



Research on Shadow Detection Method of Infrared Remote Sensing Image Based on Artificial Intelligence

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Abstract. In the process of the development of science and technology in China, in order to maximize the use of network and high-tech resources, more and more fields are increasingly being used for artificial intelligence during this period to meet the growing demand for high technology and requirements. Artificial intelligence is necessary to detect the shadow of infrared remote sensing images. Therefore, in the field of image detection, artificial intelligence must be applied appropriately. In this paper, through the research on the characteristics of artificial intelligence and the artificial intelligence infrared shadow image detection method, the importance of artificial intelligence for infrared remote sensing image detection is deeply analyzed. The significance of research on infrared remote sensing image shadow detection based on artificial intelligence is emphasized.

Keywords: Artificial intelligence · Infrared remote sensing image · Shadow image detection · Detection method

1 Introduction

Due to the limitation and influence of imaging technology, imaging conditions and other factors, there are more or less degradation phenomena in the formation of color remote sensing image, and image shadow is a typical representative [1]. The existence of shadow will disturb the image processing of computer vision, affect the accurate interpretation and interpretation of image information, and bring many difficulties to the follow-up remote sensing image processing, such as target classification and recognition, image matching, etc., so it is very necessary to detect image shadow.

At present, there are many research results on shadow detection of infrared remote sensing image. In reference [2], a shadow detection method based on depth information is proposed. In order to solve the problem of automatic shadow detection in complex scenes, an automatic shadow detection algorithm for single image based on depth information is proposed. Firstly, the depth information is used to estimate the normal and point cloud information of the image, and multi-scale texture filtering is applied to the image; secondly, the normal, point cloud and chroma information are used to estimate the shadow confidence and brightness confidence of the filtered image at different scales, and the shadow boundary correlation multi-scale fusion is applied to

the two confidence maps, At the same time, the complex shadow boundary information and structure information are preserved. Finally, Laplace operator is used to optimize the shadow confidence and get more accurate shadow detection results. However, this method is too complex and has a long time-consuming problem. In reference [3], a shadow detection method of infrared remote sensing image based on support vector machine is proposed. Firstly, the image is segmented into independent regions; secondly, the high-order energy equation is built by using support vector mechanism to model the shadow layout information; finally, the minimum equation is used to determine whether the region is a shadow, but the detection accuracy of this method is low, and the actual application effect is not ideal.

Artificial intelligence technology has the new characteristics that the previous science and technology systems do not have. The design and application of artificial intelligence technology under the Internet background should also be adapted to the new era and new requirements. The construction of infrared remote sensing image shadow detection method under artificial intelligence technology should also be adapted to the modern situation [4]. In order to combine the innovation of science and technology in the development of image detection methods in the contemporary development, we must design and construct the infrared remote sensing image detection technology under the Internet according to the actual situation, which really plays the role of artificial intelligence technology [5]. There is also a big innovation and reform in the detection method of shadow images, which makes the artificial intelligence technology more and more important and the inevitability and importance of using artificial intelligence technology to carry out technological innovation in various fields [6].

Because most methods of infrared remote sensing image shadow detection rely on manual work and have strong subjectivity, the detection accuracy decreases. Although some researches have put forward methods of infrared remote sensing image shadow detection by computer, there are some defects. In order to solve the problems existing in the traditional methods, this paper puts forward an infrared remote sensing image shadow detection method based on artificial intelligence. This method can solve the problem of complex scene shadow detection, promote the further development of image shadow detection technology, and can be better applied in many fields.

2 Research on the Characteristics of Artificial Intelligence

In recent years, more and more industries have gradually realized the positive significance of artificial intelligence [7]. Especially in the era of the Internet, many companies have increased the design and application of artificial intelligence technology, and gradually pay attention to the new methods of using modern technology and digital technology in the process of infrared remote sensing image shadow detection. However, in the actual application of artificial intelligence, some enterprises or fields are not optimistic after the successful use of artificial intelligence technology. This is because many companies have succeeded in completing the artificial intelligence technology under the Internet background. On the contrary, the requirements for the accuracy and

accuracy of technical work have gradually relaxed, which eventually led to the negative effect [8].

When looking at the artificial intelligence technology in the context of the development of the Internet, even if new technologies have been formed, it is necessary to pay attention to the emergence of various other problems. It is necessary to exert the true value of artificial intelligence technology under the Internet, rather than letting it flow, but sometimes it will affect the work [8]. Many large companies' optimism about artificial intelligence makes them want to build and use this technology in the enterprise to improve the efficiency and accuracy of their work. Due to its uniqueness, artificial intelligence often has relatively high technical requirements in the process of application [10]. Especially for developers, artificial intelligence-based infrared remote sensing image shadow detection method is the latest method at this stage [11]. Under such a background, the research on artificial intelligence-based infrared remote sensing image shadow detection method has gradually become an important topic. It is necessary to seize the opportunity, give play to the important role of science and technology, promote scientific and technological progress and innovation, improve the updating and upgrading of shadow image detection methods, and strengthen the innovation and upgrade of image detection methods in the intelligent context [12].

3 Research on Shadow Detection Method of Infrared Remote Sensing Image Based on Artificial Intelligence

China's high-tech has shown a state of rapid development. Infrared remote sensing image shadow detection has also received more and more attention. The solution to the problem of shadow detection is also mentioned on the agenda [13]. Due to the shadow of infrared remote sensing images, the inspectors are often in a state of long-term intense work, which not only exacerbates the psychological pressure of the staff, but also increases the difficulty of image discrimination [14].

According to Table 1, in the context of intelligence, the Internet and artificial intelligence present new features that China has not had before, in terms of technological innovation, application, and implementation [15]. This uniqueness has created the inevitability and particularity of the rapid development of various fields in the Internet age [16]. Artificial intelligence infrared remote sensing image shadow detection method has new features that traditional image detection methods do not have [17]. For the development and innovation of detection systems in the context of artificial intelligence, it is also necessary to adapt to the new era and new requirements, and the improvement of detection methods should also be adapted to the modern situation.

Table 1. Artificial intelligence technology information sheet

Constitute	Availability	Effective rate
Computer technology	87.4%	38.2%
Data base	69.2%	65.8%
Visual technology	76.4%	67.2%

According to Figs. 1 and 2, it can be known that the projection method of infrared remote sensing images plays an important role in the detection of shadows. In the projection of an image, the probability of projection for a region can be expressed by the following formula:

$$P(A/B) = P(B/A) * P(A)/P(B) \tag{1}$$

This formula shows the probability that an A event will also occur under the condition that the B event occurs, which is equal to the conditional probability of the occurrence of the B event under the condition of the A event, and then multiplied by the probability of the A event, and then divided by the probability of the occurrence of the B event [18]. When A and B are replaced by S and T, the total probability values of S and T and the conditions to be satisfied can be expressed by the following formula:

$$Rc(s) = \{s|I(s, t) > 0\} \tag{2}$$

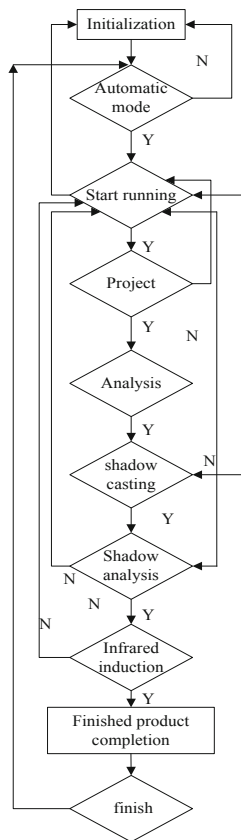


Fig. 1. Image projection flow chart

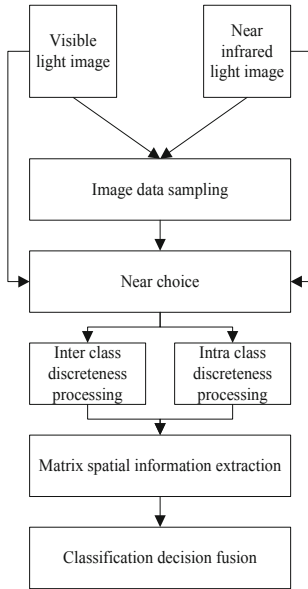


Fig. 2. Image shadow information collection flow chart

According to Fig. 3, with the modernization of China, in recent years, the state’s investment in artificial intelligence technology and remote sensing technology is gradually increasing. This has enabled the technical work in various parts of the country to be carried out in an orderly manner, and the demand for shadow image detection and recovery is growing. It has led to the booming image detection industry and artificial intelligence technology [19]. For radiance in remote sensing technology, the following formula can be used to calculate:

$$Le = dLe/d \cos \theta \tag{3}$$

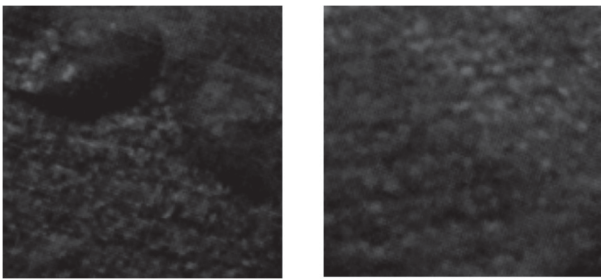


Fig. 3. Infrared remote sensing image map

In the formula for radiance, θ is the angle between the given direction and the normal of the source cell. The research on shadow detection method of artificial infrared infrared remote sensing image is to analyze and research the modern image detection problem on this basis. Also, it discusses and discusses the solutions to the common problems in the current shadow image detection process, improving the quality and efficiency of shadow image detection. At the same time, the technical support for scientific and technological personnel is strengthened and the harmonious development of science and technology is jointly promote in all aspects of China [20].

4 Verification of Shadow Detection Method for Infrared Remote Sensing Image Under Artificial Intelligence

The research on shadow detection method of artificial infrared infrared remote sensing image is based on such a society, in order to alleviate the psychological pressure of staff and enable them to concentrate on their work. If the person inspected does not have artificial intelligence awareness and works blindly without professional training, it may cause mishandling of the monitoring work or even cause an accident. If the staff does not have good physical and psychological qualities, they will not be qualified for the

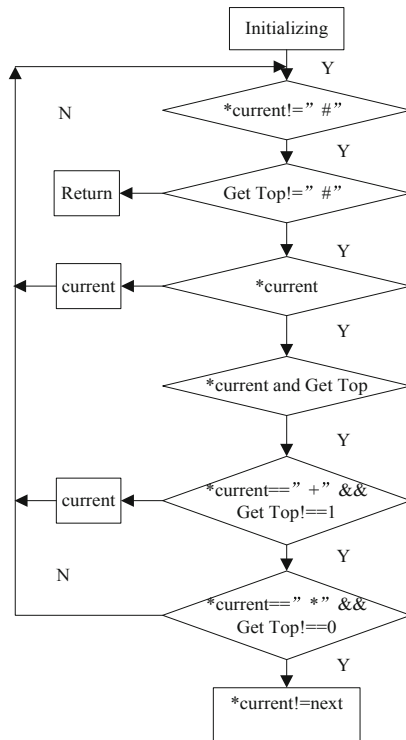


Fig. 4. Image position conversion flow chart

shadow detection of infrared remote sensing images. Therefore, inspectors must conduct job tests and professional training before working, especially to know the characteristics and characteristics of artificial intelligence.

According to Fig. 4, the development of modern social science and technology is very rapid. Work in all industries is linked to technology, the Internet, and artificial intelligence. Artificial intelligence infrared remote sensing image shadow detection method is the product that emerged in such a large environment (Fig. 5).

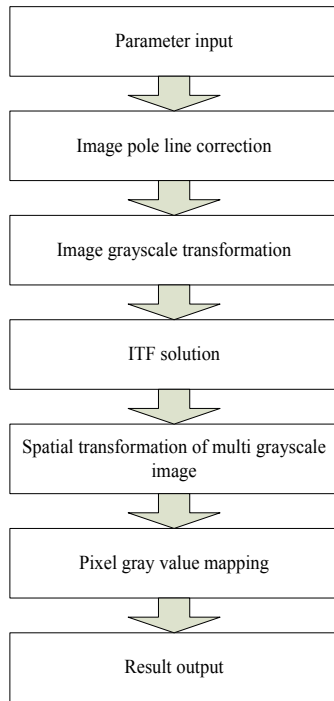


Fig. 5. Shadow image detection process diagram

As you can see from the above figure, when testing, you must first put your own safety first. In the process of testing, all units and enterprises must make every effort to ensure the full use and utilization of artificial intelligence technology, increase the effectiveness of detection, and avoid the occurrence of detection errors. As a new type of high-tech detection method, artificial intelligence infrared remote sensing image shadow detection method can effectively improve the technology and innovation consciousness of the inspectors. It can also reduce the psychological burden and psychological pressure of the workers, ensure the completion of the project on time, quality and quantity, and improve the quality and effectiveness of shadow image detection.

According to Table 2, the application of artificial intelligence technology in the Internet age and the design of image detection methods are in line with modern work requirements. In actual work, it has to play a positive role and truly achieve

technological innovation. The development of modern society is very fast, and the work of various industries must be related to technology, the Internet and artificial intelligence technology. The artificial intelligence-based infrared remote sensing image shadow detection method is a product that emerges in such a large environment (Figs. 6 and 7).

Table 2. Infrared remote sensing shadow detection table

Detection project	Definition	Shadow influence
Infrared camera	High	Great
Infrared radiometer	Low	Great
Color infrared photography	High	Small

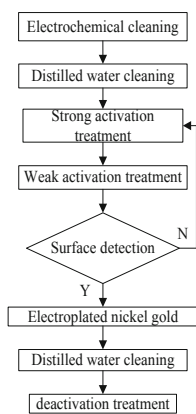


Fig. 6. Planar image stereoscopic structure

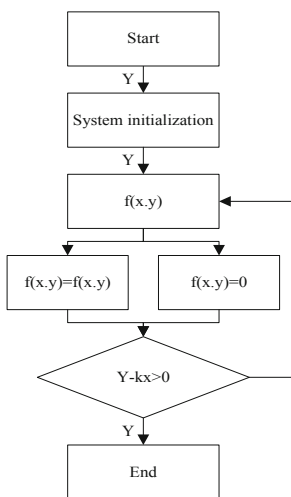


Fig. 7. Infrared remote sensing shadow detection flow chart

According to the above two figures, the image detection system under the background of rapid development of science and technology has a big innovation and reform. This has caused the importance of artificial intelligence technology and infrared remote sensing technology in image detection, and the difficulty and necessity of constructing artificial intelligence in various regions. Therefore, there must be a dedicated technical staff to carry out technological innovation, fundamentally solve the problems of image detection, and ensure the smooth progress of shadow image detection.

In order to further verify the superiority of the artificial intelligence-based infrared remote sensing image shadow detection method proposed in this paper, a comparison experiment of detection accuracy was conducted. The experimental results are shown in Fig. 8.

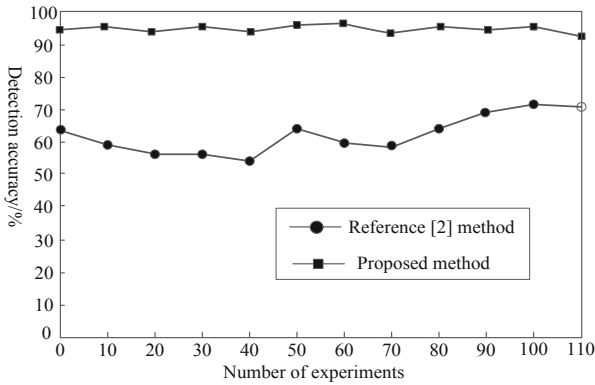


Fig. 8. Comparison of detection accuracy of different methods

The analysis of the figure above shows that the detection accuracy of reference [2] method is 54–73%, and the fluctuation is unstable, indicating that the detection accuracy of traditional methods is low and unstable. The detection accuracy of the proposed method remains above 94% and the fluctuation is relatively stable, indicating that the method in this paper can accurately detect the shadow of infrared remote sensing image with good stability.

Based on the above experiments, the detection time of different research methods is compared, and the results are shown in Table 3.

According to the above table, the detection time of the reference [2] method is between 13.5 s–18.1 s, while the detection time of the proposed method is before 1.2 s–1.6 s, which is much lower than that of the experimental comparison method, indicating that the infrared remote sensing image stealth detection method based on artificial intelligence has a short detection time and high efficiency.

Table 3. Comparison of testing time of different methods

Number of experiment	Reference [2] method	Proposed method
20	13.5 s	1.2 s
40	16.0 s	1.6 s
60	14.8 s	1.4 s
80	13.7 s	1.6 s
100	18.1 s	1.3 s
120	14.7 s	1.5 s
140	17.6 s	1.2 s
160	15.2 s	1.6 s

5 Conclusion

According to the unique characteristics of remote sensing image shadows, artificial intelligence infrared shadow image detection method is proposed to improve the detection accuracy of shadows. It is necessary to combine the innovation of artificial intelligence in the development of image detection methods in contemporary development. Therefore, we should carry out the improvement and update of the infrared remote sensing shadow image detection method under the Internet according to the actual situation, and truly play the role of artificial intelligence. In the era of the development of artificial intelligence, the design method of infrared remote sensing shadow image detection should meet the modern operation requirements. It plays an active role in actual work to truly achieve technological innovation.

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