Design of Advance Security Early Warning System for Network Data Based on Artificial Intelligence

Ya-fei Wang[1(✉)] and Wei- na He[2]

[1] Information Engineering College, Pingdingshan University, Pingdingshan 467000, China
wangyafei54512@yeah.net

[2] Pingdingshan University School of Software, Pingdingshan 467000, China

Abstract. At present, the design of network data advance security early warning system warning accuracy rate is low, leading to long warning time, poor stability. Based on artificial intelligence, a new advance security warning system for network data is designed. The hardware of the system is composed of power module, acquisition module, driver module, alarm module and display module. The software program is designed according to the hardware structure of the system. The software program includes integrated control main program, temperature collection program, temperature display program and sound and light alarm program. Experimental results show that the network data advance security early warning system based on artificial intelligence can effectively improve the system early warning accuracy, shorten the warning time and improve stability.

Keywords: Artificial intelligence · Network data · Advanced security · Security early warning · Early warning system

Classification No.: TP277 Literature Identification Code: A

1 Introduction

As the carrier of information, network data automatic identification system has the ability to process information and extract key attributes of information, which facilitates people's lives and ensures the authenticity of information [1]. There are a large number of common signals with nonlinear and non-stationary characteristics in the data signal, and the information contained in the internal time domain and frequency domain must be analyzed by the safety early warning system [2, 3].

Artificial intelligence (AI) technology is a newly emerging technology in recent years. As a branch of computer science, AI includes robot, language recognition, image recognition and switching systems. AI uses the behavior of computer to achieve higher level applications. AI technology is therefore applied in various fields [4].

In order to improve the accuracy and efficiency of the early warning system, this paper designs a new network data advanced security early warning system based on

W. Fu et al. (Eds.): ICMTEL 2021, LNICST 387, pp. 553–565, 2021.
https://doi.org/10.1007/978-3-030-82562-1_54

artificial intelligence. The hardware part consists of five parts: power module, acquisition module, driver module, alarm module and display module. The software program includes Integrated control program, temperature acquisition program, temperature display program and sound light alarm program. The effectiveness of the system is verified by experiments.

2 Hardware Design of Advance Security Early Warning System for Network Data Based on Artificial Intelligence

The hardware of network data advance security warning system based on artificial intelligence is composed of power module, collection module, drive module, alarm module and display module. The structure of AI -based advance security warning hardware for network data is shown in Fig. 1:

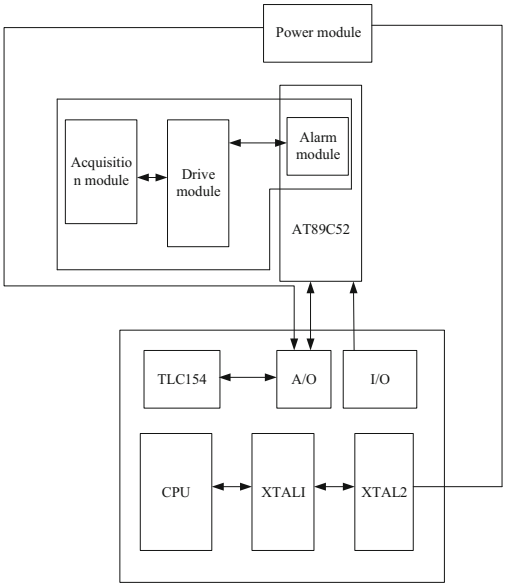

Fig. 1. Hardware structure of network data advanced security early warning system based on Artificial Intelligence

Analysis of Fig. 1 shows that the power module consists of an external AC power supply and an internal battery, both of which work simultaneously to ensure that the system can have continuous power. The stepper motor driver is controlled by the AT89C52 controller and the data acquisition is carried out by the TLC1543 chip.

Single chip microcomputer plays an important role and is the core structure of the advanced safety warning system. Two resistors are added outside the system. When the analog signal is collected by the sensor, the analog signal will be converted into digital signal through the corresponding signal processing circuit. Only the digital signal can

be input into the I/O interface of the single chip successfully, and the CPU of the system will scan the four I/O interfaces at regular time. When the I/O interface with high level is found, the system will immediately send out the demand for power failure. The alarm module inside the system is equipped with acoustic alarm. If the submersible pump fails, the acoustic alarm will quickly indicate the type of failure. In order to update and extend the system, a 8255 programmable peripheral parallel I/O interface is added to the peripheral.

2.1 Design of SCM Module

In this paper, the single- chip microcomputer AT89C52 is selected. The single- chip microcomputer is the main control chip of the system, which can realize A/D conversion, data reading, data processing and data output. Compared with the traditional SCM, AT89C52 SCM consumes less power, has higher performance, can realize ISP online programming, and can fully compatible with 51 all sub-series [5]. After the 8-channel analog of A/D conversion is input to ADC0809 chip, the chip will work at the same time with the CPU, choose the appropriate method to interrupt. When the A/D conversion is complete, the conversion signal is sent back to the CPU, which requests an interrupt [6].

2.2 Power Module Design

The control chip AT89C52 is used to control the operation of the whole system, and the crystal circuit and clock circuit are introduced into the power module. The AT89C52 is a CHMOS chip with strong control capability, and the pins are also equipped with XTALI and XTAL2. The reset circuit is programmable X25045 chip, which has the ability to monitor the working state of power supply [7]. The watchdog has the function of timing to meet the requirement of monitoring timing. The power module circuit diagram is shown in Fig. 2:

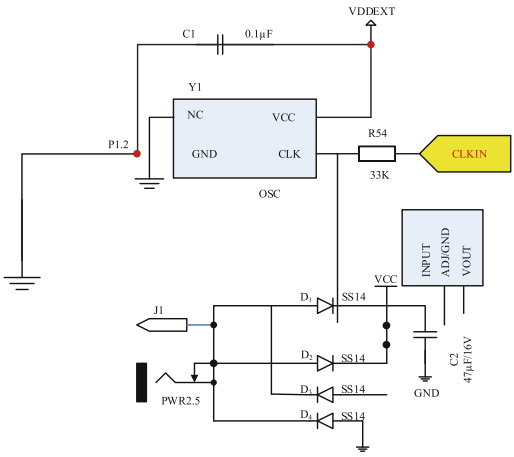

Fig. 2. Circuit diagram of power supply module

Set the working voltage of the intelligent integrated control system studied in this paper to be +5 V. When the +15 V DC voltage is introduced from the outside, the voltage is reduced, and two lithium batteries connected in series are used to charge the system power module. After the charging is completed, the system has a stable voltage. The power module chooses LM317 as the voltage regulator chip. LM317 has a strong series integration capability. While adjusting the system output, it ensures that the output voltage of the system is 2.2 V and the output current is 1.5 A. Compared with other regulators, the operation of LM317 is simpler. Connecting two resistors outside the regulator can set the voltage value. The operation is simple and the operation performance is stable [8].

2.3 Drive Module Design

The motor is also controlled by AT89C52. Three interface signals: pulse signal, offline signal and direction signal are added to the driver. These three signals are responsible for different tasks. The pulse signal is responsible for controlling the working speed of the stepper motor, and the direction signal is responsible for controlling the step. When the stepping motor stops, the off-line signal can ensure that the current of each phase is cut off [9].

The driver module is shown in Fig. 3:

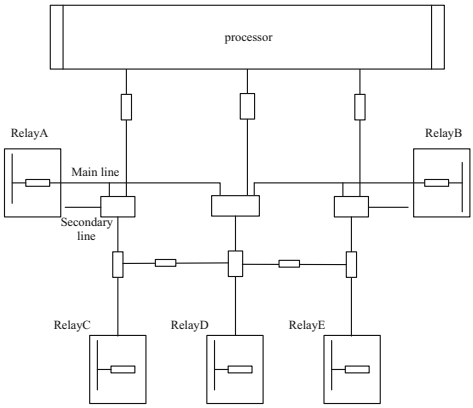

Fig. 3. Driver module

Observing Fig. 3, we can see that the drive module also introduces a double-pole double-throw relay. The double-pole double-throw relay transmits the control signal to the contactor that controls the motor. The normally closed contact in the relay is connected in series with the total number of faults. Once the submersible pump fails, the normally closed contact will be disconnected, and the total fault output circuit will also be disconnected. The setting of the freewheeling diode can well prevent the induced current generated by the relay coil from damaging the circuit components [10–13].

2.4 Sound and Light Alarm Module Design

Different from the traditional module, the alarm module selected in this article is the sound and light alarm module. Use light-emitting diodes and speakers to alarm at the same time. The indicator status lights of the diodes have two colors of red and green. When the submersible pump is in normal working condition, the green light of the system is on; when a fault occurs, the green light of the system is off and the red light is on. At the same time, the corresponding speaker will also emit an alarm sound. The system is equipped with a display, which displays the specific fault type, helping the staff to plan the corresponding solution in a short time.

2.5 Signal Receiver Design

The signal receiver's recognition and analysis speed for sounds in the recognizable range is 200 MHz/s. It can recognize and analyze the signals output by different wave propagation and different frequencies of broadcasting and broadcasting, and can process the received 6 signals in parallel each time. Broadcast audio on non-stop channels.

The special advantage of this type of signal receiver is that after identifying the outside broadcast, it will safely identify the broadcast data and audio to ensure the safety and health of the data. If the requirements are met, the signal receiver will record and backup the broadcast audio store and transmit to the host of the hardware part, and the host performs external transmission. In order to adapt well to the characteristics of broadcasting, the signal receiver opens the corresponding channel five minutes before the start of the broadcast program that can receive the signal, and starts the recording process to ensure the integrity of the broadcast data and prevent loss.

2.6 VS78 Model Host

The VS78 model host is the core part of the hardware area of the automatic broadcast recognition system based on artificial intelligence. The VS78 model host is an inclusive cabinet where the hardware area is placed. The motherboard recommends other hardware devices. The main work is to record the storage of the signal receiver of the hardware part. Perform demodulation and transmission. When the host broadcasts the broadcast audio to the outside, the broadcast recording audio is first encoded and compressed. On the one hand, the size of the broadcast audio is reduced and the operating pressure of the system is reduced. On the other hand, the copyright of the recorded broadcast audio is guaranteed to prevent criminals from carrying out downloads and using the broadcast audio in other unfair industries, bringing bad effects.

The type of the VS78 host is a virtual host. The advantage of the virtual host is to reduce the memory of the system, increase the sensitivity to the broadcast audio signal transmitted by the wireless network, and the virtual host has high variability. In special cases, according to the broadcast audio The special format of the virtual host can change the communication channel for signal reception, which is a manifestation of the high efficiency of automatic broadcast identification. The virtual channel communication direction is shown in Fig. 4:

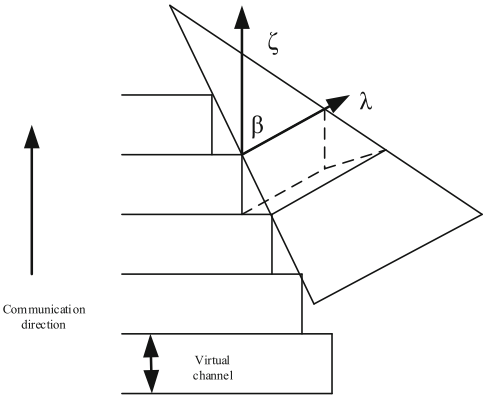

Fig. 4. Virtual channel communication direction

The structural framework of the hardware part the demodulation device is a structural adjustment of the hardware area. Its working principle is to monitor the hardware area equipment in real time, pay attention to the operation of the broadcast automatic identification system hardware area, and if there is a hardware device work processing result If the format and status are abnormal, the equipment is adjusted and the adjustment result is sent to the VS78 model host, and the host sends the final processing result back to the staff in the form of data. Structural framework The demodulation device converts the audio into digital audio signals by scanning the frequency spectrum of various broadcast audio services. If the converted broadcast audio digital signal is not within the normal range, it belongs to abnormal broadcast audio and needs to be demodulated. The demodulation process is to destroy abnormal broadcast audio to prevent other accidents from happening and ensure the normal operation of the automatic broadcast recognition system.

2.7 HI89 Model Chip

This article uses HI89 type chips for the work requirements of the artificial intelligence-based network data advance security early warning system. The chip is the key to system data storage. Therefore, this article chooses a new type of chip produced by the artificial intelligence field. The HI89 type chip is composed of UHF radio waves, wireless identification technology, and a four-channel interface composed of Edifier R2000. Compared with traditional chips, it has higher reading and writing functions. The card reading efficiency is 50 s and can complete 1G broadcast audio recognition. To a certain extent, the speed of automatic broadcast recognition is improved.

In addition, the core program of the HI89 chip is the JR7604 program, which has 4 TNC connectors with a memory of 50 Ω, and has a large memory storage space, which provides the basis for broadcast audio recognition. This chip has ultra-high radio frequency processing function, can run 8 identification channels at the same time, the signal loss of automatic identification is less, and the efficiency is improved. The HI89 type chip does not need the host to send instructions to the incoming system, which reduces

the operating procedures of the safety early warning system. HI89 model parameters are shown in Table 1:

Table 1. Model parameters of hi89 chip

Parameter	Numerical value
Working temperature	−40 °C–85 °C
Input forward current	30 mA
Input reverse voltage	10 V
Low level input current	300 μA
High level input current	20 mA
Low level gate voltage	1.0 V
High level gate voltage	VCC
High level delay time	50 ns
Low level delay time	80 ns

The work content of the TI processor of the artificial intelligence-based network data advance safety warning system is mainly to control the core. The processor will sense the operating heat and power consumption of the system in real time. If the internal heat of the system exceeds 70 °C or the thermal power consumption reaches 65 W, then the processor will turn on the cooling function. The processing speed of TI processors is as high as 8GT/s, which meets the operating requirements of the hardware area of network data systems.

3 Software Design of Advanced Security Early Warning System for Network Data Based on Artificial Intelligence

The software program is designed according to the hardware structure of the system. The designed software program includes the integrated control main program, temperature acquisition program, temperature display program and sound and light alarm program. The software flow chart of the network data advanced security early warning system based on artificial intelligence is shown in Fig. 5:

Analyzing the above figure, we can see that the artificial intelligence network data advance safety warning system studied in this article converts the temperature through the look-up table method. The system will automatically set two tables, namely the output voltage-temperature correspondence table and A/D conversion number- Analog voltage correspondence table. After obtaining accurate data information, the data in the table will be recorded in detail in the memory, and the temperature results obtained will be displayed on the LCD. The displayed temperature range is −5–150 °C, and the display accuracy is between ±0.5 °C.

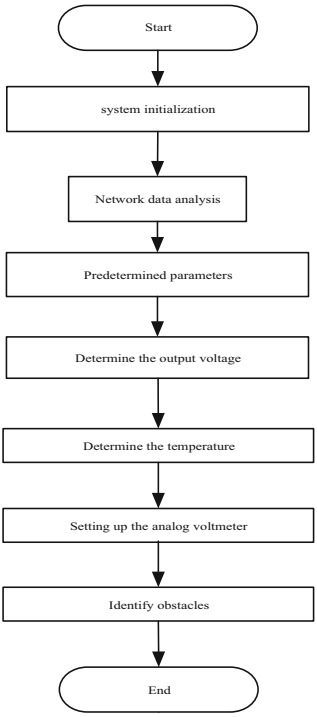

Fig. 5. Flow chart of software main program.

The software detection workflow is shown in Fig. 6:

The content detected by the integrated control system includes motor winding temperature, bearing temperature and motor humidity. If the electric pump in the motor is overloaded or the motor itself has quality problems, it will cause the winding temperature to be too high. When the winding temperature is too high, the motor will automatically sound an alarm. The bearing temperature is too high because the motor is overloaded or the axial force is too large, so the sound and light alarm subroutine and the CPU run at the same time, which can make the software run more flexible. Since the electric power is counted for a long time, once the humidity is too high, leakage may occur, so it is very important to monitor the humidity of the motor. Use I/V to convert the voltage and analyze the reference voltage. If the reference voltage is exceeded, it is necessary the alarm sounds.

4 Experimental Research

In order to further verify the early warning capabilities of the artificial intelligence-based network data advanced security early warning system, a comparative experiment was designed to compare with the traditional early warning system.

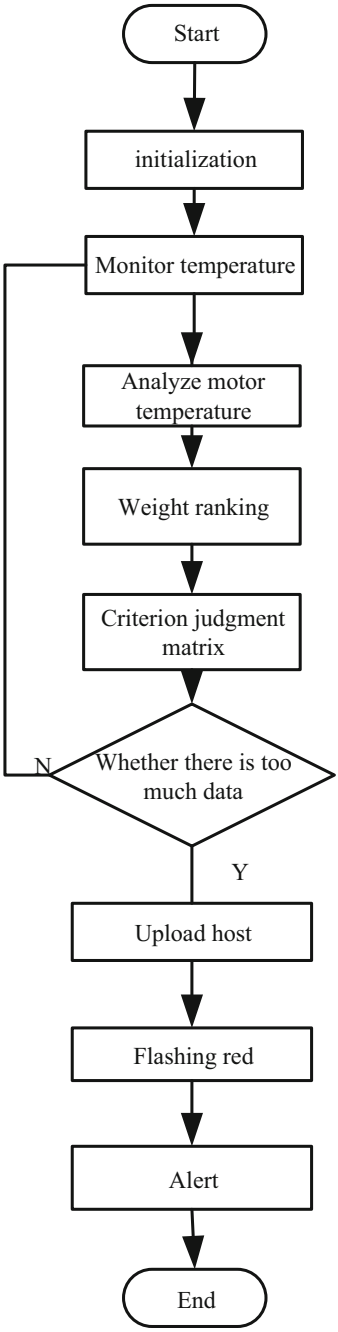

Fig. 6. Flow chart of software early warning

4.1 Experimental Parameters

The selected raw data parameters are shown in Table 2:

Table 2. Experimental data

Experimental project	Specific parameters
Working voltage	5 V
External voltage	15 V
Model of single chip microcomputer	AT89C52
Conversion mode	A/O conversion
Display temperature range	−5–150 °C
Display accuracy	±0.5 °C

4.2 Experimental Process

Experiments are performed according to the above set parameters, and the traditional integrated control system and the artificial intelligence-based network data advanced security early warning system based on this article are selected for integrated control, and the superiority of the control system studied in this article is verified by experimental results.

4.3 Experimental Results and Analysis

The experimental results obtained are shown in Fig. 7.

(1) Accuracy comparison of early warning results

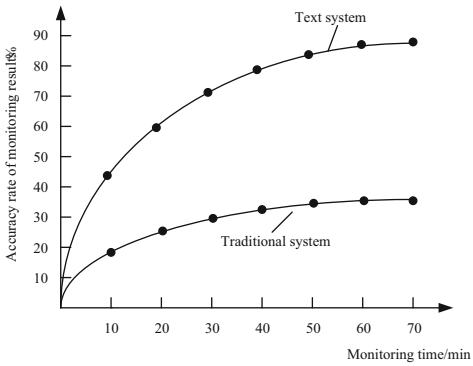

Fig. 7. Comparison of accuracy of monitoring results

Observing Fig. 7 we can see that as the monitoring time increases, the accuracy of the monitoring results of the system in this paper and the accuracy of the monitoring results of the traditional system are increasing, but the accuracy of the early warning system studied in this paper is always higher than that of the traditional early warning system. The circuit of the early warning system studied in this paper can simultaneously monitor the motor winding temperature, bearing temperature, motor humidity and mechanical seal degree, and feed back the monitoring results to the host system. The analog and switch values are closely integrated, which improves the accuracy of the system's early warning (Figs. 8 and 9).

(2) Stability comparison of early warning process

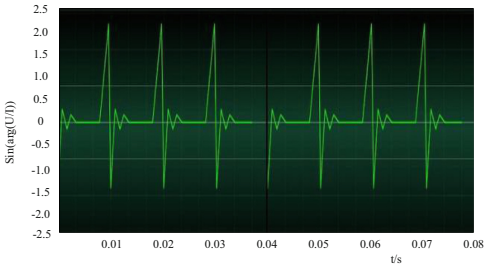

Fig. 8. Process stability of traditional system monitoring

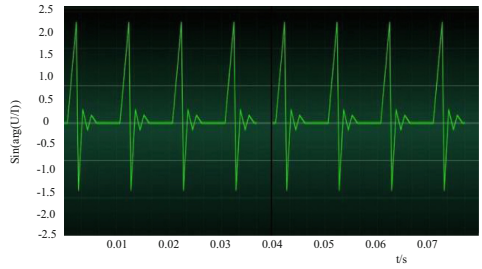

Fig. 9. Stability of monitoring process in this paper

On the whole, the early warning process of the system studied in this article and the traditional early warning control system are relatively stable, but when the early warning time reaches 0.04 s, the traditional early warning system has a fault in the early warning, and the early warning system studied in this article always maintains monitoring in a stable state. It can be seen that the early warning system studied in this paper is more stable.

(3) Comparison of warning time

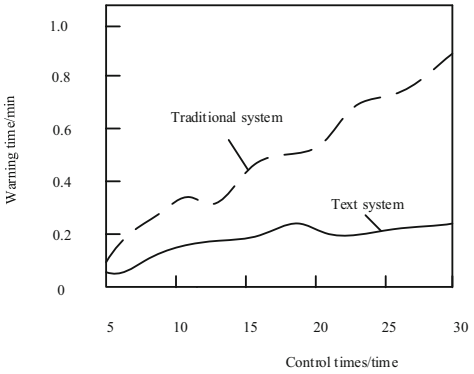

Fig. 10. Comparison results of early warning time

Analyzing Fig. 10, it can be seen that when the number of early warnings is 10 times, the early warning time spent by the traditional system is 0.11 s, and the warning time spent by the system in this paper is 0.08 s; when the number of early warning control times is 20, the warning time spent by the traditional system is 0.47 s, the early warning time spent by the system in this paper is 0.14 s; when the number of warnings is 30 times, the warning time spent by the traditional system is 0.85 s, and the warning time spent by the system in this paper is 0.21 s.

In summary, the overall performance of the early warning system studied in this paper is better than the traditional system. The system studied in this paper is designed with a special signal acquisition circuit and signal conditioning circuit. AT89C52 is very convenient to maintain, and it can monitor analog and switch values in a targeted manner, and control the working status of substation submersible pumps more safely and reliably.

5 Conclusion

The early warning system studied in this paper also introduces fault diagnosis technology, micro-motor technology, sensor technology and intelligent measurement technology, which can not only monitor the operation status of submersible pumps online, but also detect the operation failure of network data in time. Compared with traditional For the early warning system, the system studied in this article has stronger detection capabilities, better monitoring effects, and better realization of safety monitoring. On the whole, the intelligent strength of the system has been strengthened. AT89C52 is low in cost, stable in performance and easy to maintain. Very convenient, rich warning functions greatly reduce the burden of manual work, making the system operation safer and more reliable.

References

1. Rui, N., Lin, Z.: Design of learning quality assessment and early warning system based on artificial intelligence and data analysis. Electron. Des. Eng. **28**(11), 37–41 (2020)
2. Xiaokang, R., Rui, M., Li, Z., et al.: Artificial intelligence-based big data security management platform for dike engineering and its implementation. J. Yangtze River Sci. Res. Inst. **36**(10), 104–110 (2019)
3. Ping, L., Bin, W.: I-based propagation feature mining system for network public opinion big data. Mod. Electron. Tech. **043**(004), 176–179 (2020)
4. Leihua, Z., Hongtai, N., Zhongni, W., et al.: Research on the construction of early warning model of criminals based on big data. Netinfo Secur. **220**(04), 88–95 (2019)
5. Linfeng, Z., Jiancheng, L., Lixin, W.: Early warning technology of oil and gas pipeline based on monitoring data. Press. Vessel Technol. **036**(005), 55–60 (2019)
6. Yabin, L., Xinxiao, Z., Liangjun, M., et al.: Design and research of integrated safety risk early warning platform for hazardous chemicals handling and transportation. J. Safety Sci. Technol. **015**(005), 179–184 (2019)
7. Rong, Y., Benwu, N.: Design of intelligent safety management and control model for hydropower projects based on safety system theory. China Work Saf. Sci. Technol. **015**(009), 147–152 (2019)
8. Chen, Z., Shengrong, Z., Qingwei, M., et al.: Design and implementation of early warning and prompt function of clinical decision support system. Chin. Digital Med. **014**(008), 57–60 (2019)
9. Jiangao, D., Jiayin, Q., Binxing, F., et al.: Research on the governance model of Internet information behavior fusion for national public security. Jiangsu Soc. Sci. **300**(05), 133–145+281 (2018)
10. Wu Qiang, X., Hua, Z.Y., et al.: Mine water disaster smart emergency rescue system and application based on cloud platform. J. China Coal Soc. **43**(10), 5–11 (2018)
11. Liu, S., Liu, D., Srivastava, G., et al.: Overview and methods of correlation filter algorithms in object tracking. Complex Intell. Syst. 2020. https://doi.org/10.1007/s40747-020-00161-4
12. Liu, S., Lu, M., Li, H., et al.: Prediction of gene expression patterns with generalized linear regression model. Front. Genet. **10**, 120 (2019)
13. Fu, W., Liu, S., Srivastava, G.: Optimization of big data scheduling in social networks. Entropy **21**(9), 902 (2019)