Application of Computer Image Recognition Technology in Power Informationization

Jiaxuan Li1*, Xin Wen2

1University of Cincinnati Joint Co-op Institute, Chongqing University, Chongqing, China, 400030
2Department of Computer Science, Chongqing University, Chongqing, China, 400030

*Corresponding author e-mail: li5jn@mail.uc.edu

Abstract. With the rapid development of informationization, image recognition has been applied more and more deeply in various industries, and has become an important technical means in production and life, especially for the development of artificial intelligence. With the continuous development and progress of China's economy and society, the demand for electricity is increasing. How to provide sufficient electric energy safely and efficiently for social development has become the key goal of power system reform. Power equipment detection is one of the earliest links to realize information in China's power system. Because of its highly intelligent advantages, this technology can play an important role in the detection of power equipment, which further improve the automation and intelligence level of power equipment detection. Starting from the practical application of this technology in power information, this paper analyzes some advantages that this technology can bring in power system, and provides a reference model for the popularization of this technology.

Keywords: Image Recognition Technology, Electric Power Informationization

1. Introduction
Electric power is the energy base of China's economic development, promoting electric power informatization is undoubtedly an effective guarantee for China's energy security. Image recognition is the representative of information technology, how to apply image recognition technology in the power system will be an important problem to consider in the future power information.

2. Overview of image recognition technology
The so-called image recognition, is through the computer for the acquisition of image analysis, processing and understanding, so as to distinguish the target in different modes of technology. With the accelerating process of information technology, the application of image recognition in various industries in society is more and more in-depth, and it has become an important technical means in production and life, especially for the development of artificial intelligence. Before image recognition, the required image must be obtained first, mainly through the camera and video camera to obtain [1].

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd
Because the process of image acquisition will be affected by the instrument itself and the external environment and other factors, it is necessary to preprocess the acquired image, so as to remove the interference and noise in the image and improve the quality of the image. After that, computer image processing technologies such as transformation, enhancement and segmentation are also needed to extract and analyze the features of the image and describe the features of the objects in the image. In the process of image recognition, the construction of image recognition model is an essential link, which is widely used in template matching and prototype matching model. The template matching model can only identify the target which is consistent with the template, while the prototype matching model only needs the similarity between the target and the prototype template to identify the target.

With the continuous development and progress of China's economy and society, the demand for electricity is increasing [2]. How to provide sufficient electric energy safely and efficiently for social development has become the key goal of power system reform. And through the application of computer information technology to achieve power information is undoubtedly an important option, as an important branch of computer technology, image recognition is believed to play an important supporting role in the process of power information.

3. Present situation of electric power informatization in our country

Electric power industry is a cover planning and design, construction, production, distribution, marketing, and other links of complex information, the electric power informatization is through every link of computer information technology to the electric power industry informatization reform, so as to realize the modernization of the whole system upgrading, the traditional power industry into a highly intensive, better educated and chemical industry. Realizing electric power informatization is the only way to continuously improve the core competitiveness of the electric power industry. It mainly covers the two major aspects of management informatization and production process automation.

China's electric power information originated in the 1960s, through the early information technology initially realized the automatic control and monitoring of substations and power plants. After the 1990s, the development of computer information technology, a variety of new technical means continue to emerge, the development of China's electric power information has also presented a blowout situation [3-4]. Electric power information changed the original only limited to the single machine and single item of information situation, began to move toward the overall, network and comprehensive direction, from local application to global application, by single machine operation extended to the network operation, the level of information greatly improved. Nowadays, informatization has become an important strategic goal of all electric power enterprises' operation, production and management.

4. Application of image recognition in power informationization

Image recognition is an important branch of computer technology, which represents an important direction of future technology development. In the process of electric power informatization, the research and application of image recognition technology can promote the process of electric power informatization. (figure 1)
4.1. Application of this technology in on-line inspection of power equipment

Power equipment detection is one of the earliest links to realize information in China's power system. Because of its highly intelligent advantages, this technology can play an important role in power equipment detection, and further improve the automation and intelligence level of power equipment detection. It is not only necessary but also feasible to use this technology to detect power equipment.

4.2. Based on the technology of the power equipment detection of the overall scheme

Many power plants and substations have built a relatively perfect video monitoring system, based on which the purpose of detecting and analyzing power equipment can be realized. Digital camera is the main equipment in video monitoring system to monitor the running state of power equipment. Its sensor is a charge coupling element, which can convert the acquired information into optical signal and then transmit it to the monitoring computer. In the whole system, the monitoring computer is the core, image processing, analysis and recognition depend on it. After the monitoring image is collected by the digital camera, the computer will analyze and process it through the image recognition technology [5-7]. If abnormal power equipment is found, it will send an alarm to the computer of the master station through the GPRS wireless network for early warning.

4.3. The process of image recognition

Image recognition is a crucial link, in this link contains a number of different steps, each step has an important impact on the results of recognition, determines whether the power equipment detection work can go on smoothly. (figure 2)
(1) Image preprocessing
Under the influence of various factors, there are all kinds of quality problems in the image collected by digital camera. If it is directly used without the link of image preprocessing, it will bring extremely adverse effects on the results of identification and analysis. In this step, the collected image should be gray processed first, and then the noise interference in the image should be eliminated through smooth filtering. When processing the image through smooth filtering, the smooth template with the weighted coefficient can be used to realize the realization. After smoothing, histogram equalization is used to ensure the image quality.

(2) Select the binarization threshold
In the process of image recognition, the computer memory needs to be occupied. If the amount of images is large, the speed of calculation and recognition will be affected, which is not conducive to guaranteeing the real-time performance of power equipment detection. In addition to improving the hardware performance, we can also improve the processing speed by improving the algorithm. By converting the gray digital signal into binary digital signal, it can provide more convenience for image analysis and improve the speed of calculation and recognition. There are three methods of image binarization: global threshold, dynamic threshold and local threshold.

(3) Identification of electrical equipment
After the completion of the above two steps, the quality of the target image has been able to meet the requirements of analysis and recognition, and it has entered the identification stage of the original power equipment. In the identification of power equipment, the identification method of template matching model is undoubtedly extremely inefficient, which is not conducive to the improvement of the detection ability of power equipment. Therefore, the sequential similarity detection algorithm can be used to identify power equipment.

(4) Failure analysis and judgment
In addition to monitoring the running state of the equipment, the purpose of the inspection of the power equipment includes finding out the fault of the power equipment, and judging the fault type, and finally troubleshooting the equipment fault [8]. In order to realize the judgment of the running state of power equipment, it is necessary to compare the current image with the historical image through the frame difference method to judge. If the equipment is in an abnormal state, there will be mutations and new contours in the image. The system can then send out an alarm signal to remind the relevant personnel to troubleshoot.

4.4. Application of image recognition in electric power marketing
Electric power marketing is an important link in the electric power industry system, which occupies the core position in the business of power supply enterprises. The quality of electric power marketing determines the survival and development of electric power enterprises. With the continuous advancement of power supply enterprise information construction, information marketing management system has been comprehensive promotion, and promote the improvement of power marketing service quality, but there are still some problems have not been effectively solved, need to use new technical means for further improvement. Among them, one of the more prominent problems is to withdraw the filling of the number of electricity meters [9-10]. Because the operator needs to enter manually through the marketing management system, it is likely to occur misoperation, which will affect the accuracy of information and cause losses to enterprises and customers. If the image recognition technology can be applied to the power marketing, the withdrawal of filling in the number of electricity meters can be automatically completed by the machine and program, and the accuracy of the electricity meter model, the representation number of electricity meters and the barcode information of electricity meters will be greatly improved.

Power marketing image recognition system needs to have a fixed operating platform, in the platform to withdraw the electricity meter is placed in the photo area, the computer will automatically control the digital camera image collection, after the collection of images can be used to identify the electricity meter model, representation number and bar code through image recognition technology.
The operation platform is mainly composed of industrial control host, digital camera, control switch and display equipment, which is the core of the whole system. After collecting the relevant information of the withdrawal table, it can also manage the relevant information through the information management function to complete the sorting, analysis, statistics and other related work.

5. Conclusion
In short, image recognition is an advanced technology, its application in the power system can effectively promote the process of power information, promote the power system technology upgrade. A technique in which a computer analyzes, processes, and interprets the acquired images in order to identify objects in different modes. Starting from the practical application of this technology in power information, this paper analyzes some advantages that this technology can bring in power system, and provides a reference model for the popularization of this technology.

References
[1] Chen Zhiwen. Data Gateway for Power Informatization and Automation: CN, CN2859597Y[P].
[2] China Electrical Engineering Society Electric Power Information Professional Committee. A Summary Report on the Development of Electric Power Informatization in 2004 Electricity Information and Communication Technology , 2005, 3(3):20-25.
[3] Fu Xinjun, Chai Lei. Electric power information network management monitoring is imperative [C]/ China Institute of Electrical Engineering Rural electrification Branch Automation Committee Annual meeting and academic seminar. 2008.
[4] Lu Junsheng. Development of Power Informatization in China [J]. A Brief Discussion Enterprise technology development: early issue, 2009.
[5] Wang Lei, Zeng Nan, Hao Yingyong, et al. A comprehensive performance evaluation method for power information.
[6] Zhang Huafeng. Discussion on the New Operation and maintenance system of Electric Power Informatization [C]/2009 Annual meeting of Gansu Electric Engineering Society. 2009.
[7] Zhang Ji. [M]. Power Informatization and Information Security China Electric Power Press, 2013.
[8] Zhang Jing, Hao Yuxing, Xue Xiaoru, et al. Application of Image Recognition in Electric Power Informatization [J]; 2 Wireless Internet Technology 15(22):164-165.
[9] Zhang Shu, Zhang Wanli, Wei Zibo, et al. Discussion on Several Problems of Electric Power Informatization [J]. 1 Scientific research , 2016, 000(007): P. 250-250.
[10] Zhao Jingrong. The Application and Research of Flex Based WebGIS in Power Informatization University of Electronic Science and Technology , 2011.