

Retraction

Retracted: The Accurate Repair of Image Contour of Human Motion Tracking Based on Improved Snake Model

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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- [1] N. Feng and P. Gao, "The Accurate Repair of Image Contour of Human Motion Tracking Based on Improved Snake Model," *Complexity*, vol. 2021, Article ID 9926936, 10 pages, 2021.

Research Article

The Accurate Repair of Image Contour of Human Motion Tracking Based on Improved Snake Model

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With the rapid development of sports science, human motion recognition technology, as a new biometric recognition technology, has many advantages, such as noncontact target, long recognition distance, secret recognition process, and so on. Traditional human motion recognition technology is affected by environmental factors such as motion background, which is prone to rough edges of the recognized objects and loss of motion tracking information, thus further reducing the recognition accuracy. In this paper, the traditional snake model will be improved and optimized to improve the defect of human motion model contour extraction, so as to realize the accurate repair of image contour; in terms of algorithm running time, this paper innovatively improves the construction process of the snake model, further improves the running time of model evaluation, and solves the concave contour problem of corresponding moving objects in the snake model. In order to solve the problem of accurate convergence, this paper improves the snake model of the average moving algorithm and sets the corresponding weight coefficient to distinguish the corresponding moving target background, so as to achieve the convergence of the differential concave contour. In order to verify the superiority of the improved optimized snake model, experiments are carried out in the corresponding database. The experimental results show that the contour of the moving object extracted by the improved snake model algorithm is complete and the segmentation effect is obvious. At the same time, the running speed of the whole algorithm has been significantly improved.

1. Introduction

With the continuous development of computer technology, Internet of things technology, and biometrics technology, human motion tracking and recognition technology based on related advanced algorithms has been paid more and more attention [1, 2]. The classical human motion tracking and recognition technology is mainly to separate the human object from the corresponding background area, so as to realize the classification, accurate feature extraction, accurate expression, and final recognition of human motion object from the corresponding background [3, 4]. The traditional human motion recognition algorithm is limited to the segmentation of the existing background or image, which is mainly affected by the background disturbance

signal. The corresponding background edge of the segmented moving object is often rough or cannot be closed, which will cause the loss of the corresponding motion features, which seriously affects the subsequent effective processing of the algorithm. Thus, the efficiency of the whole algorithm is further reduced [5, 6]. Background environmental factors corresponding to moving objects are the key factors affecting moving object detection. Complex environmental factors in moving background, such as holes and noise, will have a negative impact on human motion [7]. The current conventional background segmentation technologies, such as background reduction algorithm, inter-frame difference algorithm, motion field algorithm based on human motion, etc., all have serious convergence and background extraction defects [8, 9]. Therefore, how to extract

the contour of the moving object efficiently and reasonably and recognize the corresponding gait of the moving object completely is the key and hotspot of human motion tracking.

The conventional gait recognition technology mainly depends on the effective analysis of the moving target image sequence, which can analyze and study the moving target in detail at three levels, namely, moving target segmentation technology, feature extraction technology, and corresponding recognition and classification technology [10–12]. In the whole operation process of the algorithm, firstly, the relevant camera will get the moving image sequence of the moving object, segment the corresponding moving sequence, extract the changing background image from the corresponding sequence image, and describe and analyze its characteristics. Different algorithms here have different processing means, and the corresponding processing target is roughly the corresponding moving target. The width and angle features of the moving target are extracted. After the corresponding moving target feature extraction is completed, the recognition and analysis operation is carried out [13, 14]. In the actual algorithm operation process, it is necessary to overcome the corresponding complexity and dynamic variability in the background environment. The corresponding complex factors include weather factors, lighting factors, shadow factors, and the corresponding external interference factors. The adverse consequences brought by these factors will lead to the decline of the recognition accuracy of the whole algorithm [15]. In order to solve the above problems, this paper will improve and optimize the traditional snake model [16] and improve the defect of extracting human motion model contour, so as to realize the accurate repair of image contour; in terms of algorithm running time, this paper improves the construction process of the snake model, so as to further improve the running time of model evaluation. In this paper, we improve the snake model of average moving algorithm. In terms of technical details, the background of the corresponding moving target is distinguished by setting the corresponding weight coefficient, so as to achieve the convergence of the differential concave surface. The experimental part of this paper verifies the superiority of the improved algorithm.

The structure of this paper is as follows: Section 2 of this paper will focus on the analysis of the improved snake model, focusing on the analysis of its defects in the gap, running time, and image segmentation level; Section 3 of this paper will be based on the improved snake algorithm in a large database to test and evaluate the experimental results; finally, the article is summarized.

2. Related Work Analysis: Analysis and Research of Human Motion Tracking Image Algorithm

In the research of human motion tracking algorithm, a large number of technical personnel and research institutions have carried out research and analysis from different angles and also put forward the corresponding algorithm. Relevant

American research institutions [17, 18] put forward real-time video monitoring technology for human motion tracking algorithm, which mainly realizes the shape analysis and tracking technology of moving objects. It can realize real-time tracking of large-scale crowd by establishing human body related model, which has certain convenience, but the source of camera and gray sensor corresponding to this system are too single. The classic human tracking algorithm based on the motion field analyzes the motion field of the moving object through the time and space correlation of the video sequence and establishes the correspondence between adjacent frames. Using the corresponding background to express the movement of moving objects can realize real-time tracking of different targets. It has a wide range, but its corresponding algorithm has a high computational complexity, which is not conducive to commercial promotion [19, 20]; as another classic image segmentation algorithm, background reduction method mainly uses the difference between the real-time image and the corresponding background environment image to realize the segmentation of the moving region, which can provide the complete data of the moving object, but the algorithm is vulnerable to the background environment factors. The traditional snake model algorithm is an open image segmentation algorithm developed in recent years. The model has a certain openness, and its corresponding algorithm parameters can be adjusted in real time. At the same time, the corresponding dynamic method can reach the characteristic edge of the moving target. However, this kind of algorithm still has some serious problems such as concave defects, image gaps, and so on. At the same time, its corresponding algorithm parameters can be adjusted in real time. The running time of this method also needs to be further improved [21–23].

3. Analysis and Research of Improved Snake Model

This section will focus on the analysis and research of the improved human motion tracking snake model, focusing on the accurate repair of the moving object image contour under the improved snake model and the image segmentation analysis of the improved snake model based on the average moving algorithm. The overall framework of the corresponding human motion tracking algorithm under the improved snake model is shown in Figure 1. and it can be seen from the figure that the running state and key parts of the algorithm are different from the traditional human motion tracking algorithm.

3.1. Precise Contour Inpainting of Moving Object Image Based on Improved Snake Model. Snake model is essentially a deformable model, which starts from the initial contour of the moving object [24–26]. At the same time, under certain constraints, through the gradual deformation of the search process, the preset complete moving object contour line with the smallest energy function is finally obtained. The corresponding energy function is shown in formula (1), which contains the corresponding $a(x, t)$. The corresponding $b(x,$

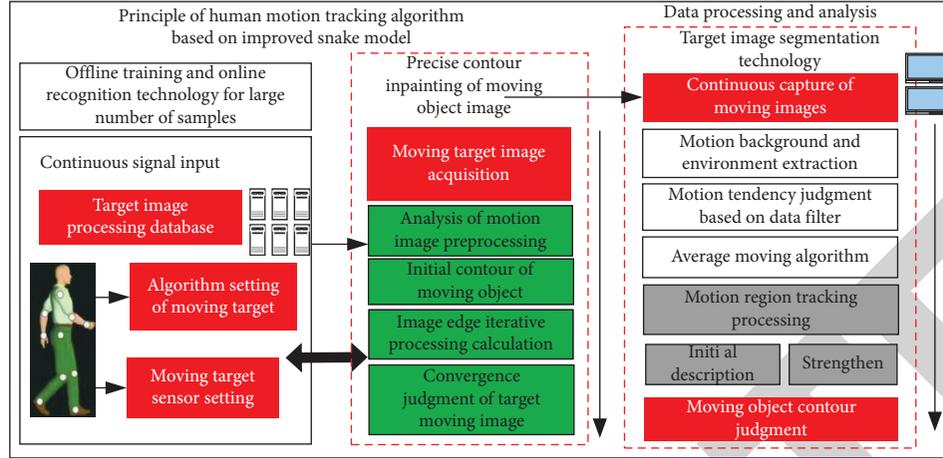


FIGURE 1: Schematic diagram of human motion tracking algorithm based on improved snake model.

t) represents that the snake model curve of the detected object can move towards the direction of minimizing the energy function in the corresponding image space, and the corresponding p_{Snake} represents the energy of the model.

$$P_{\text{Snake}} = \int_0^1 [P_{\text{int}}^*(a(x, t)) + P_{\text{ext}}(b(x, t))] dx. \quad (1)$$

In order to solve the problems of contour limitation and concave contour defects in the above classical models, based on the basic principle of optical flow field and using the variational algorithm in mathematics to convert the dense vector of the target moving image, the gradient vector flow of

$$E_{\text{Snake}} = \int_0^1 \int_0^1 [(c1_a^* c1_a + c1_b^* c1_b + c2_a^* c2_a + c2_b^* c2_b) + \text{error}^2] dadb. \quad (2)$$

Combined with the relationship between the vector field corresponding to formula (1) and the corresponding error, the snake optimization model will produce the following corresponding capture effect: when the gray level of the corresponding image is evenly distributed, the corresponding error is small, and the corresponding vector field will slowly change, while when the corresponding target image is in the corresponding edge region, the corresponding vector field will change. It will be close to the error value, so that the error function has a strong force on the edge of the image, which improves the ability of the whole snake model to capture the edge of the target image. In order to further realize the accurate patching of the target image, the above formula is processed by variation, and the corresponding calculation formula after variation is shown in formula (3). Further mathematical iteration processing based on the formula after variation can find that the fast convergence of the image can be achieved under the condition of formula (4),

the target image is finally formed, so as to realize the accurate repair of the contour of the moving target image. Based on this assumption, the vector field corresponding to the gradient vector flow of the target object is set as $f(a, b) = \{c1(a, b), c2(a, b)\}$, and then the corresponding minimum energy function can be simplified as formula (2), where the corresponding $H(c1_a^* c1_a + c1_b^* c1_b + c2_a^* c2_a + c2_b^* c2_b)$ is the corresponding minimum energy smoothing function, and the corresponding value of the corresponding H function depends on the size of the ambient noise, and the corresponding relationship is in positive proportion.

so as to complete the edge patching of the target moving image by the whole model.

$$c\nabla c1^2 - (c1 - \text{error}_a)(\text{error}_a^2 + \text{error}_b^2) = 0, \quad (3)$$

$$c\nabla c2^2 - (c2 - \text{error}_a)(\text{error}_a^2 + \text{error}_b^2) = 0,$$

$$\frac{c1\Delta t}{\Delta a\Delta b} \leq \frac{2}{5}. \quad (4)$$

Based on the above analysis, the algorithm flow of the corresponding improved snake model in the image edge precision repair is shown in Figure 2. From the corresponding control image in the figure, it can be seen that the improved snake model makes the image model enter the deep depression area by using the diffusion gradient vector, acts on the edge area of the image, and finally realizes the image precision repair. At the same time, it has good convergence. The corresponding steps are as follows.

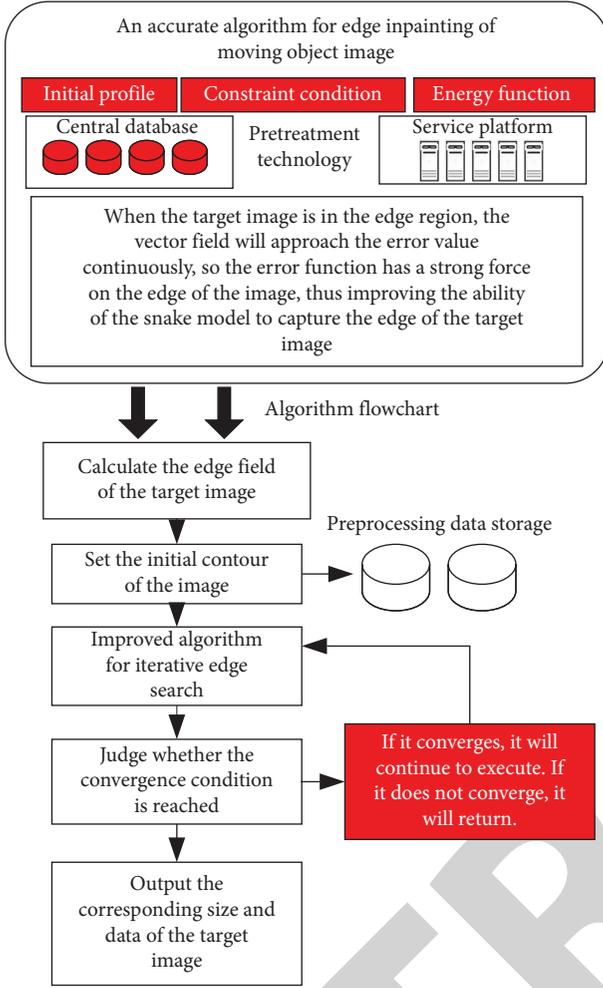


FIGURE 2: Flowchart of improved snake model image edge accurate repair algorithm.

Step 1. Get and collect the corresponding moving target image.

Step 2. Preprocess the captured moving image, extract the corresponding moving background and environment, and calculate the edge image of the corresponding image.

Step 3. Set the initial contour of the corresponding moving target, preset the initial contour, and set the corresponding convergence conditions.

Step 4. Use the algorithm in this section to process and calculate the corresponding image edge iteratively.

Step 5. Judge whether the current convergence and the corresponding convergence conditions meet the requirements. If the requirements are not met, return to loop processing. If the requirements are met, output the corresponding processing results. Based on the basic principle of optical flow field and the variational algorithm in mathematics, the dense vector of the target moving image is converted to form the gradient vector flow of the target

image, which realizes the accurate repair of the contour of the moving target image and solves the problem of the limitation of the contour and the defect of the concave contour in the classical model.

3.2. Image Segmentation Analysis of Improved Snake Model Based on Average Moving Algorithm. In order to realize the real-time tracking of moving object and accurate segmentation of its moving image, this paper uses the average moving algorithm to process it, and its corresponding core principle is as follows: we set the corresponding target motion as a mathematical iterative process. First, it is necessary to calculate the corresponding offset value of the current image point and calculate it as the corresponding average value; then, when the image enters the next frame, the current offset point is moved to the corresponding position. Based on this continuous iteration, the corresponding extended algorithm model is shown in formula (5), in which the corresponding $H(x)$ function represents the corresponding kernel function, the corresponding D represents the spatial matrix of the moving image, and the corresponding $e(x)$ is the weight of the function to the specified point.

$$A(x) = \frac{[\sum_{i=1}^n H_D(x_i - x)e(x_i)(x_i - x)]}{[\sum_{i=1}^n H_D(x_i - x)e(x_i)]} \quad (5)$$

The steps of the tracking algorithm based on this function are shown in Figure 3. The specific steps are as follows.

Step 1. Continuously capture the corresponding target moving image and set the corresponding capture data set as data1, data2, . . . datan.

Step 2. Preprocess the captured moving image, extract the corresponding moving background and environment, and binarize the corresponding image.

Step 3. Use the corresponding data filter to judge the movement tendency.

Step 4. Dynamically set the weight of the background region of the moving target and track the corresponding moving region based on the above average moving algorithm.

In the above algorithm, the corresponding image preprocessing part needs to outline the background of the moving image, and the corresponding image preprocessing technical details are as follows: comprehensively analyze the characteristics of the corresponding gait contour and the corresponding video sequence image when the human body is moving, set the corresponding rule area according to the characteristics of the human body height, and generally set the corresponding rule area in the initial setting. It is ellipse or rectangle. Based on the corresponding rule region, a gray thin line is used to represent the human body contour in the first frame of the sequence to be searched, and a thick black line is used to represent the initial contour of the human body. After the first initial preprocessing, starting from the

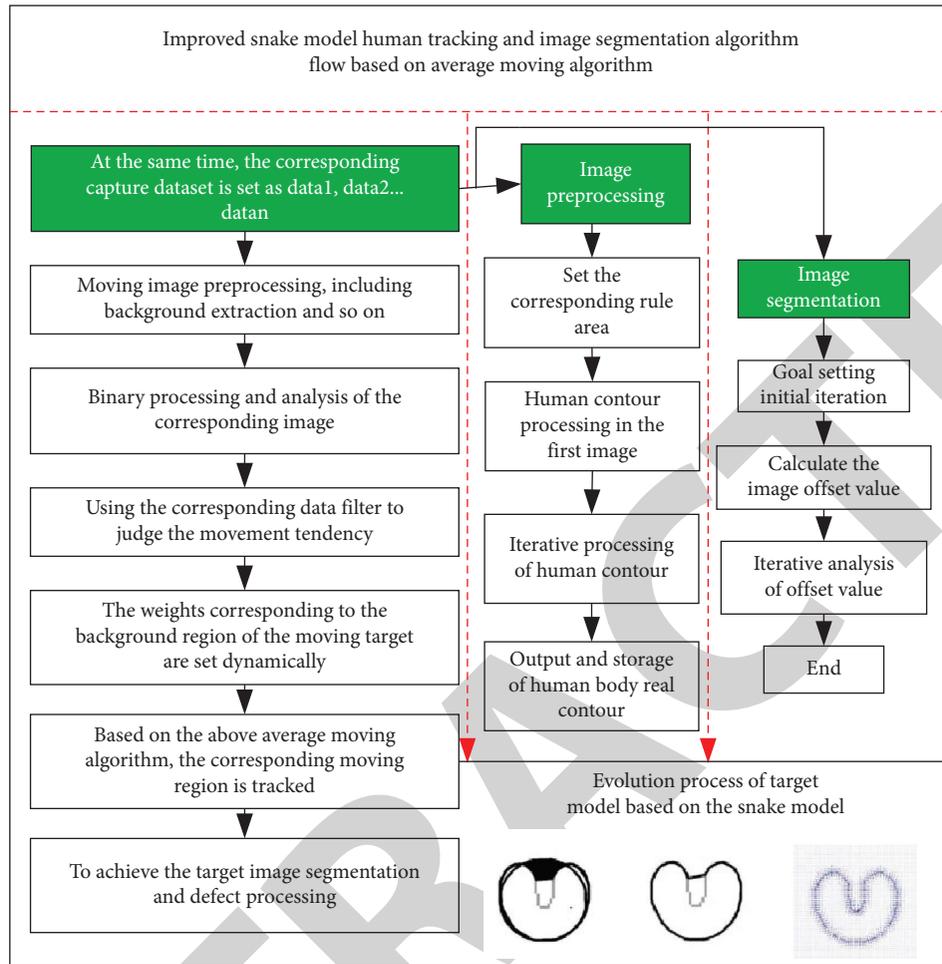


FIGURE 3: Flowchart of improved snake model human tracking and image segmentation algorithm based on average moving algorithm.

corresponding second frame image, the human contour searched in the previous frame image is used as the initial contour of the next sketch contour. In this continuous initialization iteration process, the human contour can gradually approach the real contour and finally realize the edge repair and image segmentation of the initial motion image.

4. Experiment and Analysis

In order to verify the superiority of the algorithm, this paper compares the algorithm with the traditional snake model. The corresponding experimental images are from the same large database, and the control variables of the experimental samples are retained in the experiment. The corresponding experimental picture is shown in Figure 4, in which the corresponding walking attitude of the target in the corresponding picture is slow walking, and the corresponding walking direction is the direction facing the camera. The moving target image processed by the improved snake model and the traditional snake model is shown in Figure 5. From Figure 5, it can be seen that the contour of the moving target processed by the corresponding traditional snake

model shows incomplete edges and the internal cavity with unknown reasons. Thus, it is likely to increase the information loss and further cause the subsequent shadow of the corresponding target recognition accuracy ring. The corresponding improved snake model keeps approaching the actual boundary from the initial position to the actual boundary under the convergence, so as to achieve the corresponding convergence process. At the same time, the improved snake model can fill the boundary gap of the target object.

In order to verify the advantages of the improved snake model compared with the traditional snake model in tracking the number of moving image frames, this paper carries out a comparative experiment. The corresponding experimental video is 4 segments in total, and the corresponding total number of video frames is 350, 334, 1590, and 1767. The number of frames recognized by the corresponding improved snake model and the traditional snake model is shown in Figure 6, and the corresponding statistical table is shown in Table 1. It can be seen from the chart that the improved snake model can recognize a higher number of image frames, and the improved snake model has more advantages in the video with a large number of frames.

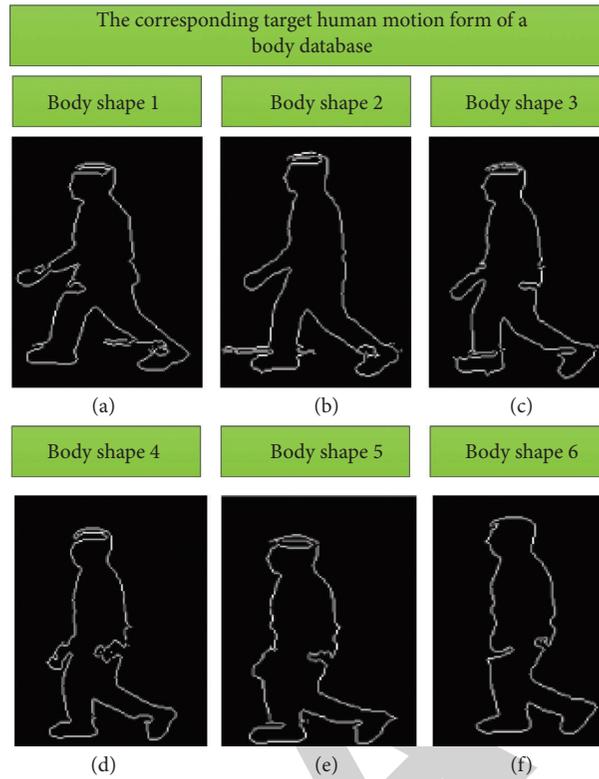


FIGURE 4: Experimental pictures in a large database.

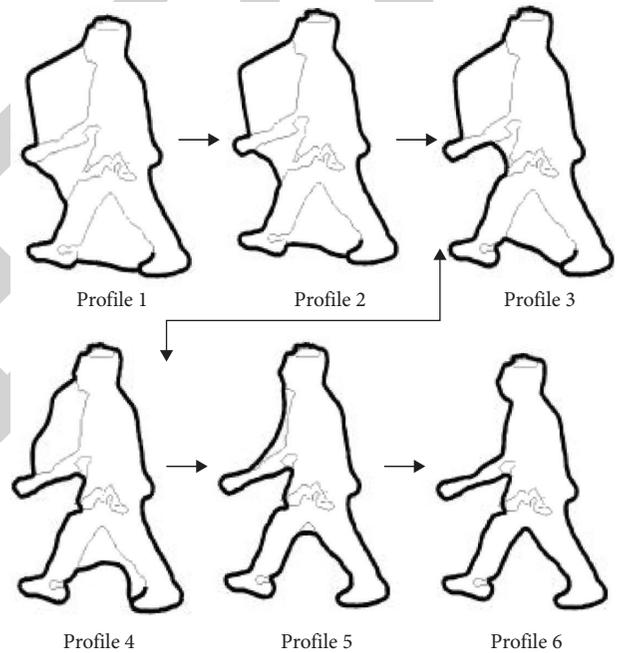


FIGURE 5: Comparison of moving objects processed by improved snake model and traditional snake model.

Based on the above recognition frame number, the effective area of the recognized moving image under the two models is compared and analyzed, and the corresponding

comparison results are shown in Figures 7 and 8. From the figures, it can be seen that the improved snake model has greater advantages than the traditional snake model, and it

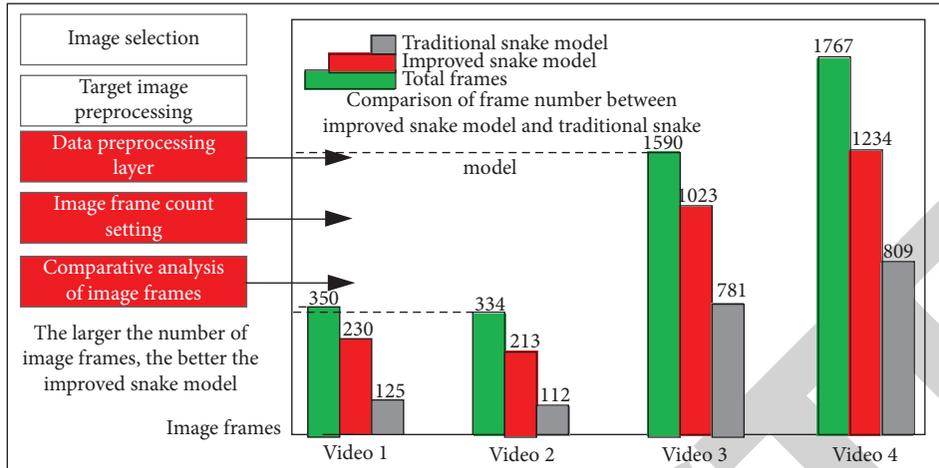


FIGURE 6: Comparison of frame number between improved snake model and traditional snake model.

TABLE 1: Comparison of frame number between improved snake model and traditional snake model.

	Video 1 mmc1	Video 2 mmc2	Video 3 mmc3	Video 4 mmc4
Total frames	350	334	1590	1767
Traditional snake model	125	112	781	809
Improved snake model	230	213	1023	1234

can achieve high-quality effective area acquisition under different frame number backgrounds.

In order to verify the corresponding running time of the two models, an iterative experiment is carried out on a certain number of images (the corresponding iterative experimental images are four images with different frame numbers in Table 1). In the corresponding experimental process, the hardware performance of the image processor is consistent. The corresponding iterative results are shown in Figures 9–12; it can be seen from the figures that the improved snake model proposed in this paper needs a lot of time in the first iteration, and its corresponding subsequent iteration time is very fast. In terms of the number of iterations, the improved snake model proposed in this paper can process the same frame number of images in twice the time of the traditional snake model, and the corresponding iteration time can be reduced by half while ensuring the integrity of the target image contour.

It can be seen from the above experiments that the improved snake model in this paper has obvious advantages over the traditional snake model. It can solve the problem of incomplete contour depression and shorten the iterative time of the image.

5. Summary

This paper mainly analyzes the research status of human motion tracking algorithm and compares the advantages and disadvantages of the corresponding algorithms. In order to further solve the problems existing in the current human motion tracking algorithm, this paper improves the traditional snake model. Firstly, it improves the defect of the model in extracting the contour of human motion model, so as to realize the accurate repair of image contour. In terms of

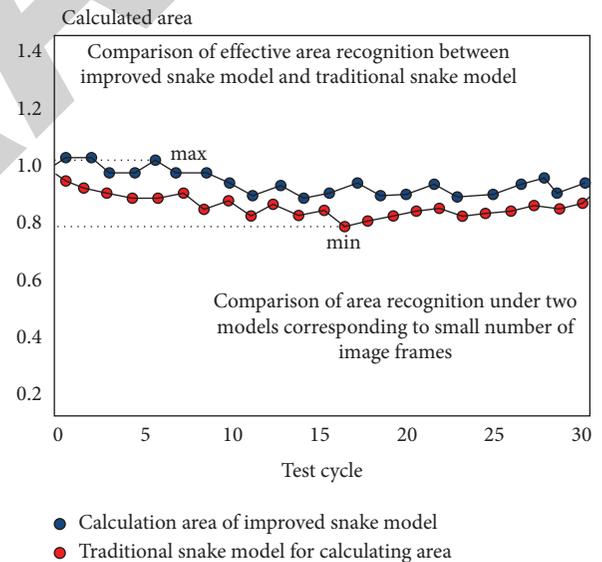


FIGURE 7: Comparison of effective area between improved snake model and traditional snake mode (in case of small number of frames).

algorithm running time, this paper improves the construction process of snake model, so as to further improve the efficiency of model evaluation. In order to further solve the accurate convergence problem of the corresponding moving object concave contour in the snake model, this paper improves the snake model based on the average moving algorithm and sets the corresponding weight coefficient to distinguish the corresponding moving object background, so as to achieve the differential concave contour convergence. In order to verify the superiority of the

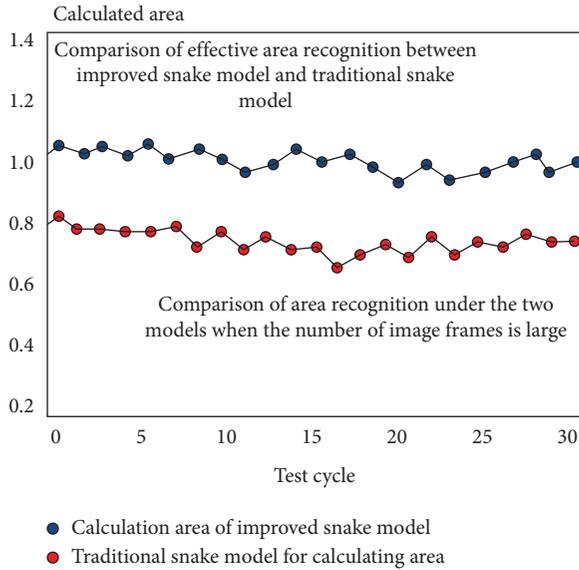


FIGURE 8: Comparison of effective area between improved snake model and traditional snake model (in case of large number of frames).

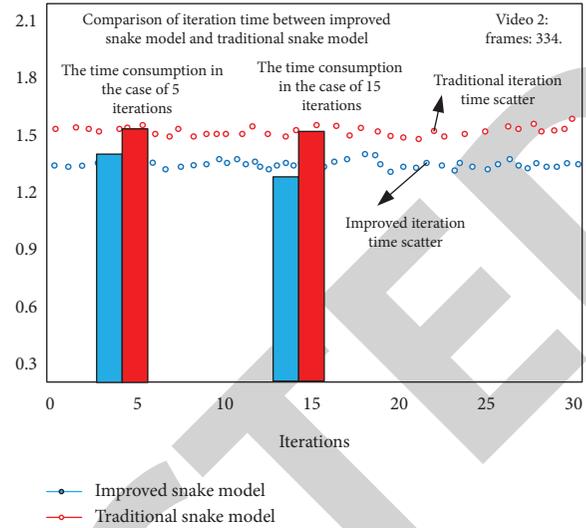


FIGURE 10: Comparison of iteration time between improved snake model and traditional snake model (video 2 processing results).

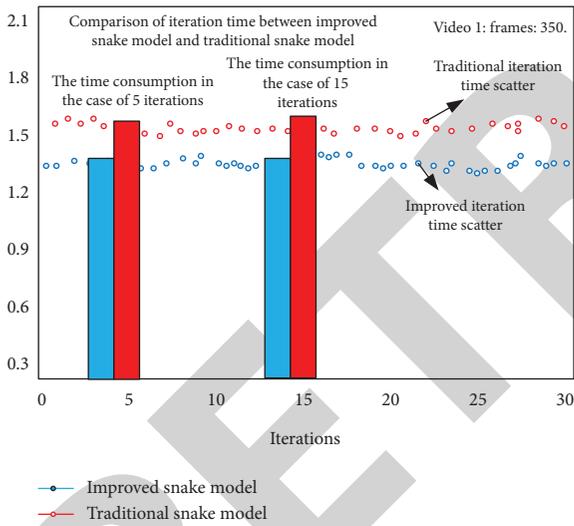


FIGURE 9: Comparison of iteration time between improved snake model and traditional snake model (video 1 processing results).

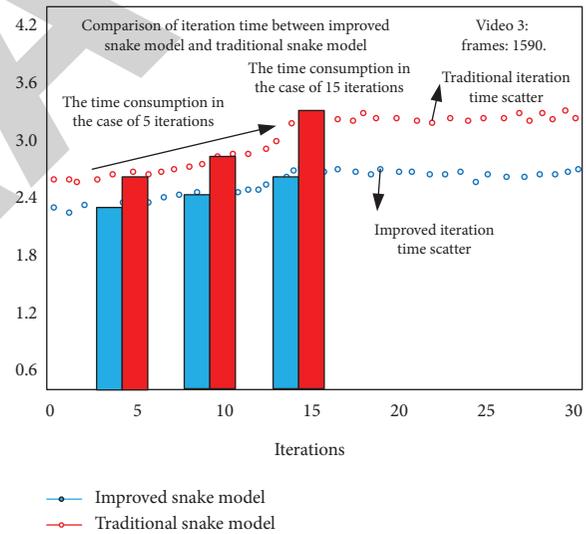


FIGURE 11: Comparison of iteration time between improved snake model and traditional snake model (video 3 processing results).

improved optimized snake model, experiments are carried out in the corresponding database. The experimental results show that the contour of the moving object extracted by the improved snake model algorithm is complete, and the corresponding segmentation effect is obvious. At the same

time, the running speed of the whole algorithm also has obvious advantages compared with the traditional algorithm. In the following research, this paper will focus on the calculation simplification of the improved snake model, so as to further improve its performance.

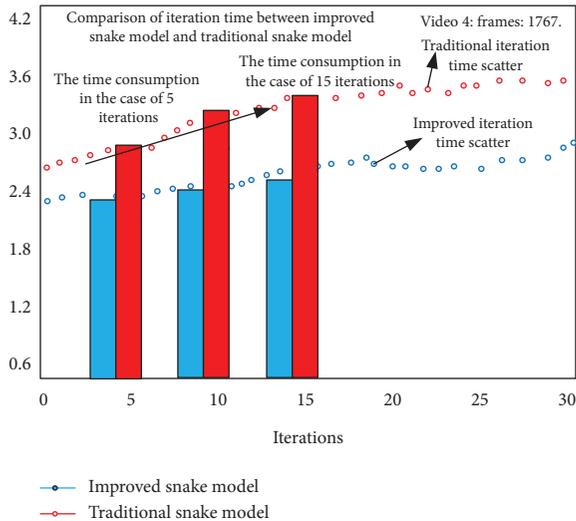


FIGURE 12: Comparison of iteration time between improved snake model and traditional snake model (video 4 processing results).

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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