

The Application and Research of Artificial Intelligence Technology in Power Grid Infrastructure Project

Xinmin Yu
110903205@qq.com

State GRID Fujian Economic Research Institute, Fuzhou, China

Abstract: Power grid infrastructure construction project is a systematic and comprehensive project, The coverage is extremely extensive, at the same time, In the construction of power infrastructure, we need to consider a lot of data and information processing work and a large number of artificial special operation system, Under the traditional techniques and ideas, It is already difficult to meet the requirements and efficiency standards of the current power grid infrastructure construction, In combination with the context of The Times, Big data technology and artificial intelligence technology can provide new hardware support and theoretical support for the power grid infrastructure construction, In the process of the artificial intelligence technology applied to the power grid infrastructure construction, It will meet the requirements of The Times with the high efficiency, high quality, high convenience and advanced nature of the system.

Keywords: artificial intelligence; power grid infrastructure; intelligent identification technology

1 Introduction

The infrastructure construction project of the power grid is a systematic and comprehensive project, The coverage is extremely extensive, at the same time, In the construction of power infrastructure, we need to consider a lot of data and information processing work and a large number of artificial special operation system, Under the traditional techniques and ideas, It is already difficult to meet the requirements and efficiency standards of the current power grid infrastructure construction, In combination with the context of The Times, Big data technology and artificial intelligence technology can provide new hardware support and theoretical support for the power grid infrastructure construction, In the process of the artificial intelligence technology applied to the power grid infrastructure construction, Will be the high efficiency of the system, high quality, high convenience and advanced to meet the requirements of the era of power infrastructure, at the same time, The successful application of AI technology in power infrastructure construction will generate new technologies and ideas, This new technology will have huge application prospects in similar industries^[1].

2 Project overview

2.1 Research background

China's infrastructure construction capacity is among the best in the world, at the same time, The state attaches great importance to electric power and energy, With the country's strategic arrangement for new energy and the increase of social demand for electricity, It can be predicted that the construction of the national power grid infrastructure will be upgraded in the future, In the face of such power facility development form and actual demand, Traditional forms and technologies of power engineering supervision have not met the new requirements, There are many problems in engineering supervision, On the one hand, many special operations are involved in the electric power inspection, Energy needs to be invested in talent training, On the other hand, manual inspection is very inefficient and heavily dependent on human resources, In particular, the data is recorded and processed very slowly and inefficiently, It is basically difficult to meet the needs of modern power grid infrastructure and high-quality and modern construction requirements[2].

2.2 Significance and value of artificial intelligence technology applied to power grid infrastructure construction

2.2.1 Study Significance

When science and technology is the primary productive force, The same is true of power grid infrastructure construction, New technologies and new design concepts can inject fresh blood into the grid infrastructure, At the same time, it promotes the development and progress of power grid facilities construction, Grid infrastructure is a systematic and comprehensive project, It has the characteristics of many inspection items, complex content, many participants, large time span and irregular problems, Facing a large number of data information, video sample acquisition, storage and processing, Using AI technology can cope with these problems very well, Promote the application of artificial intelligence in power grid construction and power grid digital transformation, Comprehensively improve the lean control level and management efficiency of the construction site of power transmission and transformation projects [3-5].

2.2.2 Specific value

In artificial intelligence to infrastructure site monitoring, for example, in general, power infrastructure construction coverage is wide, in complex and limited construction environment, construction team many lead to site traffic is large and disorderly, through artificial intelligence technology field recognition algorithm evaluation system to real-time monitoring of infrastructure environment and face recognition and vehicle identification, and identify information and some basic indicators uploaded to the database, intelligent processing by the system, greatly reduce artificial burden and unit pressure, and detection work become more efficient and convenient.

Power grid infrastructure construction will involve the construction of higher degree of risk, at the same time infrastructure personnel to face and overcome all kinds of high risk environment, using artificial intelligence technology can help managers and operators of the operation of the

equipment accurate monitoring, for high mold and deep foundation pit and mechanical hoisting and other large construction safety to provide reliable guarantee. Artificial intelligence technology in the value of power grid infrastructure construction is mainly reflected in the technology, through the data statistical analysis and program design can realize the effective processing of real-time data information and give intelligent evaluation, the evaluation results can provide important reference value for professional artificial evaluation, and reduce a lot of time.

3 Apply artificial intelligence technology to design power grid infrastructure construction

3.1 Study content and expected objectives

In the practice of power grid infrastructure construction with the technical concept of artificial intelligence, The use of big data technology and cloud computing and intelligent evaluation system to seek to build an intelligent construction procedure and intelligent management platform, Through the intelligent identification algorithm evaluation system and BIM and other technologies to achieve the whole process of on-site supervision, Clear control and supervision of the construction personnel, vehicles entering and leaving the site, and related machinery and equipment, Master the project progress, To provide reference basis for the construction schedule adjustment of the project, dynamically collect all required data information by a monitored operation mode, The results are then presented through the intelligent algorithm, And to achieve the purpose of scientific early warning, To provide an important guarantee for the safety and efficient operation of power grid facilities construction projects; Improve the construction efficiency and construction quality of the whole construction process, Compress the construction period and expenses, Save money on the construction cost.

3.2 Construction of intelligent identification system of power grid base construction site

The construction environment is generally complex and limited, with high personnel density and large mobility on the site, so personnel control will be the key, and the intelligent control platform with intelligent identification system as the core can achieve an objective understanding of the work dynamics and attendance of employees, and improve the rigorous and efficient management.

1) Evaluation system of intelligent identification algorithm

a. Single scene target detection score

Single scene target detection score H is the sum of mAP scores, recall scores, detection rate scores and precision scores, in the mathematical form of:

$$H=M + P + O + K \quad (1)$$

Where, M is the mAP score (0-30) =mAP * 30

The p is the recall score (0-25) = recall * 25

O is the detection rate score (0-20) = (1000 / t / 30) * 20, where t is the average calculation

time, and the average calculation time is the ratio of the total detection time to the number of pictures. If $(1000 / t / 30)$ is greater than 1, it will be calculated as 1.

K is the accuracy score value. $(0-25) = \text{Check rate} * 25$

The evaluation method of the single-track algorithm is to measure the comprehensive effect of the algorithm by measuring mAP, missed detection rate, false detection rate and average calculation time.

b. Evaluation method of comprehensive classification scenario algorithm

It is measured by Rank (comprehensive ranking) and RankS (comprehensive ranking score). When Rank is lower, the top ranks; if Rank is the same, as measured by RankS, the higher the RankS ranking is high. If both Rank and RankS are the same, the difficult the scene is judged by experts, and the complex and difficult ones are ranked high.

$$\text{Rank} = (\text{R}_1 + \text{R}_2 + \text{R}_3) / 3 \quad (2)$$

$$\text{RankS} = (\text{R}_{S1} + \text{R}_{S2} + \text{R}_{S3}) / 3 \quad (3)$$

among:

R [num]: Represents the number of times scene names are placed in safety, progress and quality classification scenarios.

R S [num]: Order scene target detection score in safety, progress and quality classification scenarios.

Infrastructure construction site intelligent recognition system construction and research is to set up intelligent recognition system in the construction site, in the design system, to consider a large number of video image samples, based on the algorithm evaluation system research effective operation, to reduce the power transmission and transformation engineering construction site personnel work burden, improve the construction efficiency of the project.

Finally, the experimental test is carried out. Firstly, the test system can withstand the huge data pressure in specific engineering practice. In the process of data acquisition, the performance and stability of the system should be observed, and whether the data is formatted according to the estimated effect should be observed.

Secondly, the accuracy of the system is verified by the selection of the algorithm. The basic data is divided into two parts, which are used for training and testing respectively. In the testing process, the accuracy and reverberation of the system are mainly investigated. For the classification algorithm, the accuracy of the algorithm is generally verified by the confusion index.

The artificial intelligence recognition system can identify effective targets and invalid targets for the movement targets, face detection and vehicle detection of the construction site. Use multi-target tracking, target fusion and target scoring technology for continuous tracking in specific scenes, and capture a large number of high-definition pictures. Figure 1 is the artificial intelligence technology to extract video target, and the human form in the video target of intelligent simulation results, in addition, face can also extract the facial features in the video, through facial features for accurate identification, but also can automatically dig out, and the face images into metadata for upload, storage, and so on.



Figure1: Artificial intelligence technology extracts video targets

In fact, artificial intelligence recognition is widely used in power grid facilities engineering. Combined with big data technology, it can diagnose the fault of transmission line inspection images and identify the coarse-grained defects such as bird's nest, insulator self-explosion and foreign body through image intelligent recognition technology.

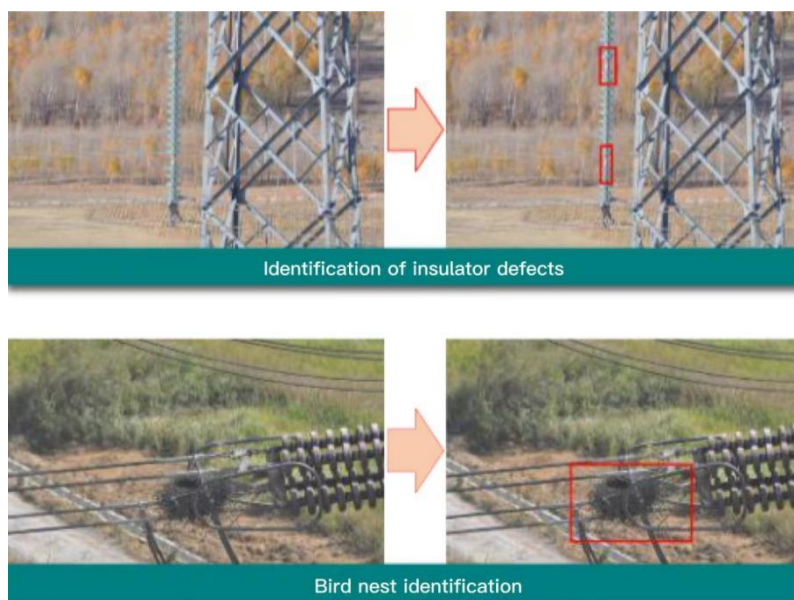


Figure 2: Insulator defects and nest nest identification

As shown in figure 2, insulator defects and the bird's nest will affect power grid facilities, and many grid facilities similar from fault and accidental failure need manual inspection, it takes a lot of human resources and personnel energy artificial intelligence identification technology can be very good to line real-time monitoring, and to identify the fault source in time, greatly reduce the loss of human resources and inspection benefits.

4 Conclusion

Through the in-depth study of new technologies and specific algorithms, the special application of artificial intelligence technology in power grid infrastructure can be realized, and the unity of comprehensive, systematic and standardized results can be formed, so as to realize the sharing and sharing of results of intelligent identification technology in power grid construction on the construction site, promote the application of artificial intelligence in power grid construction and digital transformation of power grid, and comprehensively improve the lean management and control level and management efficiency of power transmission and transformation project construction site. Artificial intelligence technology will be infiltrated into all aspects of power grid construction, which is of positive significance for improving the efficiency and comprehensive benefits of engineering construction management. The ultimate goal of promoting design digitization, construction mechanization, intelligent management and control, and data platformization is to ensure safety and efficiency of science and technology, and comprehensively improve the level of infrastructure management. The integration of artificial intelligence and power grid application technology will effectively improve the ability to control construction management and control, improve the safety of power grid construction, provide new kinetic energy for the next step to change the implementation mode of infrastructure and high-quality development, play the role of artificial intelligence in quality change, efficiency change and power change, and improve total factor productivity. Accelerate the construction of a safe, reliable, green and efficient smart grid.

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