

Intelligent Vehicle Identification System based on Traffic Video

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Abstract

With the development of information technology, in particular, to improve the video and image processing technology, intelligent video surveillance system collected data can be used to extract the relevant information on the vehicle for life and related investigations provided for convenience. Since the acquisition by the light, angle, and the impact of weather, so that the video data is difficult to retrieve, for this problem, this paper presents a background model fusion method can effectively eliminate the adverse weather light and other factors. This algorithm can quickly and efficiently and with high accuracy to detect vehicle information.

Keywords: *Intelligent video; Image processing; Vehicle detection*

1. Introduction

Traffic is the social and material factors, social workers, community resources and the orderly and efficient flow of communication platforms and channels, how to build a reasonable, accurate and efficient transport, communications, logistics network is the core of today's transportation industry content. As a major research topic for the transportation industry to meet the needs arising from: identify the type of vehicle, to further enhance the level of automation and intelligent vehicle transportation network has practical and far-reaching significance. In modern society, science and technology and the rapid economic development in the world today, the relationship between transport services as people living in many areas, although great progress has been made, but still can not fully meet the needs of people's lives in transport, and in real life continue to appear out of a series of traffic problems has risen yet to be urgent problems, such as traffic accidents, vehicle congestion, environmental pollution, congestion and car people, etc., which have now also become a growing surge of concern and attention. We know that in the early days, the world of traditional methods to solve the contradiction between road vehicles are generally large-scale expansion and construction of various grades of roads, but the face of limited energy, pressure on land resources and economic conditions and constraints of the environment such that people have to go actively consider other methods. Since the 1980s, the rapid development of society, science and technology developed in Japan, the United States and Western Europe and other developed rapidly in solving the traffic problems facing these countries is to establish a wide range, full-functioning accurately, Real-time, integrated intelligent transportation management systems approach and efficient: the successful integration of advanced artificial intelligence technology, information and communication technology, automatic control technology, electronic sensor technology and systems engineering technology up used in ground transportation management. Initially, intelligent transport, the United States due to lack of attention, is behind Europe and Japan, but later on the great potential of the UN. Intelligent traffic between each other to improve the role of the car, the road, a lot of people and other transportation systems, ease congestion and thus improve the transportation efficiency, and protect the safety of traffic, reducing energy waste and to avoid excessive environmental pollution, on the whole, it has to solve traffic problems and improve the social and economic benefits opened up a bright road. Rapid social and economic development, so that China's rapid increase in the number of cars. Since 2002, the Chinese auto industry has begun to enter the explosive growth stage, the automobile industry has completed the process from small to large, it is gradually from weak to strong huge leap.

At this stage, the construction of highway investment is relatively large, it is still performed by loans to road construction and road maintenance toll road repayment policy. But to build toll booths on the highway charge procedure will greatly reduce the normal capacity of the road. Currently in foreign countries have implemented toll collection mode example, in the country, toll collection model will be the development direction. As well as easing overcrowding toll, long time waiting in line and pollute the environment and other issues, thus creating an electronic toll collection system [1-4].

By video camera as a data collector, this method will be collected traffic video through a series of image processing technology, through the analysis of traffic video image sequence, target detection and location traffic, the final location, identification or tracking the target, so its behavior analysis is completed and the extraction of various traffic parameters, in order to realize the intelligent real-time traffic management. Compared with other kinds of monitoring, video image processing of information can be obtained with a variety of intersection traffic monitoring system, including the recognition of vehicle information, traffic parameter extraction, the abnormal behavior detection, *etc.*, [6-9]. At the same time, the traffic monitoring system based on video image processing installation and maintenance, and the normal traffic order will not be affected, the information is, the scope is wide, can cope with sudden traffic conditions.

2. Related Works

Image recognition is the use of a computer to identify the object in the image and sorted by machine intelligence to replace human intelligence. It is very extensive field research, for example, machining parts identification, classification; distinguish crops, forests, lakes and military installations from remote sensing image; accurate weather forecast from meteorological data or satellite photographs; from X-rays determine whether the cancer occurred; judging from the ECG waveform is checked whether suffering from heart disease; implement traffic control centers in traffic, identifying illegal traffic of cars and drivers, and so on.

Now has image enhancement technologies include spatial domain and transform domain based on two categories [10-12]. Based on the spatial domain method primarily direct gray-scale transformation, histogram processing and spatial filtering methods. Method transform domain is based on the image from the time domain to the frequency domain, and then corrected by the coefficient of the transform domain to achieve image enhancement purposes. It is superior to the method based on space domain, representative of the algorithm based on Fourier transform algorithm based on wavelet transform and algorithm based on stationary wavelet transform and the like. Algorithm based on Fourier transform is easy to produce "ringing" phenomenon. Multi-resolution analysis of wavelet analysis as represented while enhancing image details can effectively suppress image noise, and enhancing regional and enhancement goals easy to control. But the one-dimensional to two-dimensional wavelet Zhang separable wavelets have limited direction, are not well represented in the image direction information. Filter performance than conventional filters have improved, but they are not without distinction or select all input sample filtering process. For an image containing noise, only a small portion of the pixel noise disturbed the rest of the pixels are still retained. No selection or filtering process is bound to some of the original information without loss of image difference performed for each pixel. Therefore, the proposed method is to add another type of image filtering in the filtering process is determined that the first detection of each pixel of the image has been tainted, and then to selectively filter, the output is in the original pixel gray and filter Results switch between. Because it is selective filtering, avoiding unnecessary filtering operation and fuzzy image filtering effect has been further improved. However, these methods are still some flaws in judgment and filter out the noise in the process, such as for lighter or darker image, it will produce more false positives and false negatives noise, but also makes significant increase in computational algorithms, affecting the filtering effect and speed. Meanwhile These algorithms do not consider human visual characteristics, but also because the image filter is to enhance the human visual effect or be better applied to subsequent image processing, so they filter effect is not very satisfactory. Image enhancement

technology is the image of the observer useful information to be enhanced, making the image easier to use, better visual effect. For example, so drowned in the noise of the image presented, or the low-contrast images appear as high contrast images, or emphasizing high spatial frequency components, so that the image tone clear and so on. Conventional methods of image enhancement histogram equalization, homomorphic increase clarity and so on. Histogram equalization method is a technique often used it for a little image enhancement histogram range are very effective[13-15]. However, for some gray-frequency smaller areas, the contrast will be reduced, or even eliminate this part of the information. In addition, the histogram equalization sensitive to noise, while enhancing the visual effect will be enhanced noise.

3. Moving Target Detection and Background Extraction Algorithm Analysis

3.1. Moving Object Detection Algorithm

Common target detection algorithm basically has the following categories:

1 Interframe Difference Method

Between her virginity in finite difference method is mainly used for two consecutive frames corresponding pixel difference algorithm, the difference figure by setting the threshold of binarization, differential value is greater than a certain threshold, the judgment for the moving point, finally will be detected by the moving target binary graph connectivity and morphological processing, if the connected area is greater than the setting threshold, conform to the target area scope, is judged to be moving targets. As shown in the flow chart of 1.

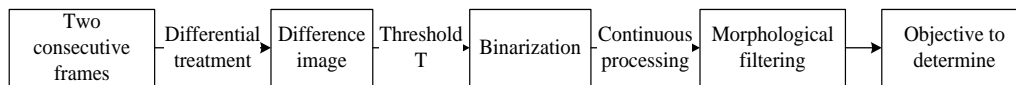


Figure 1. The Flow Chart of Interframe Difference Method

Interframe difference method mainly through formula (1), the difference of two consecutive frames score by fujian value T binarization processing.

$$D(x, y) = \begin{cases} 1, & |f_t(x, y) - f_{t-1}(x, y)| > T \\ 0, & \text{other} \end{cases} \quad (1)$$

Principle of interframe difference method is simple, programming complexity is not high, computing speed is fast. Because interframe difference method chosen is continuous sequence of tilting, short time interval, so the light effect is very small, and its update speed, can be a good real-time performance. But as a result of this method to detect is the change of movement, so the detected target is not continuous and accompanied by wave interference, need further use connectivity and morphological filtering processing, connecting scattered the whole and remove the detected noise, then and targets set by the product range of threshold value, meet the conditions of the determination for moving targets, does not meet the judgement of interference and noise removing. In the actual video monitoring, if moving target with slow or gray uniform distribution, the target area can produce hollow effect of detection, can't detect the complete movement goal or to complete the target partition [6-8].

2 Background Difference Method

Background difference method is a way to use the current frame and background image difference algorithm method to detect the moving targets. Its core idea is to determine an appropriate background image $B_k(x, y)$, the use of the current post image sequence and the background image and the difference image $D(x, y)$, according to the threshold binarization

difference image.

$$D(x, y) = \begin{cases} 1, & |f_t(x, y) - B_k(x, y)| > T \\ 0, & \text{other} \end{cases} \quad (2)$$

The difficult point of this method is not the difference link, but to set up and update the background image in real time. Actually because of the light in the scene, and the weather factors such as interference, background will continue to change, it is necessary to establish the real-time accurate background information. The flow chart shown in Figure 2:

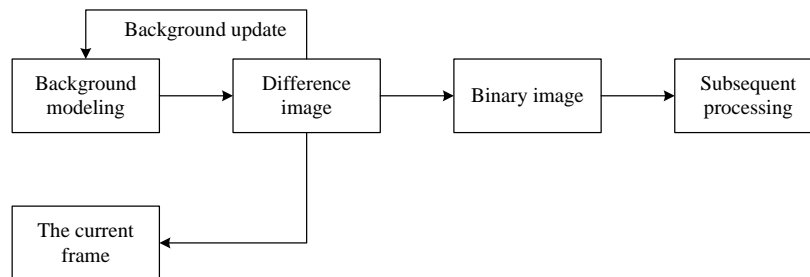


Figure 2. The Flow Chart of Background Difference Method

In terms of the interframe difference method, background difference method in computing speed and detection effect, performance is good, can complete detect moving targets, to adapt to the complex scene moving target detection. This method in the case of stationary camera operation speed and motion target detection precision. But as time changes, the light, weather, and sports activities of moving targets is in constant transformation, can lead to real time image background change, need to dynamically update the background to adapt to the real-time demand.

Three optical flow method

Optical flow is space moving object in the observed image pixel motion on the surface of the instantaneous velocity, not only contains the sports movement information of the object, and the 3 d structure information scenario. Moving object in three dimensional space and scene in the 2 d image plane projection motion, coupled with image plane brightness pattern of flow is the flow of light. The above relationship determines the optical flow field of three basic elements: projection, optical properties and the velocity field. Projection relationship refers to the movement object and image geometric projection; Optical properties is referring to the image pixel gray value reflect the movement of the object parameters, such as lighting conditions; Velocity is the rate of movement of the moving object in the image on the surface of the reaction. So the optical flow is reflected in the image represents each pixel gray value changes the speed and direction.

Optical flow method is used to detect moving target is to find the light flow field of the three basic elements: one moment in the sports, the image pixel and the actual three-dimensional space object points to form the corresponding projection; The actual light conditions with the image of grey value conforms to the optical properties; To the pixels in the image on the motion vector, namely the formation velocity field. Optical flow method of moving target detection is according to the velocity field of dynamic image sequence analysis: if the stationary state, the image of the optical flow vector is continuous variation; When there is relative motion, the velocity vector on a moving object can produce difference velocity vector and static background, according to the difference to detect moving targets. Optical flow method in the detection of moving target, not only can reflect the movement of the target information, also contains the rich scene information. It can in the case of don't know any scene accurately detect moving object, but the method of calculation is too complicated and antinoise performance is poor, used to process real-time traffic video not good reflect its

advantages.

3.2. Common Background Extraction Algorithm

Comparing the above three algorithms of comprehensive treatment effect, select background difference method as the research object. Common methods how to build background model frame averaging method, histogram statistics background modeling method.

1 More Frame Average Background Modeling

More than average method is based on statistics theory, in a certain statistical time, change caused by moving objects in image sequence can be offset each other. Frame averaging method will be more understood as a vehicle noise, through the type (3) the average of the calculated pour more, eliminate movement by using the method of average vehicle caused by the change, so as to get the same point of background pixels.

$$b(x, y) = \frac{1}{N} \sum_{i=1}^N f_i(x, y) \quad (3)$$

Principle of the method is simple, easy to calculate, for speed stable and simple road traffic scene has good extraction effect. But for the target motion more slowly and environment complex scenes, if you want to get good background effect, the average number of meal to choose is large, make the data storage needs to occupy a certain space. For the target motion faster scene, can appear the phenomenon of ghosting background model.

2 The Histogram Statistics Background Modeling

Histogram statistics statistics is a pixel in image sequence of grey value distribution within a certain time, type (4) $N(x, y, k)$ said in the pixel gray value (x, y) as the number of k . The frequencies of each gray values in the histogram and its seen in the image sequence is proportional to the probability, so grey value of the highest frequency can be identified as background grey value.

$$N(x, y, k) = \begin{cases} N(x, y, k) + 1, & \text{if } (f_i(x, y) = k) \\ N(x, y, k), & \text{if } (f_i(x, y) \neq k) \end{cases}, i = 1, 2, \dots, N \quad (4)$$

This method is more, average method for background extraction effect is better, but for the distance of moving targets, relatively close shot speed slower, longer for background of coverage, can lead to a statistical error, the background of the vision effect is close to. Also, this method in order to get a better effect on background, select the number will reach a certain number, higher requirements for data storage [9-12].

4. Background Modeling Method based on Fusion Research

4.1. Background Modeling Algorithm

Different levels of histogram is a kind of the same variables corresponding to the frequency expressed in rectangular bar chart, the area of the rectangular bar or highly on behalf of the corresponding frequency. For gray image, the image is level with the grey value, said the frequency or the number of occurrences of each gray level in the image. Histogram statistics believes that if a grey value of pixels in the image frequency of the highest in the video sequence, which is to think the grey value as the background grey value. This method for small cars have higher accuracy and simple calculation. But when the course or the speed is slow, motor vehicles for background covering time increases, the histogram appears multi-peak state, interfere with the largest selection of frequency point, more serious or even directly to the prospects of point misjudgment as the background. Background to obtain good

results, you should choose enough kok like sequence histogram statistics, ensure that the highest frequency of background pixels. This kind of practice, plus the amount of calculation and increases the demand for storage empty asked. Used to solve the above problems, a filter window smooth traditional histogram curve, the peak is more apparent, less error, easy to select. And combining the pixel mean peak as a reference, when there are multiple peak, will each histogram peak compared with corresponding to pixels of the mean, choose the most close to the average peak as the background grey value, the background model is set up. Method design flow chart shown in Figure 3.

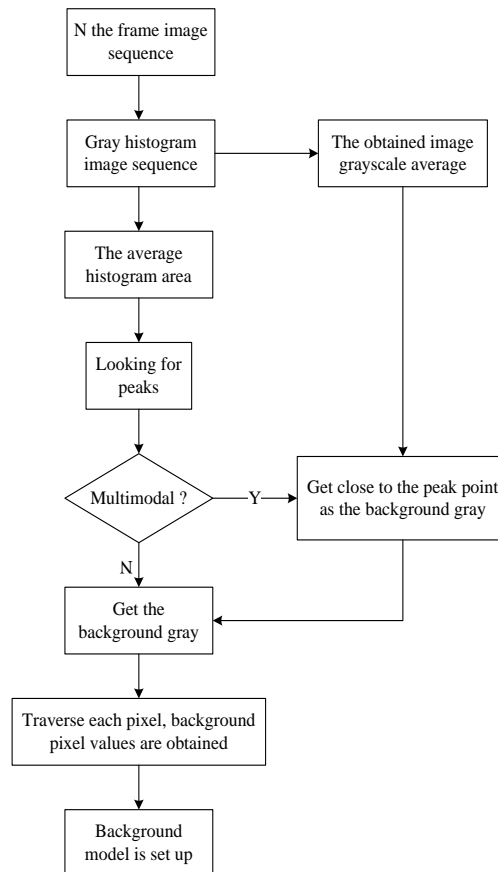
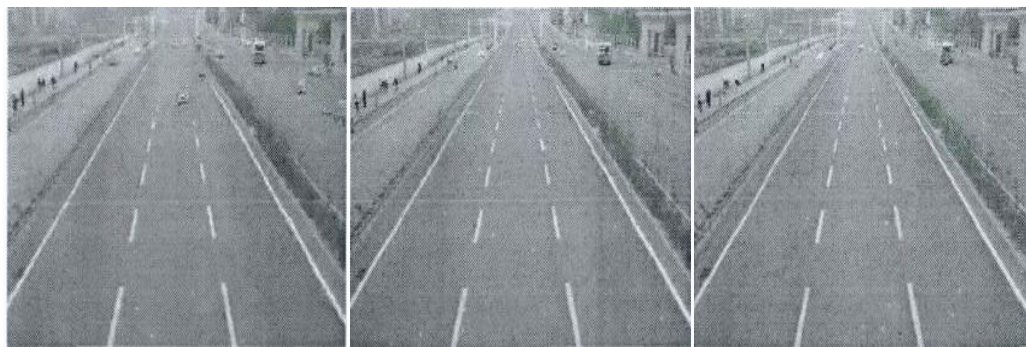


Figure 3. Background Modeling Flowchart

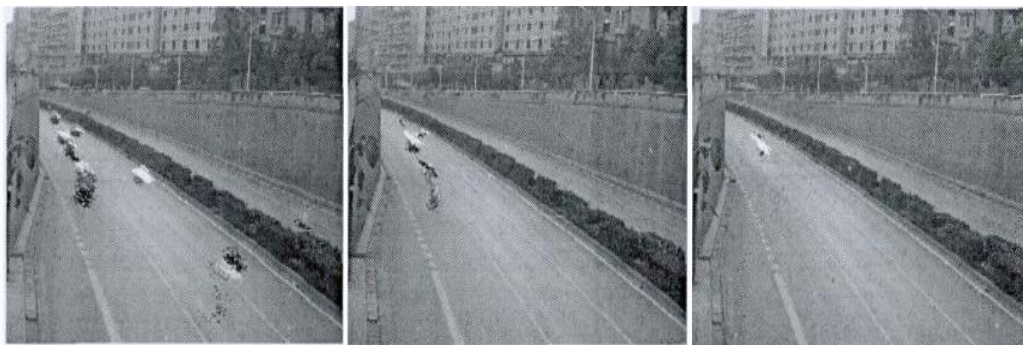
Under the condition of the traffic scene is complicated, passing vehicles to background covering time is not long, or in the case of vehicles bodywork color close, foreground points frequency and background of grey value of grey value frequency may produce peak at the same time, a multimodal state. In order to solve this multimodal state caused by the interference, can be calculated through the video sequence in pixels of the mean, using the gray average for reference, for further judgment [13-15].

4.2. The Experiment Results Analysis

For this method to establish the background model, USES the frames in order from left to right in figure 25, and 65, respectively. Can be seen from the diagram, for the fast moving target, such as movement in the front of a blue car, 25 frame has a clean background can be detected. But for vision and a slower moving object detecting interference effect in the foreground is more serious. In statistics all the time, the movement of the vehicle is not completely across the corresponding background region, grey value of the vehicle when the statistical occupy the highest frequency, are misidentified as the background, in the background left the vehicle. Comparison results figure, 65 frames of background model has high accuracy, and operation cost is not high.



(a) Video 1 rendering



(b) Video 2 rendering

Figure 4. Background Modeling Effect

Compared with median filtering, this method has a better anti-jamming ability, more can deal with the complex traffic conditions; The frame difference method, the smell can effectively solve the problems of the ghosting, and can use less, get more accurate background effect; For the more traditional histogram statistics method, can be effective treatment of slow movement and vision object, get the ideal background model. To establish the initial static background, the effect of this method is good, but if have to deal with dynamic video, will want to consider the problem of computation and storage capacity, more want to consider the real-time updating of background.

5. Conclusion

In this paper, the detection algorithm of moving vehicles in the related research, introduces several common methods of target detection, puts forward the histogram statistics method and smoothing the pixel initial background model is established with the method of average, frame average method can effectively solve the ghosting effect. In ensuring good real-time background model, on the basis of calculation is more simple and quick. Combined with single gaussian model, using the histogram method to establish the initial model, using the method of single gaussian model update background model, not only can save a clear straight Fang Ge tectonic background required a large amount of storage space, you can also get real-time background, solve the problem of the histogram statistics background model update.

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