Research on Image Registration Based on Traffic Accident Scene

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Abstract: Transportation has made an indelible contribution to the development of human society, greatly facilitating people's production and life. However, with the development of traffic, the probability of traffic accidents is increasing year by year. In the scene of traffic accident, the investigation and mapping of the scene pictures of the accident need a long working time, which leads to a long delay in the investigation of the accident. Under normal circumstances, the automatic mapping system will be used to quickly reflect relevant data to support the investigation and processing of the traffic accident site. These data must be based on the actual plane investigation map of the accident site, and actively use the currently known image processing technology to promote the formation of perfect image processing technology and accelerate the on-site exploration of traffic accidents.

1. Introduction

The research and development and progress of motor vehicles are outstanding achievements in the development of human civilization and science and technology, and have greatly promoted the changes of human production and travel modes, with countless contributions. The progress and development period of modern society is also the progress and development of transportation modes. However, the extensive use of transportation means has also brought great negative impact on people's life and environmental protection. Excessive exhaust emissions have caused serious pollution to the earth's atmosphere, and roads that should be gradually crowded in urban construction are facing great pressure. At the same time, the increasingly frequent traffic accidents have gradually become a major killer that seriously endangers people's physical, mental and property safety. It destroys not only the interests and well-being of a person and a family, but also the accumulation of its number has fundamentally impacted the stability of the country. Therefore, the prevention and timely treatment of traffic accidents not only plays an important and fundamental role in the basic construction of people's livelihood and urban planning, but also greatly protects people's personal and property safety, thus ensuring the stability and well-being of the country. Therefore, it is the main work at this stage to actively improve the handling technology of traffic accidents.

2. Social Background of Image Registration

The advent of automobiles is one of the most prominent manifestations of modern civilization in human society and has become a necessary tool for people to live and produce. However, the widespread use of automobiles has not only caused many environmental problems, but also caused a series of legal disputes due to the frequent occurrence of traffic accidents, which puts forward more stringent requirements for the post-event exploration of traffic accidents. Therefore, it is urgent to improve and develop the exploration technology at the scene of traffic accidents so that the identification and evaluation of traffic accidents can be more rapid and fair.

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Collecting images or video data at the time of the accident is the most critical work after the accident. In order to obtain information timely and accurately, cameras are now installed on almost all traffic arteries. Only need to find out the impact data that is consistent with the time of the accident and extract it with the help of professional technology, then the situation at the time of the accident can be restored, which also provides a direct basis for quantitative analysis of traffic accidents. In the early analysis process, it mainly relies on computer vision technology and digital image processing technology [1]. However, due to the problem of different camera shooting angles at each intersection, there are certain differences in the shooting time of the images, which makes the collected images need to be registered with professional technology.

3. The Process of Image Registration

The four basic elements that must be followed in image registration are the establishment of feature space to search for space, the testing of similarity and the way to form search. Many different types and algorithms of image registration are developed and extended on this basis. However, no matter what type and algorithm, it must be based on the above four basic elements and cannot be tampered with or omitted. The main steps of image registration at the scene of a traffic accident are as follows:

(1) processing the image data to be registered in advance [2]. After collecting an image of the scene of the accident, it should be strengthened first. Based on the degraded form of different images in different forms, appropriate dynamic supplements and corrections should be made accordingly. Then the geometric shape of the enhanced image is corrected, and finally the difference of gray values is further processed.

(2) Classification and selection of images based on their characteristics. When investigating the scene of a traffic accident, it is necessary to refer to an object on the scene. In order to register the image information of the accident scene by means of two-dimensional reconstruction, it is necessary to find a reference object with prominent features and relatively conspicuous features. For example, road signs and tire tracks can be easily found on the road surface, and more than four reference points can be accurately found at the scene of the accident, so there is no need to prevent additional reference points for marking for the time being.

(3) After pre-processing the image and selecting its features, it is necessary to match the similar features. The number of matching features possessed by two or more images should be even and the number of matched features should be multiple. When a few features are difficult to determine, it will not affect the global matching.

(4) Based on the category and requirement of the image, find the transformable model that may be suitable for the image, compare the models, select the model with the best application effect, and then obtain the reference data for transformation. Obtaining the reference data requires the aid of corresponding registration algorithms. Reasonable registration algorithms can shorten the time required for registration and obtain the best registration effect.

(5) Based on some special circumstances, the collected images cannot be directly processed and need to be subsampled [3]. Based on the transformation function, transform between similar images until the images are adjusted to the best use requirements. The most commonly used methods are nearest neighbor interpolation and bilinear interpolation.

According to the above description, the overall flow of image registration of traffic accident scene is shown in Figure 1.

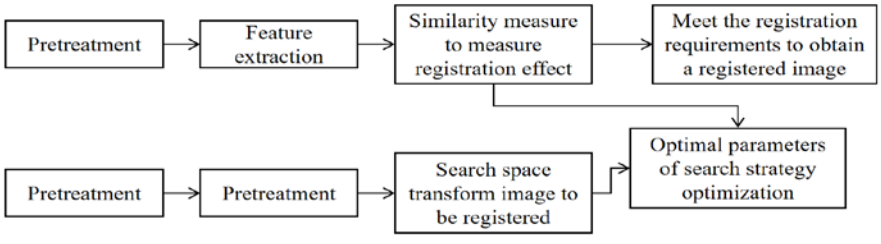

Fig.1 Image Registration Process

4. Optimization of Image Registration Algorithm for Traffic Accident Scene

The overhead photograph of the scene of the accident is the image data of the accident phenomenon taken at a certain height and overhead angle. After correcting the image data, a certain amount of on-site data information will definitely be lost and lost, so reducing the loss of on-site image information is an important link in traffic accident on-site image registration. Other situations will also affect the presentation of the image information to the details of the actual situation in the field, such as determining the size of the image, then how much information can be contained after correction. Therefore, in the actual use of image information, the maximum information content of an image of a certain size is required, and the details of the actual situation on site reflected by the image should be as clear as possible. In order to achieve the best correction, it is necessary to explore a comprehensive method to solve the problem reasonably.

Powell algorithm, genetic algorithm and ant colony algorithm are the main centralized algorithms of image registration algorithms at present. These algorithms have their own advantages and disadvantages. Ant colony algorithm is not fast enough, and the answer knowledge obtained is aimed at local images and is not the best overall answer. Therefore, based on such defects of ant colony algorithm, correction and optimization are carried out [4]. First, for the shortcoming of slow operation of ant colony algorithm, genetic algorithm is used to improve and optimize the reference value in ant colony algorithm, so as to achieve the purpose of accelerating operation. Secondly, the result based on ant colony algorithm is limited to partial images, and its solution is to use Powell algorithm to fill it, which is based on Powell algorithm's strong performance of finding the best local results. Specifically, it is to use ant colony algorithm to obtain a local best answer first, then Powell algorithm is used to optimize and supplement, and then the overall best answer is obtained. This is an effective new algorithm combining Powell algorithm, genetic algorithm and ant colony algorithm. Its specific calculation flow is shown in Figure 2.

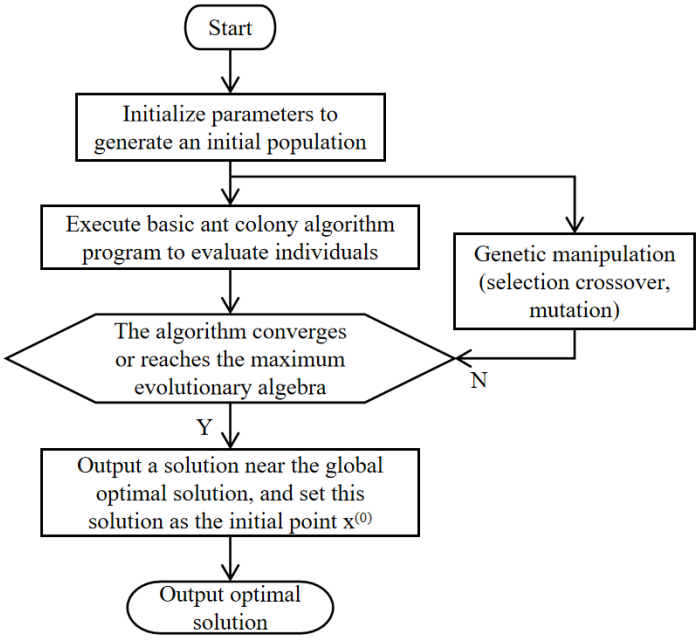

Fig.2 Specific Calculation Process

Under normal circumstances, ant colony algorithm is enough to get the best answer, but it is still difficult to get the best answer from the space angle, and it is generally an answer value adjacent to the overall best answer [5]. Based on Powell algorithm's strong local optimization ability, it is a reasonable means to solve this problem, so it effectively combines the overall exploration ability of ant colony algorithm and the local optimization ability of Powll algorithm. This kind of method can achieve the best effect when applied to the image registration process. Due to the large number of calculations for the objective function in ant colony algorithm, the optimization takes too long. Therefore, our calculation strategy should be shifted to multi-resolution based on wavelet transform.

The optimization process of the overall algorithm is roughly divided into two major steps: the first step is to use ant colony algorithm for low-resolution image registration. Because the image being processed at the beginning is too small, the calculation speed will be relatively fast and the optimization process will be completed in a short time. In the second step, Powell algorithm is used for optimization processing on high-resolution images, and the best answer under ant colony algorithm is taken as the node from which the calculation starts. The specific operation flow is as follows:

(1) The floating image to be registered and the reference image are pre-processed by wavelet decomposition to obtain sub-images with smaller specifications. After that, the sub-images are further registered, which is also the process of image optimization. The realization of these processes cannot be achieved without the technical support of ant colony algorithm. At the same time, with the help of interpolation method of similar image data, the graphics with substandard resolution are processed twice. In order to speed up the calculation and obtain the best results. Furthermore, the accuracy of image registration is greatly improved and the degree of image ashing is reduced.

(2) The starting point of Powell's optimization process is the best result obtained by ant colony algorithm. As the reference data for image registration, the image with high resolution is registered to obtain the best registration effect. In the process of optimization, PV interpolation method is adopted to set the gray value of the image to 256, so as to achieve the purpose of accuracy of artwork registration [6]. Since powell algorithm selects the optimal registration result of ant colony algorithm as the starting node, this provides a very helpful initial starting point for powell's optimization, which has less influence on the optimization result, and also has less influence on the optimization order of Powell algorithm reference data, so it is no longer necessary to optimize the order of reference data according to the characteristics of graph composition. At the same time, compared with Powell's calculation method of selecting initial nodes randomly or by default, this method of directly using the optimal result of ant colony algorithm as the initial point can save the optimization time. The ant colony algorithm is strictly followed to optimize the image with lower resolution. This is an interpolation method that highlights the relative simplification of ant colony algorithm. The calculation time for information is short, which can ensure that the image selection can be completed within a short time. Compared with Powell algorithm, its work efficiency is ideal.

5. Actual Inspection of Traffic Accident Site

5.1 Inspection Basis

To verify the image registration results at the scene of traffic accidents, it is mainly to check whether the relevant mathematical models, algorithms and applications of programs are correct. The verification results should be fully based on the actual situation and checked on the basis of the calculation results, so as to achieve the purpose of checking the algorithm.

5.2 Actual Verification

Make full use of the known conditions and take two photos of the accident scene from different angles. Then the algorithm is processed by matlab processing program, and its calculation method is matched with the calculation method introduced in this paper in terms of characteristics, so as to compare the different effects of image registration using different algorithms. In the registration process, 20 feature nodes are selected in each image to match. With the aid of ant colony algorithm, genetic algorithm and Powell algorithm, these 20 feature nodes are matched with the image features for optimal matching, and the feature matching result pages obtained by different algorithms are different.

Based on the current technology application practice, Powell algorithm has obvious advantages in terms of local merit selection ability. However, to play its role, Powell algorithm must be guaranteed to enter the internal space of the image in time and accurately. Genetic algorithm has the same excellent ability of local selection, and its disadvantage is that the calculation time cannot be

determined. The best results of feature matching based on ant colony algorithm are wandering in the neighborhood of the overall best results, and its disadvantage is too long operation time [7]. Therefore, ant colony algorithm is relatively ideal in feature matching, but it needs to be optimized and improved before it can be used.

The accuracy of image feature selection directly affects the accuracy of image registration. Although Powell algorithm has strong merit in image feature selection, its image coverage is too limited and its line of sight is too constrained. Although ant colony algorithm ensures the quality of image feature selection, its operation time is too long, which is not conducive to accident exploration.

Throughout the whole article, the new operation method after improving the traditional image registration operation is more time-effective, which is due to the perfect result obtained after optimizing the reference data of ant colony algorithm through genetic algorithm. This technical progress has not only saved time but also enhanced the accuracy of the double harvest, making the ant colony algorithm's excellent overall operation narrow the search range. Combined with Powell algorithm's strong performance on local selection, the best results can be obtained.

6. Conclusion

Based on the characteristics of the scene images of traffic accidents, this paper discusses the measures to deal with the problems inside the box. In this paper, powell algorithm, genetic algorithm and ant colony algorithm are analyzed and studied for their specific advantages and disadvantages, and these three are effectively combined to extend a brand-new and more practical feature matching algorithm. This is the reform and progress of the traffic accident scene image matching technology, which can greatly promote the technical progress of traffic accident investigation, and then let traffic accidents be solved in a timely and effective manner, so that people's personal and property safety can be more effectively protected.

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