An Object Tracking Algorithm Based on the "Current" Statistical Model and the Multi-Feature Fusion

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***Abstract*— Aimed at accurary and real-time object tracking under complex background,an object tracking algorithm based on multi feature fusion is proposed. Feature points tracking is used to reduce the match time and improve the real-time of tracking; To overcome the inaccuracy of a single feature tracking, the object model is presented by the color and texture features. For the traditional "current" statistical model in maneuvering object tracking defects, an improved algorithm which combined with adaptive kalman filter (AKF) is proposed to improve the tracking accuracy. Experimental results show that the proposed method is effective and robust under complex background, the object is similar to each other, the target was partial occlusion and when the object is maneuvering.**

***Index Term*— object tracking; objective model; "current" statistical model; feature points; feature fusion**

I INTRODUCTION

Object tracking is a challenging task in computer vision because of the diversity of object features and complex background. A robust tracking algorithm must be able to solve the various difficulties in tracking, such as occlusion, rotation, size changes, the light changes etc. In recent years researchers have proposed a lot of tracking algorithms, They mainly based on motion model, optical flow, feature and image region features etc[1-6]. Compared with other algorithms, feature-based tracking algorithm has good performance in real-time, robustness and is widely used, but it is difficult to overcome occlusion under complex background.

For this reason, many scholars have proposed a variety of tracking algorithm based on feature points. Ref.[1] has proposed a object tracking algorithm based on the feature corner by comparing edge corner and gray corner. Ref.[5] extracted feature points based on texture features, and judged occlusion by characteristics of optical flow and the correlation coefficient, achieved an effective tracking when the target under occlusion or turn; They are used texture or gray feature to represent object model, but they have defects on identification of different color objects. Ref.[7,8] proposed feature point extraction and matching method based on color SIFT, to a certain extent, the method has compensated the defects for SIFT algorithm for different color object recognition, but the descriptor used in the SIFT algorithm by calculating the local neighborhood gradient direction histogram of feature points of 128-dimensional feature vector space, it takes a large amount of computation in the process of feature extraction and matching and it is difficult to meet real-time requirement .

Based on the above analysis, taking into account the accuracy and real-time tracking, it is very important for feature point selection and object model composition. They require less feature points and can describe the object accurately and each feature point contains more information. Single gray feature tracking algorithm often can not guarantee the robustness and reliability, it often missed the targets when illumination changes during tracking, the object gray is similar to background, the target was in occlusion, etc. We combine texture and color for each feature point to establish eigenvectors and present object model by feature vector composed of the object feature points, making full use of color and texture information to the description the object. Defects on the recognition of different color vehicle based on the gray-scale image matching track is made up, tracking of color objects is enhanced.

The establishment of object motion model and the design of filtering algorithms are the key technology to track moving objects. The study of maneuvering object motion model has been a difficult and hot issue in maneuvering object tracking, the more realistic of object motion model to establish, the stronger self-adaptive algorithm to track and the better the performance of object tracking.

The difficulty to establish the maneuvering model is the description of the object acceleration, domestic and foreign scholars have been studied the maneuvering object motion model in-depth, of which the most representative model is Singer model, but the model which has the assumption of zero mean does not meet the actual object maneuver situation [9]."Current" statistical model compensates for acceleration based on the Singer model, making the acceleration variance adaptive change with the mean, making the tracking performance is superior to Singer model [10]. But acceleration of maximum takes a fixed value in the "current" statistical model, the acceleration is not adaptive adjusted with the case of current maneuvering, resulting in deterioration of tracking accuracy.[11-13] propose a dual tracking filter algorithm, although this algorithm can improve the adaptive capacity of process noise variance

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matrix of the "current" statistical model to some extent, but the performance of object maneuver acceleration of maximum for tracking filter still exists.Ref.[14] using covariance matching and multi-level white noise adaptive filtering algorithm idea, has proposed a maneuvering object tracking algorithm in the case of the maximum acceleration of unknown based on a "current" statistical model, and has achieved better results, but this algorithm increases the amount of computation, can not guarantee real-time requirements.Ref.[15] has supposed that maneuver acceleration has the probability density function of the same non-hybrid four-fold symmetry. This non-uniform feature makes the model acceleration noise variance adaptive change with the object maneuvering, but the estimation accuracy is not ideal when the object without maneuver. In this paper, adaptive Kalman filter algorithm is established based on the "current" statistical model, we describe the maximum acceleration using the relationship between acceleration and the predicted state and adaptive changing as the case of object maneuver , thus making the system noise variance adaptive change with the movement of the object.

In this paper, the target feature points model is established by the fusion of color and texture features, the use of point features can overcome some partial occlusion or the light change of the tracking process, the fusion of color and texture information can compensate the lack of a single feature tracking to improve tracking accuracy. For the traditional "current" statistical model deficiencies, improved model is proposed, making the use of the relationship between acceleration and the predicted state to describe maximum acceleration, with the movement of the object to be adaptive, so that the system noise variance with the movement of the object adaptive change, tracking robustness is further improved.

The rest of this paper is organized as follows: in Section II we describe the method of feature points extraction and optimization choice. Section III describes how to establish the object represent model combine color and texture features. Section Ⅳ introduces the adaptive filtering algorithm based on the "current" statistical model and proposes an improved algorithm. We present the methods of the feature points matching and the template update in Section V.The experimental results are shown in Section Ⅵ. Section Ⅶ offers our conclusion.

Ⅱ FEATURE POINTS EXTRACTION

A Harris corner detection algorithm

Corner detection algorithm based on image-gray proposed by Harris and Stephen[16-18]. Harris has been widely used in the field of computer vision and image processing. Because the calculation is simple, feature point extraction is uniform reasonable and high reliability.

For an image, corner point is related to the characteristics of the curvature of autocorrelation function, the autocorrelation function describes the changes of local image gray. Image grayscale autocorrelation function is defined as follows:

$$E(x,y)=\sum_{u,v} w_{u,v}\left|I_{x+u,y+v}-I_{u,v}\right|^2 \tag{1}$$

Where $I_{x+u,y+v}$, $I_{u,v}$ is respectively the corresponding gray value of the image coordinates $(x+u,y+v)$ and (u,v). The pixel (u,v) of (1) can be expressed as the dual function of the Taylor expansion, E (x, y) can be expressed approximately as a Taylor polynomial:

$$E(x,y)=Ax^2+By^2+2Cxy \tag{2}$$

The Harris corner detector is:

$$R=Det(M)-kTr^2(M) \tag{3}$$

Parameters A, B, C, M can see in Ref. [19]. Let M be the two eigenvalues λ1 and λ2, a point of extreme curvature of image gray-scale of the autocorrelation function can be approximated by the eigenvalues of the matrix M. When two eigenvaluesare both more small, feature points lie in smooth area of the image; When one eigenvalue is large and the other is small, feature points lie in a one-way texture area; When two eigenvalues are large, feature points located at the corner or cross texture area of the image .

The value of experience k is 0.04, the seeking corner can be obtained if the R is take reasonable threshold.

B optimization selection of feature points

Firstly, taking into account the real-time and accuracy in video tracking, the number of extracted feature points must be appropriate, too much will affect the computing speed, too little is not accurate to describe the object, so we need to screening or delete feature points.

According to the preceding analysis, we can choose a larger λ_1 and λ_2 as the best feature points, then set λmin = min (λ_1, λ_2).

In addition, in the video image sequence tracking, the significant point of single-frame image is not necessarily solidity feature points for tracking, the initial screening of the feature point need a second choice. As a result of using texture and color information to establish object model, the color components of feature points should be considered when in the selected feature points. We chose points which color component and the background image corresponding points color difference larger as a significant feature points in the first selected feature points. Background image can be extracted by the background extraction algorithm. Let I_1, I_2, I_3 is color component of feature points, I_1', I_2', I_3' is color component of the feature points corresponding to the background. We define the feature points where foreground and background color variance as:

$$\text{MSE}=\frac{1}{3}\left[\left(I_1-I_1'\right)^2+\left(I_2-I_2'\right)^2+\left(I_3-I_3'\right)^2\right] \tag{4}$$

The MSE> T (T is the set threshold) points as a significant feature points.

Figure 1 (a) and (b) are the distribution of feature points by the initial feature point extraction algorithm and the optimized feature point extraction algorithm for video scenes with Harris in the selected area. Figure 1 (a) shows the quantity of initial feature points in the match with a longer time tracking and it extracts a lot of background feature points, it is not conducive to establish the object model.Figure1 (b) is the optimized feature points, it can be seen from the figure all the extracted feature points is the object feature points, it has no background feature points basically, compared with the traditional feature tracking algorithm, the object model of feature points distinguish more accurately between the object and background. The MSE minimum of two feature points is respectively 0.1958 and 0.2012 in the figure (a); the minimum MSE of feature points after optimization is respectively 0.3356 and 0.3186, indicating that the feature points after optimization and background color vary widely, reducing the number and distributing sparse and evenly. It also seen from the figure that the object feature point have high repetition rate, indicating that the feature points robustness in the tracking process, providing the conditions to an exact match for the next step.

(a) Initial feature points

(b) Optimization of feature points

Fig.1 Simulation of feature extraction and optimization

III OBJECT REPRESENT MODEL

The object model for video object tracking by feature type can be divided into three categories[20-22]: color representation model, shape statistical model and other models. These models are described using the different characteristics of the object, but it has not any kind of features can be individually adapted to all visual occasions, cues to reflect the characteristics of the target is between related, complement each other, and track the target using a variety of characteristic information can be to achieve the complementary information between the various features, greatly improve the tracking robustness. So, applying data fusion ideas, we comprehensive objective color and texture information to establish object model.

A Object color representation model

Color representation model is not affected by the changes of pixel space, it was provided a stable object representation for the track in certain situations. In the actual color feature extraction and matching process often requires the use of color model that has a certain robustness for lighting changes. In different lighting conditions, color is main related to the object itself and the surface glabrous, Gevers and others put forward a color models with a variety of color invariant features, which typically models include rgb model, $c_1c_2c_3$ model, $I_1I_2I_3$ model and $m_1m_2m_3$ model[8]. $I_1I_2I_3$ model calculates the difference between the three RGB components to eliminate the surface reflection component. It is a certain color invariant with highly reflective surface, for natural light and the smooth surface characteristics of moving car, we select $I_1I_2I_3$ model.

Expression as follows:

$$I_1 = (R-G)^2 / ((R-G)^2 + (R-B)^2 + (G-B)^2) \quad (5)$$

$$I_2 = (R-B)^2 / ((R-G)^2 + (R-B)^2 + (G-B)^2) \quad (6)$$

$$I_3 = (G-B)^2 / ((R-G)^2 + (R-B)^2 + (G-B)^2) \quad (7)$$

B Object model based on color and texture information

Established vector for each feature point feature:

$$F(x_i, y_i) = [R_i, I_1(x_i, y_i), I_2(x_i, y_i), I_3(x_i, y_i)] \quad (8)$$

Where (x_i, y_i) coordinates of i-th feature point, R_i is the interest value, I_1, I_2, I_3 is the feature point color information. The object model is presented by all the feature points composed of feature vector. We make full use of color and texture information in the description of the object to make up the tracking based on gray-scale image matching for vehicle identification of different colors and enhanced the ability to distinguish color objects.

IV THE ADAPTIVE FILTERING ALGORITHM BASED ON THE "CURRENT" STATISTICAL MODEL

A State equation

Let the sampling period T, the "current" statistical model of the discrete state equation as follows[23-24]:

$$X(k+1) = \Phi(k+1/k)X(k) + U(k)\bar{a} + W(k) \quad (9)$$

Where,

$$\Phi(k+1/k) = \begin{bmatrix} 1 & T & \frac{1}{\alpha^2}\left(-1+\alpha T+e^{-\alpha T}\right) \\ 0 & 1 & \frac{1}{\alpha}\left(1-e^{-\alpha T}\right) \\ 0 & 0 & e^{-\alpha T} \end{bmatrix} \quad (10)$$

$$U(k) = \begin{bmatrix} \frac{1}{\alpha}\left(-T + \frac{\alpha T^2}{2} + \frac{1-e^{-\alpha T}}{\alpha}\right) \\ T - \frac{1-e^{-\alpha T}}{\alpha} \\ 1-e^{-\alpha T} \end{bmatrix} \quad (11)$$

W(k) is a discrete-time white noise sequence, the covariance matrix $Q(k)$ is as follows:

$$Q(k) = E[W(k)W^T(j)] = 2\alpha\sigma_a^2 \begin{bmatrix} q_{11} & q_{12} & q_{13} \\ q_{21} & q_{22} & q_{23} \\ q_{31} & q_{32} & q_{33} \end{bmatrix} \quad (12)$$

Where,

$q_{ij}, (i, j = 1,2,3)$ is a function of the sampling period T[25].

Let the state vector is:

$$X(k)=\begin{bmatrix} x & \dot{x} & \ddot{x} & y & \dot{y} & \ddot{y} \end{bmatrix}^T \tag{13}$$

x, y were coordinates of the location information; $\dot{x}$ 、 $\dot{y}$ were the object velocity in x, y direction; $\ddot{x}$ 、 $\ddot{y}$ were the object acceleration in x, y direction. Let the current acceleration were $\bar{a}_x=\ddot{x}(k/k-1)$ and $\bar{a}_y=\ddot{y}(k/k-1)$, the prediction expression can be obtained as:

$$X(k+1/k)=\Phi_1(k)X(k/k) \tag{14}$$

Where

$$\Phi_1(k)=\begin{bmatrix} \Phi_t & O_{3\times3} \\ O_{3\times3} & \Phi_t \end{bmatrix} \tag{15}$$

$$\Phi_t=\begin{bmatrix} 1 & T & T^2/2 \\ 0 & 1 & T \\ 0 & 0 & 1 \end{bmatrix} \tag{16}$$

$$O_{3\times3}=\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \tag{17}$$

State noise covariance matrix as follows:

$$Q(k)=E[W(k)W^T(k)]=\begin{bmatrix} 2\alpha_x\sigma_{ax}^2Q_x & O_{3\times3} \\ O_{3\times3} & 2\alpha_y\sigma_{ay}^2Q_y \end{bmatrix} \tag{18}$$

Where

$$Q_x=\begin{bmatrix} q_{11} & q_{12} & q_{13} \\ q_{21} & q_{22} & q_{23} \\ q_{31} & q_{32} & q_{33} \end{bmatrix}_{\alpha=\alpha_x} \tag{19}$$

$$Q_y=\begin{bmatrix} q_{11} & q_{12} & q_{13} \\ q_{21} & q_{22} & q_{23} \\ q_{31} & q_{32} & q_{33} \end{bmatrix}_{\alpha=\alpha_y} \tag{20}$$

$$\begin{cases} \sigma_{ax}^2(k+1)=\dfrac{4-\pi}{\pi}\left[a_{\max\_x}-\hat{\ddot{x}}(k+1)\right]^2 \\ \sigma_{ay}^2(k+1)=\dfrac{4-\pi}{\pi}\left[a_{\max\_y}-\hat{\ddot{y}}(k+1)\right]^2 \end{cases} \tag{21}$$

σ_{ax}^2 、 σ_{ay}^2 are respectively acceleration variance of the x, y direction; α_x 、 α_y are respectively the object maneuver frequency of x, y direction. Since $\ddot{x}$ 、 $\ddot{y}$ are the state variables of the filter, then the output of the filter itself contains the object maneuver statistics, from (21) shows that, σ_{ax}^2 、 σ_{ay}^2 update with the output of the filter $\ddot{x}$ and $\ddot{y}$ update real-time, so that the state noise covariance matrix $Q(k)$ has also been updated real-time and achieved the purpose of adaptive filtering.

B Adaptive Kalman filtering algorithm

According to the state equation and observation equation, adaptive Kalman filtering [26-27] equations can get as follows:

$$X(k/k-1)=\Phi_1(k-1)\hat{X}(k-1/k-1) \tag{22}$$

$$P(k/k-1)=\Phi_1(k-1)P(k-1/k-1)\Phi_1^T(k-1)+Q(k-1) \tag{23}$$

$$K(k)=P(k/k-1)H^T(k)\left[H(k)P(k/k-1)H^T(k)+R(k)\right]^{-1} \tag{24}$$

$$\hat{X}(k/k)=X(k/k-1)+K(k)[Z(k)-H(k-1)X(k/k-1)] \tag{25}$$

$$\hat{P}(k/k)=[I-K(k)H(k)]P(k/k-1) \tag{26}$$

C Improved the "current" statistical model

In the "current" statistical model, the maximum acceleration $a_{\max}$ that choose a fixed value, not with the object changes in the state of motion adjust adaptively, making the object deviation increase of the predicted value and the actual state and tracking performance deteriorated.

For this problem, this paper make use of the relationship between acceleration and the state of predication to make the maximum acceleration regulate adaptively with situation of object maneuver, making the system noise variance $Q(k)$ adaptive changes with the movement of the object to improve the tracking performance.

Acceleration disturbance at time k can be expressed as the dispersion relationship of the filter speed output at time k and k-1:

$$\Delta a(k)\approx\frac{\hat{\dot{x}}(k/k)-\dot{x}(k/k-1)}{T} \tag{27}$$

$$a_{\max}(k)=\bar{a}(k)+\Delta a(k)=\hat{\ddot{x}}(k/k)+\frac{\hat{\dot{x}}(k/k)-\dot{x}(k/k-1)}{T} \tag{28}$$

Taking the above equation into (21), we can get acceleration of the variance as follows:

$$\begin{cases} \sigma_{ax}^2(k)=\dfrac{4-\pi}{\pi}\left[\dfrac{\hat{\dot{x}}(k/k)-\dot{x}(k/k-1)}{T}\right]^2 \\ \sigma_{ay}^2(k)=\dfrac{4-\pi}{\pi}\left[\dfrac{\hat{\dot{y}}(k/k)-\dot{y}(k/k-1)}{T}\right]^2 \end{cases} \tag{29}$$

It can be seen from the above equation, when the object maneuver did not occur, the difference between the predictive value of speed at time k and the filtering output value of the speed at k time is very small, the variance of acceleration is also very small; When the object maneuver occurs, the difference between the predictive value of the speed at time k and the filtering output value at time k is larger and the variance of the acceleration is also larger, the covariance of acceleration adjusts depending on weather the object maneuver or not and achieves the purpose of tracking maneuvering objects accurately.

Ⅴ. FEATURE POINTS MATCH AND TEMPLATE UPDATE

A Matching criteria based on mahalanobis distance

Mahalanobis distance[28] is an effective way of computing the similarity of two unknown samples, it is difference with Euclidean distance that it takes into account the connection between various properties and the measure is independent, that is independent of the measurement scale. For a mean is $\mu=(\mu_1,\mu_2,\mu_3,\ldots,\mu_p)$, a multivariate vector of covariance matrix Σ is $x=(x_1,x_2,x_3,\ldots,x_p)$, the Mahalanobis distance can be as:

$$D_M=\sqrt{(x-\mu)^T\sum^{-1}(x-\mu)} \tag{30}$$

For the characteristics constructed by object model of the feature points, and the need in practical applications on different applications and goals, adjusting the weight of different characteristics proportion in object feature point model, the Mahalanobis distance is more propitious to the design.

In formula, set $x=F(x_i,y_i)$ is the i-th candidate feature point feature vectors of current object frame; $\mu=F(x_j,y_j)$ is the feature vector of the j-th feature point in the object template; Σ is the covariance matrix of x and μ, it can be seen as weighting matrix, let, $\sum=diag(r_1,r_2,r_3,r_4)$, r_1, r_2, r_3, r_4 is the weighting coefficient of characteristic components, its value set depends on the particular case. The smaller the value, the more similar the candidate feature points and the template feature points, if $D_M < D_{th}$, then the match is successful, D_{th} is the threshold of measure function.

B Object location and template updates

According to the adaptive filtering algorithm of the "current" statistical model established previously predict center coordinates and region of the object in next frame and extract object feature point of the current frame, obtained the feature vector and feature set of candidate feature point. According to the matching criteria in 5.1, we match the feature points of the object template and the current image of the candidate matching feature points one by one, and calculate matching rate q (the ratio of the number of successful matches of feature points and the number of feature points in object template), we can accurately determine object location while the matching is successful.

Set color-m is color mean of feature points of the target template, color-h is color mean of the candidate feature point for prediction object area, color-t is a constant. If the matching rate q is small, probably because the object is in occlusion or the object turning or deformation made part of the characteristics of points are lost, resulting in lower matching rate, both cases can be distinguished by color-m and color-h.

The judge of template update as follows:

(1) If 0 <q<50% and color-m-color-h> color-t, indicating the object in part of the occlusion, we do not need to update the template, the object location is determined by the correct matching feature points.

(2) If 0 <q <50% and the color-m-color-h <color-t, may be due to the turning or deformation caused some characteristics of the object points lost, resulting in lower matching rate, we correct match point to determine the destination at the same time update the template, that according to the current image frame to re-establish the object template.

(3) If q = 0 and color-m-color-h <color-t, the situation is the same as situation b.

(4) If q = 0 and color-m-color-h> color-t, the object is all in occlusion, it is not need to update the template, according to the prediction parameters to determine the object location, if the continuous multi-frame q = 0, then the object is missed and finish tracking.

Ⅵ.TRACKING FLOWCHART OF THE ALGORITHM AND EXPERIMENT

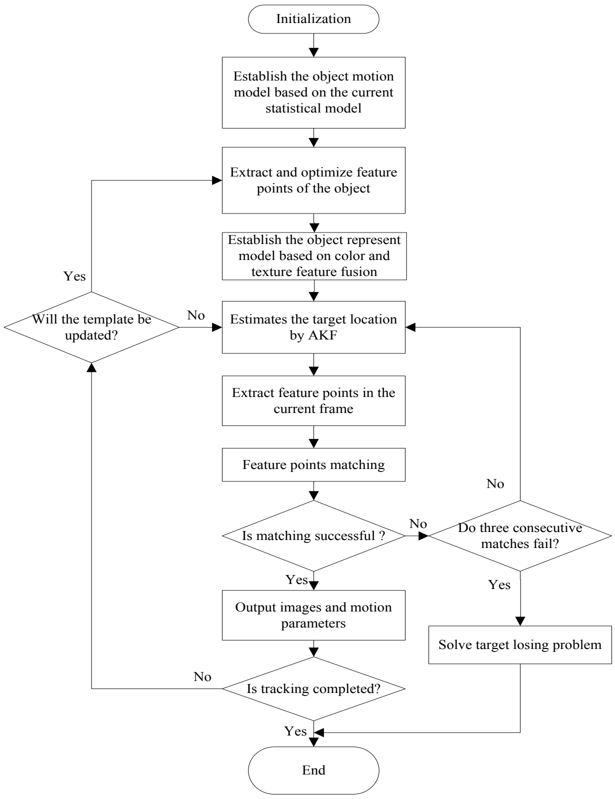

Fig.2 Tracking algorithm flow chart

A Tracking flowchart of the algorithm

The algorithm flowchart is shown in Fig.2. The algorithm used in this article works can be divided into six steps. The specific process outlined below:

(1) we get the video sequences suitable for computer processing through the framing and filtering method taking to the input video image.

(2) Extract feature points of the target vehicle, then establish the feature point description model of the target based on the color and texture feature fusion.

(3) First we building the motion model based on the improved "current" statistical model, then estimate the target's position in the next frame and extract the target feature points of the current frame according to the vehicle's motion model and AKF.

(4) We update the target position and filter parameters according to the result of this method for feature matching.

(5) According to the matching rate of the feature points and the mean difference between the means of the target color and the background color to determine whether to update the template, we update the target template if need, else re-establish it with the current image frame and go to the next frame for recycling.

(6) we get the tracking results and compute the parameters based on the tracking matching result if the tracking process normally, else go to the missing target processing steps.

B Experimental results and analysis

We use the computer of CPU of P4, 2.0, 512M, the proposed algorithm is programmed with MatlabR2007a. To verify the effectiveness of the algorithm, we test on two video sequences use different methods, and the superiority of this algorithm is further illustrated.

The comparison test is experimented for a single texture feature and texture and color fusion, the experimental results shown in Figure 3. The size of image is 384×288and frame rate 25 frames / s. Figure 3 (a) shows tracking results of green car with a single texture features, it can be seen the error tracking happens at the time of 60-th frames. using only a single texture feature tracking, you can not very well distinguish between different vehicles which the shape is similar and the color is different, two cars in the case of close each other lead to error tracking when in the long tracking. The results of Figure 3 (b)shows that using this algorithm can still track the object accurately, the result have shown the tracker have a strong robustness. Meanwhile, It can be seen the root mean square error curve of figure 4, this algorithm is superior to the algorithm based on a single texture features in general, the process of lost object is not appeared.

Frame 20 Frame 45 Frame 60

(a)Tracking results of a single texture feature

Frame 20 Frame 45 Frame 60

(b)Tracking results of our algorithm

Fig.3 Tracking results of video sequences 1

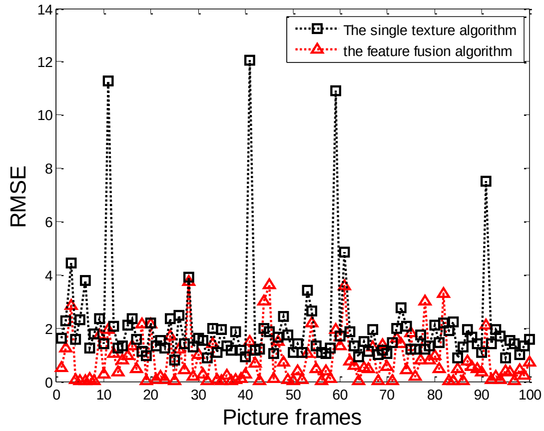

Fig.4 RMS error of video 1

Frame 10 Frame 95

Frame 186 Frame 195

(a) Tracking results of Traditional "current" statistical model feature fusion

Frame 10 Frame 95

Frame 186 Frame 195

(b) Tracking results of improved "current" statistical model feature fusion

Fig.5 Tracking results of video sequences 2

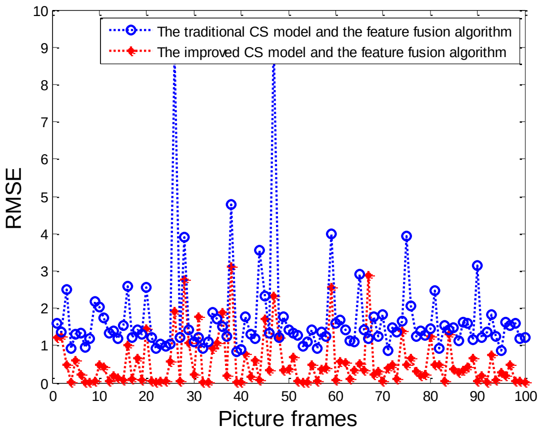

Fig.6 RMS error of video 2

The Video sequences 2 is comparison tests of the traditional "current" statistical model and the improved "current" statistical model combining features of the proposed fusion algorithm for the movement of vehicle tracking in video scene. From the Fig.5 we can see the "current" statistical model and the feature points of the object feature fusion model that combined have a strong anti-occlusion ability, the vehicle that vehicles the track was occlusion by slow moving vehicles by sides of street before frame 186, but the two algorithms can tracking reliability, it is fully proved that the use of color and texture feature fusion of the object model can achieve accurate object positioning. In Fig.5(a) we can seen vehicle in the frame 195 which has parallel similar interference, speed turns, using the traditional "current" statistical model, maximum acceleration is a fixed value , when tracking strong maneuvering objects, making the acceleration variance and state error co-variance matrix decreases, resulting in filter gain is reduced, thus making the correction filter output decreases, reducing the tracking of mobile range, leading to incorrect tracking. We can see from Fig.5(b),using the improved model, the acceleration covariance can be adjusted depending on the case of object maneuver timely, the maneuvering object can be tracked accurately.

Fig.6 is simulation diagram of mean square root error that continuous tracking 100 frames of video sequences 2 moving car in Fig.5. It is clear that the tracking error using the improved algorithm is less than the traditional tracking error, has a high tracking accuracy.

Ⅶ. CONCLUSIONS

Tracking algorithm based on feature point is proposed, jointing the color and texture information to establish the model, to make up the defects for the match based on texture features to track the vehicles of different colors, through the optimal selection of feature points enhance the distinction between the object and background, improved the tracking feature points in the robustness of the process, strengthen the tracking of real-time and accuracy. By matching the rate and the difference between object and background colors to determine the object moving state, make sure of object location and to decide whether update the template or not, and the partial occlusion problem was resolved effectively.

For the traditional "current" statistical model deficiencies, an improved model is proposed, through the adaptive update of the acceleration and improved the accuracy of maneuvering object tracking.

In future research, the technology of feature tracking under background noise and optimal selection of features will be study, thereby improving the scope of application of this algorithm and robustness.

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