Hindawi

Research Article

Application Analysis of Artificial Intelligence Algorithms in Image Processing

Lei Feng (ID)

Yulin University, Yulin City, Shaanxi Province 719000, China

Correspondence should be addressed to Lei Feng; fenglei@yulinu.edu.cn

Due to the rapid development of information, the image recognition method based on the artificial intelligence algorithm has been applied to many application fields. As the product of modern information technology, the image recognition method based on the artificial intelligence algorithm is also a significant and pioneering research topic. With the development of digital image processing technology and the updating of computer electronic products, digital image processing technology has been applied to various fields and has made great contributions to the progress of science and technology and the development of productivity. Image processing methods cover a wide range of application fields, including image conversion, restoration, separation, enhancement and matching, and classification. In order to explore the application of the AI algorithm in image processing, on the basis of the latest BAS algorithm discovered recently, we have established a brand-new hybrid intelligent algorithm BAS based on C as computing, which is applied to multiple image processing fields and achieves good optimization results. Studying the problems and future development directions in the application is conducive to promoting such development of image recognition technology and is conducive to applying image recognition technology to more fields.

1. Introduction

1.1. Research Background. In the past, people could only repair ancient cultural relics and works of art by relying on their own experience and manual techniques [1]. These image processing methods are not only slow but also prone to deviation due to human subjective will and experience. Precious cultural relics are permanently damaged, resulting in the damage of national historical and cultural heritage [2] Due to the development of science and technology, the US military developed the world's first electronic digital computer system "ENIAC" in 1946 and successfully applied it to ballistic research and large-scale military data statistics. At this time, electronic computers began to be used in all fields of scientific research and work, and it has been widely used [3]. Table 1 shows the subject fields and application fields of digital image processing.

In the middle of the last century, people began to apply computers to the field of image restoration, which greatly improved the efficiency and quality of image restoration and effectively prevented the damage of human caused images [4]. Some researchers focus on the research in this field, resulting in the limited application of computer technology in the field of image processing [5]. For a long time, the use of computers for image processing is to improve the image quality. Therefore, the development of digital image processing technology is slow [6].

Due to the rapid development of modern science and technology and the increasing capability of computer technology, the main application fields of computer technology in the field of image processing and application are not only limited to image recovery but also involve image acquisition, image conversion, image enhancement, image separation, compression and decoding, boundary extraction, image preprocessing, image cutting, image feature analysis, image digital watermarking, and information identification. Digital image processing technology has gone through three processes of generation, improvement, and application. Its application scope is still expanding and extending. It has been applied to aerospace, land monitoring, urban planning,
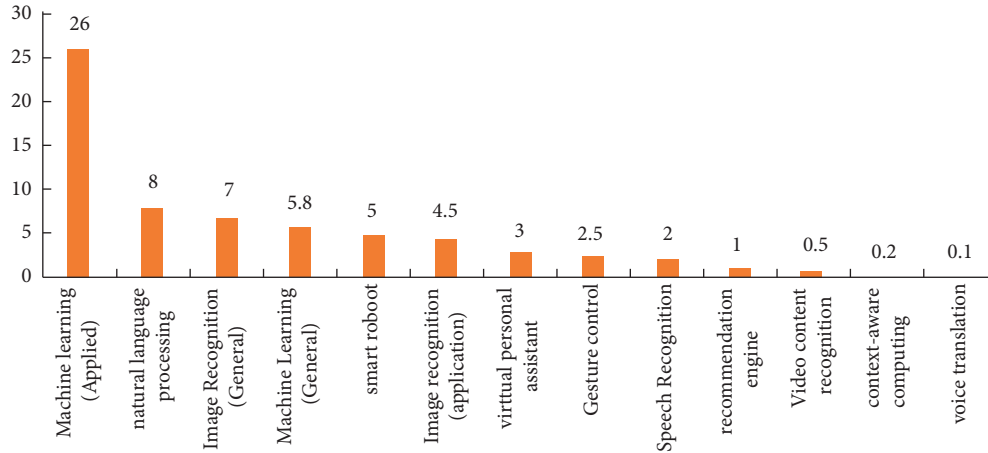
FIGURE 1: Application of artificial intelligence recognition technology.

TABLE 1: Application areas of digital image processing.

Academic area	Application field
Space exploration	Image processing of other stars
Communication	Image information transmission
Remote sensing	Address and terrain
Meteorological	Satellite cloud image analysis
Biomedical science	Cell analysis and chromosome analysis
Public security	Book of songs, live photos, and fingerprints
Archaeology	Spectrum analysis
Physics	Crystallization analysis
Chemical	Vegetation distribution check
Ocean	Robot
Forestry	Application field
Industry	Image processing of other stars

marine biomedical research and development, and other application industries.

Because of the high uncertainty of some image processing data and the difficulty of modeling, it is often difficult to obtain good results after analyzing the image processing data by using conventional methods (such as almanac, dynamic programming, and greedy algorithm) [7]. The service life is also relatively long, sometimes exceeding the unbearable limit [8]. In order to better manage such complex information data, many researchers have generated many intelligent algorithms with evolutionary and cognitive functions by simulating life activities and biological behavior laws in nature [9].

With the rapid development of science and technology, computer technology has been applied to various fields, providing many conveniences to the daily life of the public [10]. The artificial intelligence algorithm and its application in the current image processing field have attracted great attention [11]. The proper use of artificial intelligence methods in image processing can significantly improve the quality and efficiency of image processing [12]. Based on this, the concept of artificial intelligence algorithms and the connotation of processing work are described in this paper [13]. Such specific applications are explored, as shown in Figure 1 [14].

1.2. Research Purpose. In the current application field of computer technology, image recognition technology is still a major research and development content. However, with the development of new artificial intelligence computers, the progress of image recognition technology is also promoted. In terms of the current use of science and technology, image recognition technology has been applied to life and business. For example, the pattern recognition method was once used to swipe cards in the office, and the pattern recognition method was later used in face payment. However, with the further popularization of image recognition technology, it will also play an important role in more application fields.

In order to explore the wide application of artificial intelligence computing in image processing, this paper, based on the new BAS algorithm mentioned recently, integrates the CS algorithm and establishes a new hybrid intelligent algorithm BAS-CS, which has applications, so it has obtained good optimization benefits. In this way, human beings will be able to get rid of the tedious image processing and calculation, thus improving the work quality and efficiency and realizing the important foundation of image processing technology in the information age.

2. Related Concepts and Theoretical Basis

2.1. The Concept of Artificial Intelligence and Image Processing Work. In recent years, the computer has become a new science and technology, which has attracted the attention of all walks of life [15]. As machine intelligence, how does artificial intelligence help humans [16]? It can also develop intelligent technology according to human needs to improve the quality and efficiency of public work. Domestic water is the target [17]. Artificial intelligence is an antihuman way of thinking, but it lacks the same independent thinking ability as people and cannot calculate and solve problems [18]. Therefore, it is vital to serve human devices and tools. Table 2 shows the key technologies in the field of AI.

In recent years, due to the vigorous development of Internet information and computer science, people began to enter the information age [19]. While all kinds of information data have exploded, the workload and difficulty of

TABLE 2: Technical details in the artificial intelligence field.

Serial number	Technology categories	Hot technology
1	Machine learning algorithms and applications	Machine learning methods for predictive judgment | research on regression algorithms | research on clustering algorithms | research on classification algorithms
2	Reinforcement learning algorithms	Reinforcement learning and policy networks | reinforcement learning and time difference learning methods | improvement and optimization of reinforcement learning algorithms
3	Approximation and optimization algorithms	Improvement and application of approximation algorithms | research on estimation algorithms | optimization theory and algorithms | programming theory and answer set programming
4	Planning problem	Hash algorithm optimization and application | planning problem research | robot and multiagent system planning research | search algorithm research

image processing are also increasing [20]. Needless to say, image processing is widely used in many industries, including industrial applications, military applications, and medical treatment. Image processing is to convert image data into digital information through various methods and programs and upload it to the computer. This paper analyzes the image of computer processor data and explains the main reasons for limiting image processing technology [21].

2.2. The Technical Principle of Image Recognition Technology.
In fact, the same as the algorithm principle of computer processing data, the whole principle of image recognition technology based on the artificial intelligence algorithm is not complicated, and simple image data information can be extracted by using the computer. However, when analyzing the principles of image recognition technology, in order to improve the quality and efficiency of image processing, relevant personnel should find more optimized methods to innovate. The principle of image recognition technology using artificial intelligence algorithm is image pattern recognition, which is a part of artificial intelligence technology and an important part of the composition principle of image recognition. Pattern recognition is to process different types of flat pictures in order to ensure the accuracy of pictures or actual things. Using artificial intelligence algorithms in image recognition technology can virtualize the recognized objects without analyzing the physical objects. For pictures, pattern recognition and artificial intelligence can be used for three-dimensionalization. For example, in the medical field, doctors can analyze the health status and three-dimensional structure of the human body by taking pictures. Therefore, some low-tech recognition techniques such as image processing are combined with artificial intelligence to do things that humans cannot.

2.3. Application of the Artificial Intelligence Algorithm in Image Processing

2.3.1. Artificial Neural Network.
Artificial neural network, the so-called artificial neural network, is to establish a new intelligent algorithm mode by imitating the action characteristics of the neural network. Its characteristic is that the simulated neural network can obtain more valuable information by identifying and managing information nodes. Screening can realize the rationalization of big data. The use of the artificial neural network intelligent algorithm can greatly improve the image storage space. At the same time, the use of network technology for high-speed data transmission can achieve the purpose of saving the space occupied by the data, thus improving the behavior quality in a certain sense and recovering the image accurately and efficiently. In addition, for the in-depth application of this technology, related scholars also put forward different opinions, such as using the multilayer BP network to implement image processing, or segmenting images, and in the selection of image classification methods, mainly using PCA to extract data features, which can also be done using neural networks in classifying chromosome images. In addition, neural networks have significant advantages in image resolution and can accurately recognize handwritten digits. See Figure 2 for details.

2.3.2. Genetic Algorithm.
The transmission algorithm also comes from people's simulation of natural processes. It is a graphic processing algorithm derived from system design and optimization. Among them, Darwin's evolution theory is generally used as a reference for calculation. With the help of people's in-depth research and learning of biological processes, system design can quickly find optimal solutions. The important advantage of the genetic algorithm is that it is simple to operate, and it can directly process the image information so as to achieve the optimal solution effect, thus reducing various problems in image processing. However, in view of the comprehensive characteristics and complexity of the genetic algorithm, the establishment of its framework will be based on multiple scientific categories, including function optimization and combinatorial optimization. As a result, genetic algorithms have been widely used in image optimization segmentation and search optimization segmentation.

2.3.3. Ant Colony Algorithm.
It adopts the natural animal model. It is mainly through certain principles to find the best probability calculation route. Its basic basis is ant man's foraging steps. In nature, the ant colony will generate a large
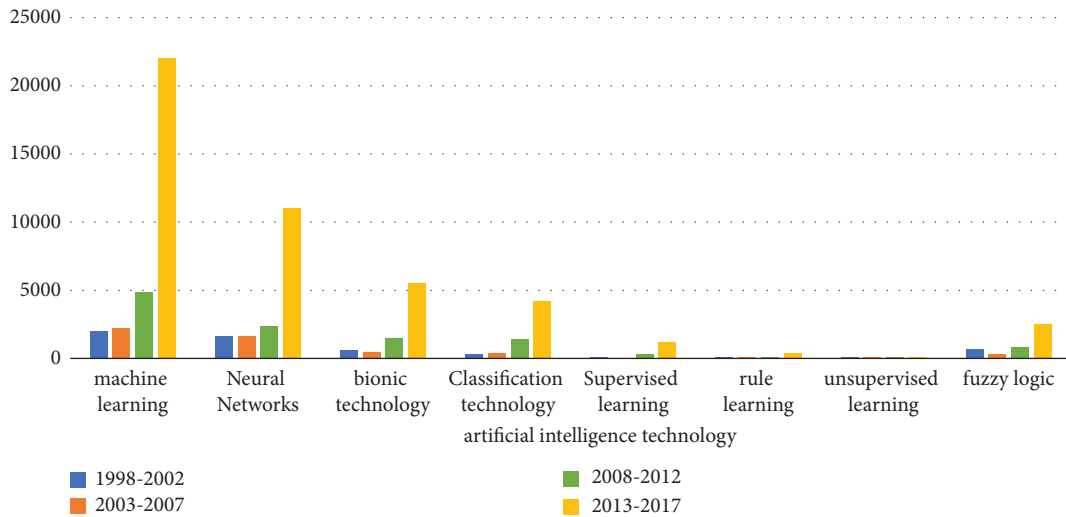
FIGURE 2: The development of the artificial neural network in artificial intelligence technology.

number of signals during the foraging process and guide its companions to find the foraging route correctly. It has the characteristics of large amount of information and large signal transmission capacity. Therefore, effective signal transmission has become an important cornerstone to ensure normal operation. Ant colony computing achieves the best value in image processing, thus achieving the most effective allocation of images, that is, it can find the best processing mode in the least time, thus greatly improving the efficiency of the new generation of artificial intelligence computing. Image matching is also an important image matching method using image structure modeling in the field of computer vision applications. However, the traditional help point optimization method is easy to fall into the shortage of local optimal solution, and the group algorithm can well optimize the objective function. Therefore, some scholars have proposed a high-order graph matching method based on previous algorithms. The algorithm provides bright knowledge by calculating the heuristic factor using the brightness value and then calculates the transition probability according to the heuristic factor and pheromone. Finally, the pheromone is updated locally and globally by using the searched solution. The algorithm can have high matching accuracy.

2.3.4. Annealing Algorithm. In this method, the best solution is obtained by the iterative method and the random method according to the physical solid annealing theory. In the process of heating the article, if the heated article exceeds the specified temperature value, it will be subject to rapid cooling treatment. In the process of warming up, the internal particles of the material will change due to the different ambient temperatures, thus presenting an irregular basic shape, and the movement ability in the material will also be strengthened. However, with the acceleration of the cooling process and the gradual decrease of the ambient temperature, the internal particles in the material will gradually change from an irregular state to an orderly state.

When the ambient temperature exceeds a certain threshold, the material state will remain relatively stable, and the internal value will also drop to the lowest point. Therefore, by applying this method to image processing, comprehensive processing can be realized theoretically, that is, the function and quality of image processing can be improved according to the nature and principle of the method; for example, the SA value can be edited; the image is segmented according to the application of the SA threshold, thereby improving the processing speed. The method can also be used to determine the Chinese character information contained in the picture so as to obtain the correct processing results. The organic fusion between the annealing algorithm and the genetic algorithm can achieve the goal of automatically coloring the map. Therefore, the practical application of image processing technology is completed by the combination of particle swarm optimization and different methods. The flow of the annealing algorithm is shown in Figure 3.

2.3.5. Particle Swarm Optimization Algorithm. This artificial intelligence calculation is based on the phenomenon that birds spread food. The particle swarm optimization algorithm selectively selects and modifies the individual information in the group. It is developed on the basis of iteration. However, there are differences between particle swarm optimization and genetic algorithms. The latter adopts the method of medium variation and crossover, but the former does not. The algorithm has to find the optimal particles on the object by searching for particles. This algorithm is relatively simplified. Because particle swarm optimization is helpful to fuzzy control and parameter optimization, it is also possible to use neural networks.

In this period, particle swarm optimization was mainly used to deal with image problems. As a cooperative random search method of a group, if this method is brought into image processing, it can be introduced into the multiagent optimization system to check the pixel boundary and deal
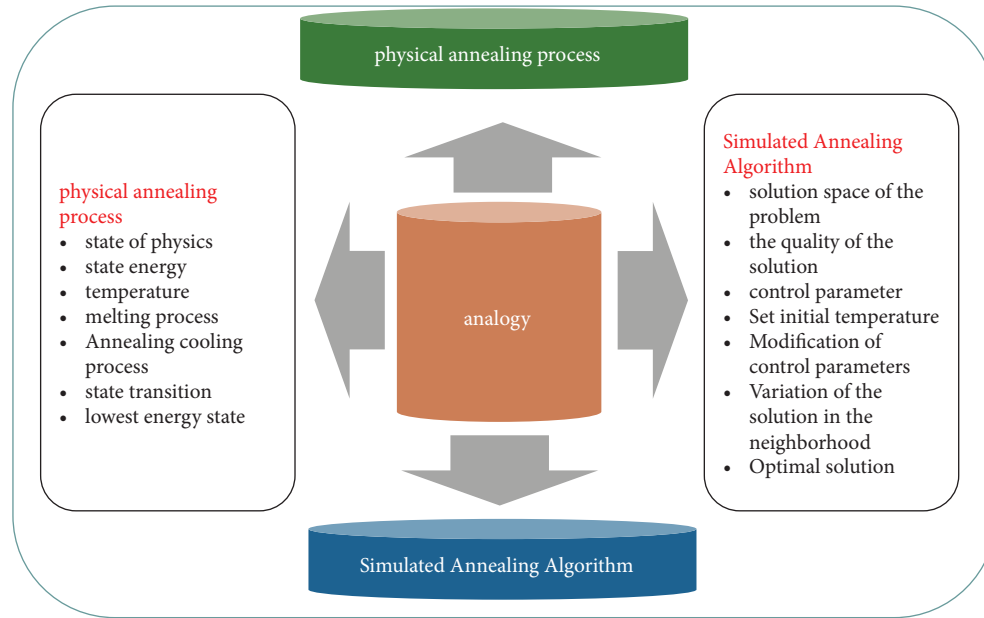
FIGURE 3: Schematic diagram of the annealing algorithm.

with the problem of pixel detail edge loss. It promotes the improvement of image accuracy and image segmentation effect on the whole.

2.3.6. 3D Otsu Algorithm. Otsu is a well-known pixel threshold division method. Pixel segmentation uses texture, gray histogram, edge, and other characteristics to divide pixels into parts with different characteristics. Generally speaking, it includes the target area and the background area, but the function difference is large. Gray threshold segmentation is one of the most common image segmentation algorithms. The image is divided into two parts, the main body and the background, by using the segmentation threshold of gray histogram; the basic principle of this method is simple, and the implementation is simple. It is applied to image segmentation. The algorithm makes use of the correlation between the gray value and the spatial position of the image to simplify the process and achieve the best separation effect. We invented a fast recursive 3D Otsu segmentation method. The calculation uses a large number of gray signals of pixels and integrates three-dimensional gray histograms, which not only increases the robustness of the calculation but also shortens the calculation time. The three-dimensional Otsu calculation not only examines the gray information of the image but also the spatial data of the image, including the neighborhood mean value and the neighborhood median value. Therefore, three-dimensional Otsu has certain antinoise performance, and its segmentation effect is better than one-dimensional Otsu and two-dimensional Otsu algorithms.

Then, aiming at the problems of large amount of computation and long operation time of the 3D Otsu algorithm, a 3D Otsu image segmentation algorithm based on cuckoo search optimization is proposed. The algorithm uses the cuckoo search algorithm to optimize 3D Otsu. Among

them, the three-dimensional interclass variance of pixel gray value domain mean domain median is used as the fitness function of the cuckoo search algorithm. By evaluating the fitness of pixels on Lévy flight path, the optimal segmentation threshold is obtained. The experimental results show that compared with the three-dimensional Otsu algorithm based on the mean gradient in the gray value domain, the algorithm has better stability and reliability for image segmentation with a low signal-to-noise ratio; at the same time, compared with the fast three-dimensional Otsu algorithm, the operation efficiency is improved by about 16.4%. Thus, the difficulty of calculation time is overcome, the speed of calculation is improved, the accuracy of segmentation is improved, the time loss of calculation is reduced, and it achieves better segmentation results.

In short, with the further development of the times, people have invested huge human and material resources to increase the research and development of artificial intelligence algorithms. The application of artificial intelligence algorithms in the field of image processing can improve the accuracy and quality of image processing on the one hand and promote the improvement of the quality of life of the public on the other hand. Due to the continuous improvement and optimization of artificial intelligence, people believe that artificial intelligence algorithms will be more perfect and developed in the future and will be applied to various fields to support the security, stability, and long-term development of human economy and society.

3. Related Technologies

3.1. Image Restoration Technology. Image restoration refers to the method of repairing and reconstructing the defective part of the image and removing the interference signal according to certain principles. It can recover the unknown area by special methods and technologies and through the

neighborhood information in the damaged area to be recovered. Its important purpose is to prevent the bystander from discovering that the picture has been damaged or repaired. Image restoration has been applied in digital image processing, computer graphics, data compression, computer animation creation, and virtual reality.

Assuming p is any point on the boundary Ω, the formula for calculating ones is as follows:

$$P(p) = C(p) \bullet D(p). \tag{1}$$

Among them: $C(p)$ is the confidence term, which represents the number of known points in the structural data.

$$
\begin{aligned}
C(p) &= \frac{\sum_{q \in \psi_p \cap \phi} C(q)}{|\psi_p|}, \\
D(p) &= \frac{\left|\Delta I_p^{\perp} \cdot n_p\right|}{|\psi_p|}.
\end{aligned}
\tag{2}
$$

Among them: φ represents the area; I_p represents the\line; n_p is the patched p, so it will use the one of squared errors, which is calculated as follows:

$$\psi_p = \arg \min_{\psi_p \in \Phi}^{d\left(\psi_p . \psi_q\right)}, \tag{3}$$

where q_{pd} represents the squared error sum between the patch to be patched and the matching block, p_a, q_b. R_a, R_b; G_a, G_b and B_a, B_b represent the R, G, B values of the corresponding pixels in p and $q\psi$, respectively.

The form looks like the following:

$$C(p)_{n+1} = C(p). \tag{4}$$

Next, conduct the research again till it is completed.

3.2. Image Segmentation Algorithm Based on BAS-CS. In many fields of image processing, people often need to analyze the target. In this way, in order to facilitate the classification of objects, the objects must be obtained in the image, and the image must be subdivided. In order to further improve the effect of image separation, many experts and scholars in China have introduced the genetic algorithm, ant colony algorithm, particle swarm algorithm, artificial fish swarm algorithm, bacterial foraging algorithm, artificial bee swarm algorithm, and chicken swarm algorithm to image segmentation in recent years. Therefore, many achievements have been generated, and the segmentation efficiency has been improved.

The expansion operation will expand the boundary of the object. If there are small gaps inside the object, these gaps can be well filled by the expansion operation, so the boundary will extend to the new area. If the object is eroded again at this time, the boundary will shrink back to its original position, and the gap inside the object will disappear forever.

$$f_1 = (A \oplus B) = \{x | \exists a \in A, b \in V : x = a + b\}. \tag{5}$$

Among them, A is the input image; B is the structural element, which has various shapes and sizes much smaller than A, such as square and disc. f_1 is the result of dilation operation on image A, and f_2 is the result of erosion operation on image A.

The erosion operation is usually used to remove boundary points of an image. Since the points included in one area will be regarded as edge points, they will be eliminated. If processing is repeated at this time, the retained large object will return to its original position, and the deleted small object will disappear permanently.

$$f_2 = (A \odot B) = \{x | \lor b \in V, \exists a \in V : x = a - b\}. \tag{6}$$

Mathematically, open operation is the result of thermal expansion after corrosion. It can also be used to remove the parts of the object that do not contain structural factors, smooth the outline of the object, break the narrow interface, and remove the large and small protrusions.

$$f_0 = f \oplus b \odot b. \tag{7}$$

The adaptability function of the BAS-CS algorithm is two-dimensional gray Otsu model, and the specific calculation formula is as follows:

$$
\begin{aligned}
t_r \sigma_B = {}& w_0 \left[\left(u_{0i} - u_{Ti}\right)^2 + \left(u_{0j} - u_{Tj}\right)^2 \right] \\
& + w_1 \left[\left(u_{1i} - u_{Tj}\right)^2 + \left(u_{1j} - u_{Tj}\right)^2 \right].
\end{aligned}
\tag{8}
$$

3.3. Image Matching Algorithm Based on BAS-CS. Image matching is also a very important image processing method. It can spatially correspond two or more images of the same scene obtained by one or more sensors at different times and environments and judge the translation between them. Image matching has great scientific research and application value in biomedical image processing, satellite navigation, biological fingerprint matching, and other application fields. It is an important cornerstone of image information fusion. With the progress of science and technology, new engineering application technology and more and more complex environments put forward higher requirements for matching calculation, and the research scope of matching calculation is more and more extensive.

Suppose the original picture is a and the size is $w \times H$. The template picture is B, and the size is $w \times H$, and set $w < W$, $h < H$.

The MAD algorithm is developed by Leese and is a well-known calculation method. The structure of this algorithm is simplified, but it is interfered by noise, and the matching efficiency decreases due to the increase of noise.

$$d(x, y) = \frac{1}{wh} \sum_{i=1}^{w} \sum_{j=1}^{h} |A(i + x, j + y) - B(i, j)|. \tag{9}$$

Among them, $d(x, y)$ is the similarity measure, when $d(x, y)$ gets the minimum value, (x, y) is the best matching position.

The SAD algorithm is similar to the MAD algorithm, and the difference is that the SAD algorithm does not take the average value of the error sum.

$$d(x, y) = \sum_{i=1}^{w} \sum_{j=1}^{h} |A(i + x, j + |y) - B(i, j)|. \qquad (10)$$

The sum of squares of errors is to square the errors obtained each time first and then to the sum of squares.

$$d(x, y) = \sum_{i=1}^{w} \sum_{j=1}^{h} [A(i + x, j| + y) - B(i, j)]^2. \qquad (11)$$

The MSD algorithm, also known as the mean square error algorithm, averages the SSDs.

$$d(x, y) = \frac{1}{wh} \sum_{i=1}^{w} \sum_{j=1}^{h} [A(i + x, j + y) - B(i, j)]^2. \qquad (12)$$

The algorithm uses the normalized cross-correlation function as the similarity measure and has the advantages of strong antinoise ability and less influence by the scale factor error. The calculation formula of the normalized cross-correlation function is as follows:

$$\sum_{j=1}^{h} A(i + x, j + y) \cdot \frac{B(i, j)}{\sqrt{\sum_{i=1}^{w} \sum_{j=1}^{h} A(i + x, j + y)^2 \cdot \sum_{i=1}^{w} \sum_{j=1}^{h} B(i, j)^2}}. \qquad (13)$$

Among them, $P(x, y)$ is the similarity measure, when $P(x, y)$ is the maximum; (x, y) is the best matching position found.

First, we select the normalized cross-correlation function (NCC) as the similarity measure and then judge whether the image contains noise. The NCC algorithm is used to design the fitness function of the BAS-CS algorithm. Finally, the BAS-CS algorithm is used as a search strategy to search for the optimal solution, Finally, the search method of BAS-CS is used so as to find the maximum matching between the template image and the original image.

4. Experimental Results and Analysis

The overall size of each calculation is $n = 40$, and the dimension of each function is $m = 2$. The maximum number of iterations is international thermonuclear fusion test reactor = 1500, and the maximum optimization accuracy is to $l = 1.0 \times 10 - 20$, and when each calculation has completed the specified number of iterations, the final convergence accuracy will reach $1.0 \times 10 - 20$, which is considered a successful optimization. The parameter settings of BAS-CS are step size step = 10, distance between two whiskers $d0 = 5$, discovery probability $a_p = 0.25$, step attenuation coefficient eta = 0.95, and the acceleration factor of the PSO algorithm is set to $1C = 2C = 1.5$ (15).

Each algorithm operates independently for each test function about fifty times, the maximum fitness, average fitness, and minimum fitness in the 50 running results were counted, and the average running time and optimization success rate were recorded. The experimental results are shown in Figure 4.
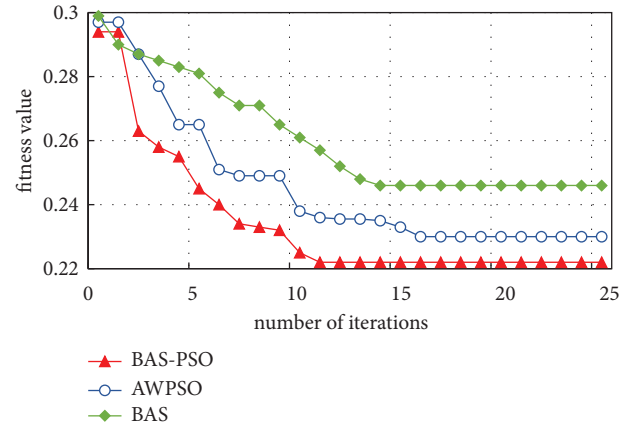

FIGURE 4: Convergence curves of algorithms at different latitudes.

As can be seen from Figure 4, under the same experimental environment and the same number of iterations, after 25 independent repeated experiments, in terms of fitness, the maximum fitness, average fitness, and minimum fitness of the BAS-CS algorithm are obviously better. For the PSO algorithm, BAS algorithm, and CS algorithm, it shows that BAS-CS has higher convergence accuracy than other algorithms; in terms of average optimization time, the running time of BAS-CS algorithm and CS algorithm is higher than that of PSO algorithm. The BAS algorithm is longer, but the convergence accuracy of the BAS-CS algorithm and the CS algorithm is much higher than that of the PSO algorithm and the BAS algorithm, so the overall performance is better than the PSO algorithm and the BAS algorithm. On the other hand, the BAS-CS algorithm has higher convergence accuracy than the CS algorithm. The average optimization time is shorter than the CS algorithm, and on the basis of high convergence accuracy and convergence speed, it still has a high optimization success rate, reaching 100% when testing each function, so it shows that the BAS-CS algorithm has strong stability.

Under the background of paying attention to economic benefits in the real engineering field, the method presented in this paper has good practical value. When the method used in this paper fixes three pictures, the population number is set to 100, they are 30, 50, and 100, respectively, and 50 experiments are here. The obtained PSNR values are shown in Figure 5.

This section discusses the influence of the dynamic adjustment parameters α and β in equation (6) on the image restoration quality when different weights are taken, and the results are shown in Figure 6.

In Figure 6, data α represents the weight of the confidence term, while the parameter β represents the weight of the data item. Because $\beta + \alpha = 1$, α values also follow β and changes with the change of β. For pictures with a complex texture structure, improved β value can make the repair process more sensitive to detail textures, while for images with a single texture structure, the β value can increase the accuracy of the priority algorithm and thus increase the recovery efficiency. As can be observed from Figure 6 $\alpha = 0.6$,
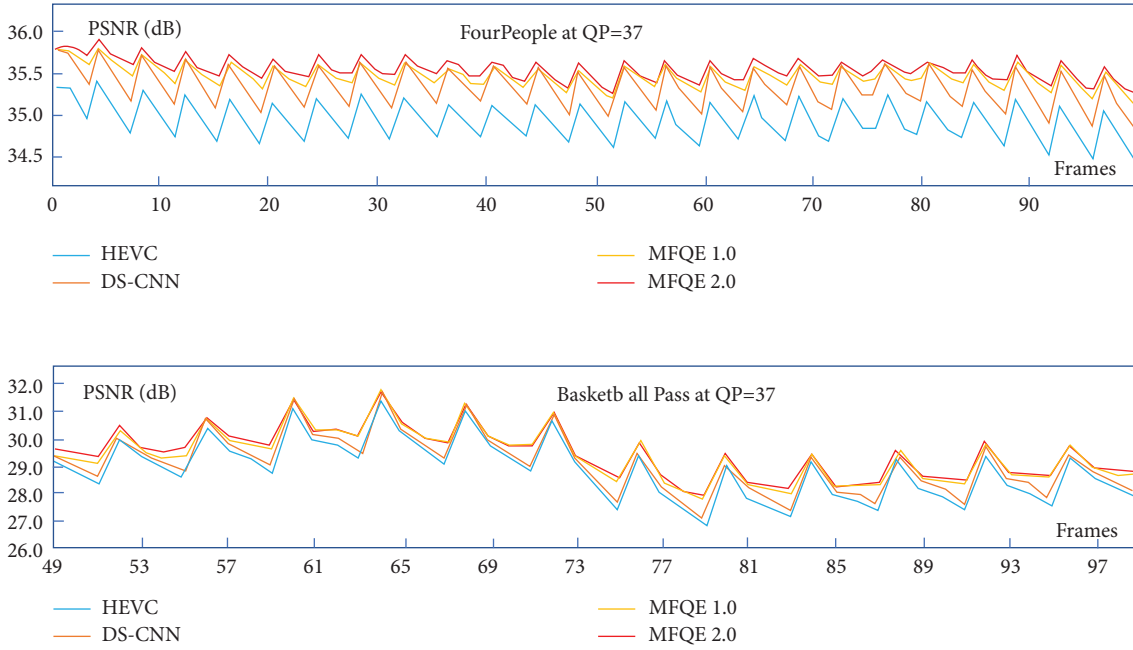
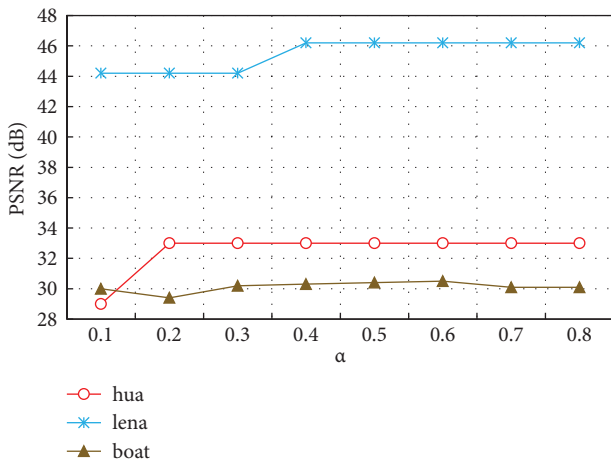Figure 5: PSNR values obtained from each independent experiment.

Figure 6: Influence of dynamic adjustment parameters on experimental results.

Figure 7: Convergence curve comparison between the algorithm in this paper and the algorithm in the literature.

β = at 0.4, the peak signal-to-noise ratio (PSNR) of the first three experimental pictures is the largest, so $\alpha = 0.6$, $\beta = 0.4$ is the optimal parameter selected for this test.

In order to further verify the convergence of the algorithm in this paper and the algorithm in the literature, this section gives the comparison of the convergence curves of the algorithm in this paper (BAS-CS) and the algorithm in the literature (GA) when segmenting the above three kinds of images. We take the fitness value as the optimal segmentation thresholds, as shown in Figure 7.

In order to test the effectiveness of this algorithm, the three-dimensional Otsu algorithm (CS-3Otsu algorithm), the two-dimensional Otsu algorithm, the M3Otsu algorithm, and the G3Otsu algorithm were based on the CS algorithm proposed by the algorithm in this paper and the
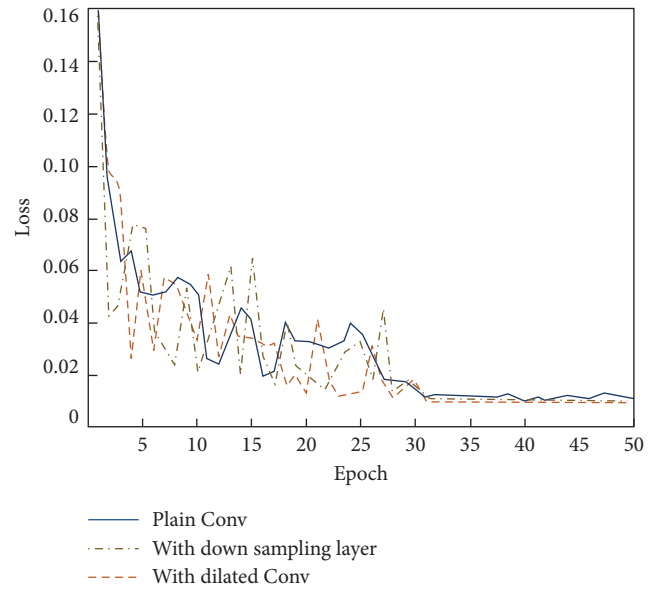
literature. The truck image is cut, and the segmentation time of each algorithm is counted. In order to accurately calculate the segmentation of the two CS-3Otsu algorithms, the algorithms in this paper are set to a fixed value, the number of iterations is set at 100, and they are independently repeated 50 times. The specific experimental parameter settings and the searched optimal segmentation and the thresholds are shown in Figure 8.

As can be seen from Figure 8, after the Otsu threshold segmentation method is extended from two-dimensional to three-dimensional, the segmentation time increases
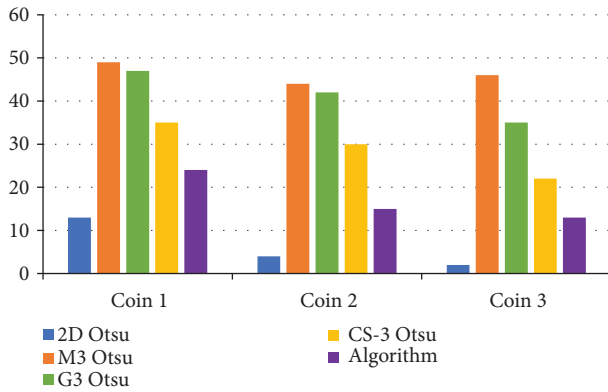
Figure 8: Comparison of segmentation time of different algorithms.

exponentially, but the CS-3Otsu algorithm uses the CS algorithm search strategy to quickly search for the best segmentation threshold, so it greatly reduces the time. The segmentation time is shortened, thereby improving the segmentation efficiency. The algorithm in this paper adopts the BAS-CS search strategy. When segmenting three different images, the segmentation time is shorter than that of the CS-3Otsu algorithm so as to maximize the improvement of the segmentation time and segmentation efficiency.

Pixel spatial separation is a major image processing technology, which can match one or more sensors with two or more images of the same background obtained at different times and conditions, and it can judge the translation and turnover between them. Image processing technology has great scientific research value and application significance in biomedical image processing, satellite navigation, and biometric fingerprint matching, and it is an important cornerstone of biological information application.

5. Conclusion

Because the combination of computer science and image processing technology can greatly improve the performance and efficiency of image processing, image processing technology has been widely used in military, remote sensing, medicine, industry, and other fields, providing a great deal for people's production and life. Convenience greatly promotes the development of social productive forces and also promotes the innovation and development of social enterprises. Therefore, as a field closely related to people's production and life, digital image processing technology has a lot of problems waiting for us to study and solve in both theoretical research and engineering application.

Based on the latest BAS algorithm discovered in recent years, this paper combines it with the CS algorithm to produce a new hybrid intelligent algorithm BAS-CS. This method has been widely used in many aspects of image processing and has obtained good optimization results. At present, as a new high-tech application technology, image recognition technology is attracting more attention and widely used, and it plays a key role in all aspects. With the rapid development of technology, image recognition

technology has been applied to many industries. With the rapid development of science and technology, it can also meet the different needs of the industry and family life. Image recognition technology can also be more effectively applied to the whole society, promote economic development, and ensure property safety. At present, the application of image recognition information technology based on artificial intelligence computing is more and more extensive, and more and more people pay attention to it. It is believed that in the future, with the needs of consumers and the innovation and reform of image identification products, the use efficiency of the market will be more prominent, and the application prospect and practical value will be greater.

Data Availability

The labeled data set used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

References

[1] K. Saikumar and V. Rajesh, "Coronary blockage of artery for heart diagnosis with DT artificial intelligence algorithm," *International Journal of Research in Pharmacy and Science*, vol. 11, no. 1, pp. 471–479, 2020.

[2] S. Vaishnavi, R. Deepa, and P. Nanda Kumar, "A ophthalmology study on eye glaucoma and retina applied in AI and deep learning techniques," *Journal of Physics: Conference Series*, vol. 1947, no. 1, pp. 012053–012133, 2021.

[3] S. K. Noh, "Recycled clothing classification system using intelligent IoT and deep learning with AlexNet," *Computational Intelligence and Neuroscience*, vol. 30, no. 2, pp. 353–358, 2021.

[4] R. K. Mishra, G. Y. S. Reddy, and H. Pathak, "The understanding of deep learning: a comprehensive review," *Mathematical Problems in Engineering*, vol. 2021, no. 21, pp. 1–15, Article ID 5548884, 2021.

[5] Y. R. Shrestha, V. Krishna, and G. V. Krogh, "Augmenting organizational decision-making with deep learning algorithms: principles, promises, and challenges (forthcoming at journal of business research)," *Journal of Business Research*, vol. 7, no. 03, pp. 27–31, 2020.

[6] M. Emri, "Methods of artificial intelligence and their application in imaging diagnostics," *Magyar Onkológia*, vol. 64, no. 2, pp. 145–152, 2020.

[7] D. Overhoff, P. Kohlmann, and A. Frydry chowicz, "The international radiomics platform - an initiative of the German and Austrian radiological societies - first application examples," *RöFo - Fortschritte auf dem Gebiet der R*, vol. 193, no. 3, pp. 13–22, 2021.

[8] Y. . Zheng, S. Li, J. Huang, L. Fan, and Q. Shu, "Identification and characterization of γ-ray-induced mutations in rice cytoplasmic genomes by whole-genome sequencing," *Cytogenetic and Genome Research*, vol. 160, no. 2, pp. 100–109, 2020.

[9] P. Sikka, A. R. Asati, and C. Shekhar, "High: speed and area efficient Sobel edge detector on field rogrammable gate array for artificial intelligence and machine learning applications," *Computational Intelligence*, vol. 35, no. 09, pp. 288–290, 2020.

[10] M. Fradi, E. H. Zahzah, and M. Machhout, "Real-time application based CNN architecture for automatic USCT bone image segmentation," *Biomedical Signal Processing and Control*, vol. 71, pp. 103123–123, 2022.

[11] D. Sotvoldiev, D. T. Muhamediyeva, and Z. Juraev, "Deep learning neural networks in fuzzy modeling," *Journal of Physics: Conference Series*, vol. 1441, no. 1, 13127 pages, Article ID 012171, 2020.

[12] S. Bagheri, N. Wu, and S. Filizadeh, "Application of artificial intelligence and evolutionary algorithms in simulation-based optimal design of a piezoelectric energy harvester," *Smart Materials and Structures*, vol. 29, no. 10, pp. 309–312, 2020.

[13] F. J. García-Pealvo, A. Vázquez-Ingelmo, and A. García-Holgado, "Application of artificial intelligence algorithms within the medical context for non-specialized users: the CARTIER-IA platform," *International Journal of Interactive Multimedia and Artificial Intelligence*, vol. 6, no. 6, pp. 77–86, 2021.

[14] R. Malinidevi, S. Vinitha, and A. Sharma, "Application and analysis of asymptotic method of cholera dynamics model in Artificial Intelligence and Image Processing," *Materials Today Proceedings*, vol. 6, no. 2, pp. 184–195, 2021.

[15] H. Khachnaoui, R. Mabrouk, and N. Khlifa, "Machine learning and deep learning for clinical data and PET/SPECT imaging in Parkinson's disease:a review Image Processing," *IET*, vol. 14, no. 1, pp. 536–540, 2020.

[16] Z. Lutowski, "IoT application of transfer learning in hybrid artificial intelligence systems for acute lymphoblastic leukemia classification," *Sensors*, vol. 21, no. 3, pp. 309–312, 2021.

[17] R. C. Ambagtsheer, N. Shafiabady, and E. Dent, "The application of artificial intelligence (AI) techniques to identify frailty within a residential aged care administrative data set," *International Journal of Medical Informatics*, vol. 136, no. 5, pp. 489–497, 2020.

[18] J. Prim, T. Uhlemann, and N. Gumpfer, "A data-pipeline processing electrocardiogram recordings for use in artificial intelligence algorithms," *European Heart Journal*, vol. 39, no. 6, pp. 102–110, 2021.

[19] J. Fitzgerald, D. Higgins, and C. M. Vargas, "Future of biomarker evaluation in the realm of artificial intelligence algorithms: application in improved therapeutic stratification of patients with breast and prostate cancer," *Journal of Clinical Pathology*, vol. 74, no. 7, pp. 717–725, 2021.

[20] S. S. Tripathy, R. Poddar, and L. Satapathy, "Image processing–based artificial intelligence system for rapid detection of plant diseases," *Bioinformatics in Agriculture*, vol. 24, no. 1, pp. 619–624, 2022.

[21] X. Zhang, "Application of artificial intelligence recognition technology in digital image processing," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 7442639, 10 pages, 2022.