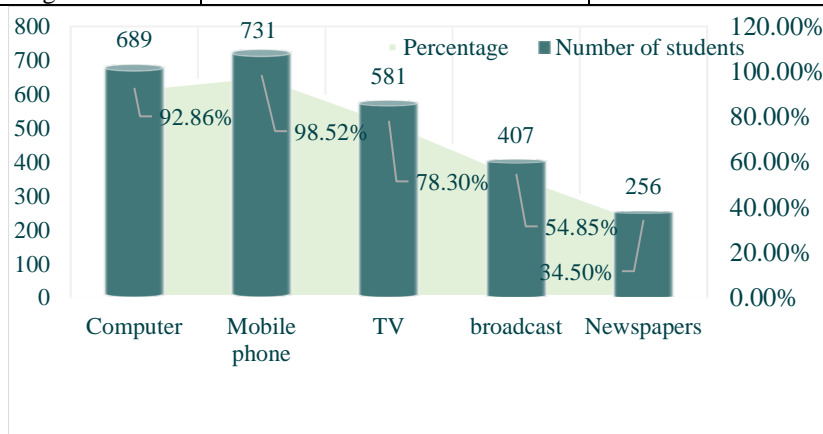


Figure 3: Media frequently used by university students

It can be seen from the chart that college students frequently use computers and mobile phones for 92.86% and 98.52%, respectively, while TV, radio, newspapers and magazines are 78.30%, 54.85%, and 34.05% respectively.

(3) In the questionnaire survey, questions about the daily use of the Internet by college students are set up, and statistics and calculations are made on the average daily use of the Internet by freshmen to senior students, as shown in Figure 4.

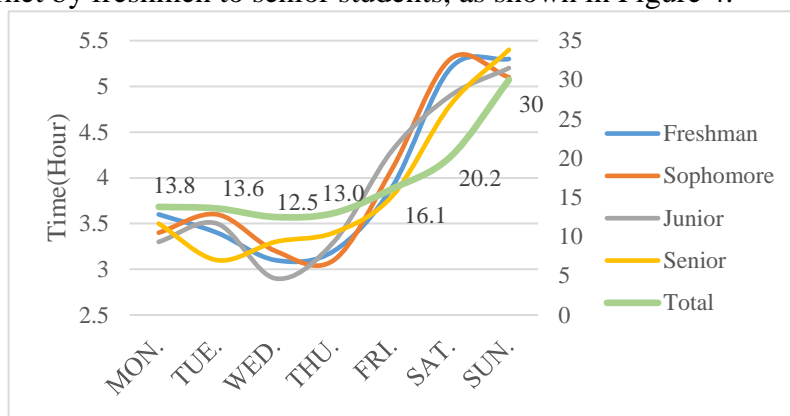


Figure 4: The average time (hours) that university students use the Internet every day

It can be seen from the chart that college students spend more time using the Internet every day, among which freshman students use the most time, followed by sophomores, and juniors and seniors spend relatively less time using the Internet; Saturdays and Sundays are students The maximum two days of online use of the Internet.

(4) In the process of questionnaire survey, the support situation of university teachers and students regarding the collaborative innovation of the supply-side reform of university campus culture and IPE based on big data, the specific results are statistically sorted, and graphs are drawn, as shown in Table 4 and Figure 5.

Table 4: University teachers and students' support for IPE reform

Option	Freshman	Sophomore	Junior	Senior	Teachers
1   Very supportive	41.24%	52.37%	36.42%	42.36%	67.31%

2	Supportive	45.67%	39.81%	47.21%	37.24%	28.05%
3	Commonly	7.66%	3.22%	9.67%	18.67%	3.82%
4	Not very supportive	2.26%	3.51%	4.16%	1.02%	0.45%
5	Very unsupported	1.17%	1.09%	2.54%	0.71%	0.37%

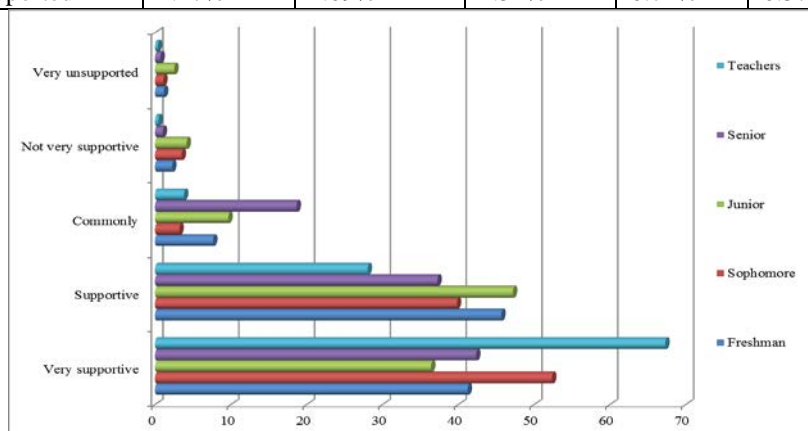


Figure 5: University teachers and students' support for IPE reform

As can be seen from the chart, among university teachers' support for IPE reform, "very support" accounted for 67.31%, "relatively supported" accounted for 28.05%, "general support" accounted for 3.82%, and "not so support" accounted for 0.45%, "very unsupported" accounted for 0.37%.

#### 4.2. Questionnaire Reliability Analysis

(1) Questionnaire validity test. The evaluation indicators are set to five levels: very reasonable, reasonable, basically reasonable, unreasonable, and fundamentally unreasonable. The specific situation of the statistical questionnaire validity is drawn into a chart, as shown in Table 5.

Table 5: Questionnaire validity test

Evaluation standard	Very reasonable	Reasonable	Basically reasonable	Not reasonable	Not reasonable at all
Questionnaire structure	10	9	7	2	2
Questionnaire content	11	10	5	2	1
Questionnaire logic	9	13	6	1	1
Questionnaire design	12	9	7	2	0

It can be seen from the chart that the scholars who participated in the evaluation affirmed the design, structure and content of the questionnaire.

(2) This article mainly applies the test-retest reliability analysis method in the questionnaire reliability testing process, using the commonly used Cronbach's Alpha reliability coefficient analysis in SPSS. Table 6 and Figure 6 show the experimental results.

Table 6: Questionnaire reliability test results

	Questionnaire structure	Questionnaire content	Questionnaire logic	Questionnaire design
Cronbach's Alpha ( $\alpha$ )	0.89	0.93	0.86	0.97

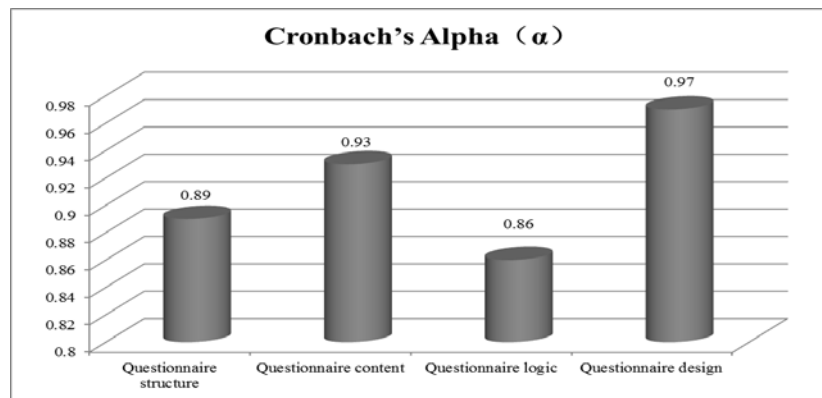


Figure 6: Questionnaire reliability test results

Calculated from the data in the table, the average value of the correlation coefficient  $\alpha$  of the questionnaire reliability is 0.91, indicating that the reliability value of the questionnaire is relatively high, and the survey content of the questionnaire is more real and reliable.

## 5. Conclusions

Innovation is a new concept of social development and an inevitable requirement for the development of IPE. Supply-side reform is one of the effective ways to promote the current social progress.

With the help of supply-side reform theory, it is helpful to promote the development of the main body and supply mechanism of universities and further promoting the implementation of the physical and mental education and quality development of college students, thereby enhancing the actual effect of the IPE of the university, it provides reference and reference for the development and implementation of IPE.

This article introduces Marxist thought and other theories, based on synergy theory, focusing on the growth status of college students, and focusing on the collaborative innovation of the supply-side reform of university IPE as the main research content.

## References

- [1] Su Z , Xu Q , Qi Q . *Big data in mobile social networks: a QoE-oriented framework*[J]. *IEEE Network*, 2016, 30(1):52-57.
- [2] Baccarelli E , Cordeschi N , Mei A , et al. *Energy-efficient dynamic traffic offloading and reconfiguration of networked data centers for big data stream mobile computing: review, challenges, and a case study*[J]. *Computers & Chemical Engineering*, 2016, 91(2):182-194.
- [3] Xu J , Hou Q , Niu C , et al. *Process Optimization of the University-Industry-Research Collaborative Innovation from the Perspective of Knowledge Management*[J]. *Cognitive Systems Research*, 2018, 52(DEC.):995-1003.
- [4] Mohan D A . *Big Data Analytics: Recent Achievements and New Challenges*[J]. *International Journal of Computer Applications Technology and Research*, 2016, 5(7):460-464.
- [5] Stevens H . *Big Data, Little Data, No Data: Scholarship in the Networked World*[J]. *Journal of the Association for Information Science & Technology*, 2016, 67(3):751-753.
- [6] Zaharia M , Xin R S , Wendell P , et al. *Apache Spark: a unified engine for big data*



- processing[J]. *Communications of the Acm*, 2016, 59(11):56-65.
- [7]Obermeyer Z , Emanuel E J . *Predicting the Future - Big Data, Machine Learning, and Clinical Medicine.*[J]. *N Engl J Med*, 2016, 375(13):1216-1219.
- [8]Specht, D. *The Data Revolution. Big Data, Open Data, Data Infrastructures and Their Consequences*[J]. *Media Culture & Society*, 2016, 37(7):1110-1111.
- [9]AtheyS . [Special Issue Perspective] *Beyond prediction: Using big data for policy problems*[J]. *Science*, 2017, 355(6324):483-485.
- [10]Hashem I A T , Chang V , Anuar N B , et al. *The role of big data in smart city*[J]. *International Journal of Information Management*, 2016, 36(5):748-758.
- [11]AkterS ,Wamba S F . *Big data analytics in E-commerce: a systematic review and agenda for future research*[J]. *Electronic Markets*, 2016, 26(2):173-194.
- [12]Yang C , Huang Q , Li Z , et al. *Big Data and cloud computing: innovation opportunities and challenges*[J]. *International Journal of Digital Earth*, 2017, 10(1):1-41.
- [13]Mauro A D , Greco M , Grimaldi M . *A formal definition of Big Data based on its essential features*[J]. *Library Review*, 2016, 65(3):122-135.
- [14]Oxendine S D ,Taub D J , Cain E J . *Factors Related to Native American Students' Perceptions of Campus Culture*[J]. *Journal of College Student Development*, 2020, 61(3):267-280.
- [15]Dang Y . *Teaching Practice of IPE in Specialized Courses —Operations Research—As an Example*[J]. *Open Access Library Journal*, 2020, 07(7):1-4.
- [16]Yi Y , Dan W . *The Realization of IPE in College English Based on Cultural Confidence*[J]. *Creative Education*, 2020, 11(11):2193-2198.
- [17]Wang H . *Research on performance evaluation of leisure agriculture supply-side structural reform with interval-valued dual hesitant fuzzy linguistic information*[J]. *Journal of Intelligent and Fuzzy Systems*, 2019, 37(3):1-8.
- [18]Erzhen, Zhang, Xiang, et al. *Supply-side structural reform and the transformational development of China's foreign trade*[J]. *China Political Economy*, 2018, 1(1):120-129.
- [19]ZHANG, HUI. *Supply-side Structural Reform: New Practice under the "New Normal"*[J]. *China Today*, 2017, 08(v.66):52-56.
- [20]Song Y ,Elsner W , Zhang Z , et al. *Collaborative innovation and policy support: the emergence of trilateral networks*[J]. *Applied Economics*, 2019(3):1-18.
- [21]DuanY . *Research on Joint Cultivation Mechanism of Adult Education under Collaborative Innovation Environment in China*[J]. *Creative Education*, 2020, 11(5):797-805.
- [22]Wu J ,Guo S , Li J , et al. *Big Data Meet Green Challenges: Big Data Toward Green Applications*[J]. *IEEE Systems Journal*, 2016, 10(3):888-900.
- [23]Alsheikh M A ,Niyato D , Lin S , et al. *Mobile big data analytics using deep learning and apache spark*[J]. *IEEE Network*, 2016, 30(3):22-29.
- [24]Zhou L , Pan S , Wang J , et al. *Machine Learning on Big Data: Opportunities and Challenges*[J]. *Neurocomputing*, 2017, 237(MAY10):350-361.
- [25]Hossain M S , Muhammad G , Alhamid M F , et al. *Audio-Visual Emotion Recognition Using Big Data Towards 5G*[J]. *Mobile Networks and Applications*, 2016, 21(5):753-763.