International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 2 Issue 3, March - 2013

Object Tracking For Video Files With Spatiogram

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Abstract

Real-time object tracking is a important task in computer applications. An object tracking algorithm presented in this paper is based on the joint colour texture spatiogram which is used to represent a target and then applying it to the mean shift framework. Usually histograms are used for object tracking. But histograms do not include any information on the spatial information of colours. To cope with this lack of spatial information, spatiograms have been recently proposed for tracking purposes. A spatiogram is an image descriptor that combines a histogram with the mean and the variance of the position of each colour. Compared with the traditional colour histogram based algorithms, the proposed algorithm extracts effectively the edge and corner features in the target region. It can be used in the cases such as similar target and background appearance. .

1. Introduction

Real-time object tracking is a critical task in computer applications. Many tracking algorithms have been proposed to overcome the difficulties arising from noise, occlusion and changes in the foreground object or in the background environment. Among the various tracking algorithms, mean shift tracking algorithms[4] have recently become popular due to their simplicity and efficiency.

Mean shift is a procedure for locating the maxima of density function given discrete data sampled from that function. Mean shift vector always pints towards the direction of the maximum increase in the density. It is an iterative kernel-based procedure which converges to a local maximum of the measurement function. Moreover mean shift is a low complexity algorithm. It gives a general and reliable solution to object tracking and it is independent of the target representation

A common method used for target representation is colour histogram[1][4]. Colour histogram is a representation of the distribution of colours in an image. It represents the number of pixels that have colours in each of the fixed list of colour ranges.Color histogram can be viewed as the discrete probability density function (PDF) of the target region. But if we are using colour histogram only for tracking it will cause some problem. First the target's spatial information is lost. Second, if the target and the background has similar the colour histogram could not work properly. Texture describes the surface properties of the object. Textures are the combination of pigments, normal and finishes. The texture patterns of an image reflect the spatial structure of the object. These texture features gives a new information and these information can't be represented by using colour histogram. So in this paper we introduce the new concept called joint colour-texture spatiogram for target representation and tracking the object.

In image synthesis the transfer of color, in histogram space is not sufficient. So we consider an additional spatial processing of the images. To consider the spatial distribution of colours, we use the concept of spatiogram[2]..Here we propose a general method for spatiogram transfer that allows dealing with various image editing problems with a help of a single energy minimization. The concept of spatiogram is related to the mean and covariance of the position of each colour and was proposed in [3] for tracking applications.

In this paper, we use the LBP scheme to represent the target texture feature. After finding LBP Texture values we use joint colour-texture spatiogram method for an effective target representation. The major uniform LBP patterns are used to form a mask for this proposed method. The proposed method eliminates the difference between similar background and the target and also reduces noise in the tracking process. Thus by using this proposed method we can achieve better tracking performance with fewer mean shift iterations.

The paper describes as follows. Section 2 describes the terms related to this proposed work. Section 3 deals the tracking details with spatiogram.Section 4 describes the experiments related to this work and section 4 includes the conclusion.

2. Related Terms

2.1 Introduction to Spatiogram

Let I(x) be a colour image defined on the spatial domain Ω ,and $I:x \in \Omega \rightarrow (I1,I2,I3) \in [0:255]^3$. The RGB colour space is considered here. For colour $\lambda=(\lambda1,\lambda2,\lambda3) \in [0:255]$, histogram h_I of I is defined as

$$h1(\lambda)=1/|\Omega|\int\delta(I(x)-\lambda)dx \quad (1)$$

where δ(.) is the Dirac function whose value is 1 if its argument is 0 and 0 otherwise.

Histograms give a global description of the colour distribution of images. In order to add some spatial information to this description, here consider the mean position μI and the spatial covariance ΣI of the pixels of each bin,

$\mu_I = 1/ |\Omega| \, h1(\lambda) \int x\delta (I(x) - \lambda)dx$

$\Sigma_I = 1/ |\Omega| \, h1(\lambda) \int (x- \mu I (\lambda)) \, X \, (x- \mu_I(x))^T (I(x)-\lambda)dx$ (2)

2.2.Target Representation with Mean Shift Tracking Algorithm

A target is usually defined by a rectangle or an elliptical path region in the image. Here we are presenting a new target representation approach by using the joint colour-texture spatiogram. For this method we are using the mean shift tracking algorithm.

Suppose there are $\{x^*_i\}_{i=1\cdots n}$ normalized pixel positions are there in the target region, the target model $\hat{q}$ corresponding to the target region is calculated as .

$\hat{q} = \{\hat{q}_u\} \; u=1\cdots m$

$$\hat{q}_u = C \sum_{i=1}^{n} k(\|x_i^*\|^2) \, \delta [b(x_i^*) - u] \qquad (4)$$

Here $\hat{q}_u$ represent the probabilities of u in target model $\hat{q}$, m is the number of spaces, δ is the delta function, b (x_i^*) is the pixel histogram associated with an image, k(x) is an isotropic kernel profile and *C* is a normalization function constant .

3. Tracking with Joint colour Spatiogram

3.1.LBP Textures

The LBP operator indicates one pixel in an image that is surrounded by a set f pixels and thresholds its neighbours with the centre value. The result is a binary number. The general form of LBP operator is as follows

$$LBP_{P,R}(x_c,y_c)=\sum_{p=0}^{P-1} s(g_p - g_c) \qquad (5)$$

Here gc corresponds to the gray value of the centre pixel (xc, yc) and gp corresponds to the gray values of set of pixels *P* that are equally spaced on a circle with radius *R*. The function *s*(*x*) is defined as follows:

$$s(x) = \begin{cases} 1 & x > 0 \\ 0 & x < 0 \end{cases} \qquad (6)$$

Here we are using LBP $_{81}$ operator that is one pixel is surrounded by 8 different pixels. The texture value obtained by (5) is gray value.

There is one limitation of LBP is that it does not work properly on flat regions. To overcome this disadvantages we are modifying the LBP operator by replacing the term *s*(*gp*−*gc*) in Eqs. (5) with *s*(*gp*−*gc*+*a*). If the value of |a| is increased, the fluctuations in pixel are not affected the picture quality. From this calculations we find out the LBP feature of each point of the image whose value is between 0 and 9. Thus an got the appearance model. This model consists of colour channel and LBP texture pattern.

The $LBP_{8,1}$ model contains nine uniform texture patterns, these uniform patterns is known as a micro-texton.Among these micro-texton the portions such as edges, line ends and corners are called "major uniform patterns", these represent the main features of target. The other parts such as spots and flat areas are called "minor uniform patterns", these are minor textures. For a target representation we extract only the major uniform parts.

Here we are considering a table tennis video file as the input. The following figure shows the target window and the corresponding LBP texture patterns

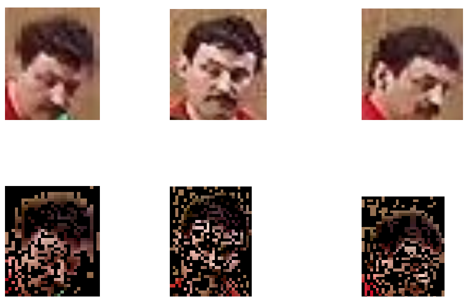

Fig 1 .(a)The tracking window (b) Corresponding LBP Texture patterns.

3.2.Object Tracking

The next step is finding out the object or the target. For this target tracking first we have to extract the LBP texture patterns .The extraction can be done with the help of RGB channels. To obtain the colour and texture of the target region we use Eq (1).Here u is consider as(8X8X8X5) where first three 8 represents red, green and blue bins and the last 5 shows the threshold value. The following shows the whole tracking algorithm.

Input : The target model ˆq and its location y0 in the previous frame

i. Initialize the iteration.
ii. Find out the new center window value by adding increments.
iii. With the help of the new center value calculate the candidate model. Here we are using spatiogram.
iv. Find out the weight corresponding to each pixel in candidate window.
v. Calculate the new location of the target candidate model.
vi. After each new window calculation increment the iteration number and check whether it is equal to the maximum number of frames.
vii. If the iteration is not equal to max. no load the next frame and repeat the steps. Otherwise save and display the tracking result and reinitialize all the values including spatiogram

4. Experimental Result

The experiment for tracking is with a video sequence of table tennis playing. This video file contains 58 frames. The tracking target is the moving head. The target is initialized as a rectangular path. The following figure show the experimental result of tracking. Frames 1,20,40 and 58 frames are displayed

Fig 2 Tracking results of sequence "table tennis playing". Frames 1, 20, 40 and 58 are displayed

5. Conclusion

. The model proposed in this paper is based on the new concept called spatiogram which is a powerful tool in comparison with our traditional histogram method for target tracking. Here we propose a joint colour spatiogram and LBP texture that is based on a mean shift. This method is more powerful in the extraction of edges and corner. Experimental results indicate that the proposed method performs much better than the existing colour based method in the case of less iteration numbers. This method works well especially in tracking objects that have similar colour appearance to the background

6. References

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