Robust Visual Object Tracking Via Fast Gabor Approximation

K. Bhuvaneshwari, D. Akila, P. Rajesh

Abstract: ***Visual Object Tracking is the process of finding a moving object (or multiple objects) over time using a camera. It has a variety of uses, some of which are: human-computer interaction, security and surveillance, video communication and compression, traffic control. Video tracking can be a time consuming process due to the huge amount of data in video.The main aim of object tracking is to estimate the states of the target in image sequences.Visual object tracking is challenging due to image variations caused by various factors, such as object deformation, scalechange, illumination change and occlusion.To overcome these challenges, windowing technique is applied in the proposed work.It is used to remove the noise in the image and gives the exact image.Experimental results are done for various sequences in the video and it is analysed the windowing technique is robust to partial occlusions and variations of illumination and pose, resistent to nearby distracters.Also,it performs favorably against several state-of-the-art algorithms.***

I. INTRODUCTION

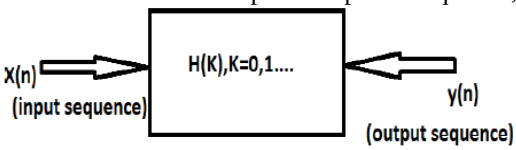
Image processing is a strategy for dividing some helpful data by changing over picture into digital format by applying few operations.For example, vehicle route and video reconnaissance are the challenging tasks in tracking and object recognition.Toworks in powerful condition in various occasions Video surveillance is one of method, like traffic management sports and open security. This paper audits the different difficulties in following the object.

The image sequence analysis plays an main role in following a dynamic item.To track an object,there are numerous issues like,survelliance, gesture recognition, collision avoidance, survelliance,gesture recognition tracking. The object of intrigue recognized and requirement is to track its situation over the series of pictures in many tracking functions. . By identifying few characterstic in every frames, the tracking object can be easily designed. In numerous logical and business applications, it is normally important to foresee what an object may do faster rather than later.The challenges in tracking an object are listed below,

- Camera movement Tracking
- Object-to-protest and protest scene occlusions.
- Non inflexible object format.

In the field of computation,object tracking plays an significant function such as close observation, artificial robots, intelligent transport and human computer interaction. The quick growth in artificial intelligence and in computation have noticed robust object tracking system drawing attention in industries and academics, at an reasonable rate and best solution.The robustness and accuracy are the major progress in the field of object tracking.The following factors are the difficulties in tracking such as abrupt motions, illuminationvariation, distracters, background clutter, rotations and occlusions.To represent an object in tracking, simplified biologically inspired features is utilised.To differentiate the targets in a fram, appearance model is utilised. In this paper object tracking is used to track an object in an video. For instance, if the video is of 10seconds or 1minute, it runs in the form of set of frames. It compares the object moving in the first frame and the 10^{th} frame so that the tracker can easily follow the object. It is mostly used in surveillance. Its tedious to track an single object in an crowd this process makes sure to track the object easily. First the feature is selected and then selected feature is encoded, the feature is represented.Then the tracker finds out the matching and predicts the result. Incase if there is any noise or disturbance in image fast gabor approximation is applied to remove it. Fast gabor approximation is an filters which is used to remove noises.one of the method is windowing technique which is derived from FIR filters.

The Finite Impulse Response (FIR) filters :It is represented in the form of impulse response sequence, h(k)



for FIR is

$$Y(n) = \sum_{k=0}^{n-1} \mathrm{h(K)x(n-k)}$$

In FIR filters, there is less possibility of error like coefficient quantization.

FIR filters have an exactly linear phase responses.

It is realized as an nonrecursively filter and that is always stable.

To design the FIR filter, there are various methods such as:

Windows methods ,Fourier method and Frequency sampling method.

TYPES OF WINDOWS FUNCTIONS

There are 5 types of window functions and they are Rectangular,Barlett,Hamming,Hanningand Blackman

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II. RELATED WORKS

Multi-object tracking, one of the complicated method in trackingaobject.Themultibobject tracking based on connected component model is difficult to extract the information from the nearby frames instead of group of frames.Retrieving the information directly from two or more frames becomes np-hard multi-dimensional assignment(MDA)problem.To resolve this MDA problem (CCM) connected component model is used.Data association problem is splitted into individual problem and relationship between the association based on the observations becomes hard.The CCM model acquires the optimum outcome instead of searching an tedious algorithm.The entire problem is just connected component, if its not splitted into individual problem then the video will be separated into many clippings.[1]

According to [jialong.etal] object tracking based on discrete graph with multiple experts is done by historical tracker and current tracker. The challenges in tracking drifts such as target deformations, heavy blockage and brightness changes.To overcome this challenges discrete graph optimization is discovered.To justify the effectiveness in the system three trackers are combined.And three methods are used in this framework for an valid results. They are SVM(support vector machine)algorithm,correlation filters and convulationalnueral network. The main aim of both trackers is to model the graph nodes by multiple experts.To illustrate the connectivity of multiple experts, graph points are represented in a semi-supervised manner. The recent frame of graph score can be calculated by the multiple experts based on the current achievements. The tracker drifts can be corrected and rectified.The 3 main trackers accomplishes the results fairly opposed to state-of-the-art methods.[2]

Object tracking based on surveillance, becomes more popular because of smart surveillance which is used in every places.To develop the visual object tracking in day today life there are two issues which stands as an obstacle. Speed and the brightness are the issues. To overcome this, correlation filter based tracker is proposed.For alternate patterns and disclosure, the tracker builds with an numerous positions.The discovered area is shuffled to calculate the target's speed of the optimum flow.The other pattern is saved in the outline with the pattern's restore method.The smart surveillance supports the unifying stage.Using divide and conquer method the tracker can also track many object by single object tracking algorithm.[17]

To evaluate the relationship among the cadiate targets and target model by the set of biologically inspired feature for representing an object.[min li etal] points out the difficulty of the visual tracking based on the appearance model.To reproduce the model distribution, SIR (sampling importance resampling) particle filter is used.The appearance model joined together as Bayesian state.Many observations are organized. The representation of an object based on set of biologically inspired feature is divided into four layers such as s1,s2,c1,c2 where c and s is comlex and simple cells.The another method is tracking based on particle filtering.The model assesses the likelihood of test perception having a place with the followed target.Theparticle filter based methods proves with the experimental results against state of the art .[3]

The major challenge for object tracking is the appearance change, can be overcome by appearance model which achieves both local representations and holistic templates.Themodel generated by sparsity based(SGM) and the model based on discriminative classifier(SDC) is used for robust object tracking.For (SDC module), the efficient technique is presented to define confidence value which adds the weight for the foreground instead of background.For (SGM)module,To handle occlusions the spatial data deals with histogram technique.

III. PROPOSED ALGORITHM

Windowing Technique

FIR filters uses few methods to design,in that one of the simple method is the windowing technique.When the digital signals are large that the dataset cannot be calculated easily for a whole.To avoid the issue, engineers mostly analyse small part from a whole data signals through a process called windowing.windowing is a simple and quick method to analyse the digital signal. Windowing technique selects the ideal frequency selective regionand eliminates its impulse response to get linear-phase. The main advantage of using linear phase is clarity.

A two-layer bio-inspired tracking model proposed for advanced learning combines the generative and discriminative model: the response of view-tuned learning is the model which is generated (S2) via convolution and a fully connected to neural network for task-turned learning (C2 units) as a discriminative model. BIT exploits fast Gabor approximation (FGA) to speed up feature extraction based on biologically inspiredfunctions(s1 and c1) and fast Fourier transform (S2 units and C2 units).

The BIM [2], [3] comprises of four layers of computational units: s1, c1, s2, and c2. We initially depict and after that survey agent augmentations of the BIM.

The computational units based on biological inspired model comprises of : s1,c1, s2 and c2. The tasks and restrictions related with these layers is expaineddetaily below.

The Features of Biological inspired model.

s1 Units: The cells in the primates visual cortex is straightforward and its compared with the s1 unit layer. To deliver the s1 layer,the first image is multiplied by various gaborfilters.The curved gaussian envelope is the result of particular gabor filter:

$$F(x,y) = \exp\left(-\frac{x_0^2 + \gamma^2 y_0^2}{2\sigma^2}\right) \times \cos\left(\frac{2\pi}{\lambda} x_0\right) \quad (1)$$

$$x_0 = x\cos\theta + y\sin\theta, \quad y_0 = -x\sin\theta + y\cos\theta \quad (2)$$

Gabor channels based on size is related with the scopes of X and Y.

C1 Units:

The cells in visual cortex is represented by c1 units. The c1 unit is produced by utilizing s1 units with various operations that controls the greatest reaction inneighbourhood units:

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$$r = \max_{i \in s} x_i$$

S1 unit is the result of *xi* in the neighbourhood units and c1 is the result of *r*.

s2 Units:

The s2 units represents the comparability among C1 units and models by means of convolution task. *conv* describes the means of convolution task

c2 Units:

The c2 is the worldwide highest results on gathering thes2 picture by areas and scope.

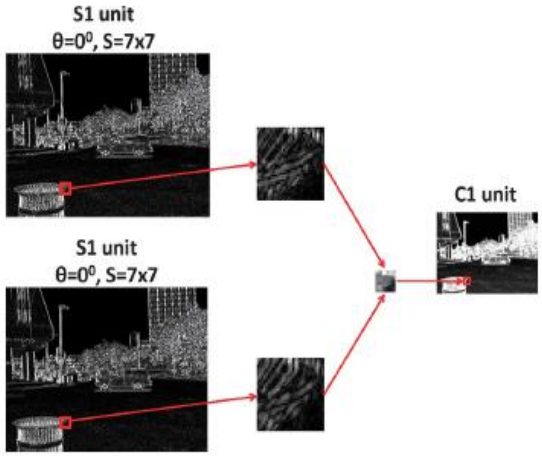

Fig. 1: Forinstance, Develpoing The c1 Unit From Two Neighboring s1 Units.

Fig. 1. Forinstance, develpoing the c1 unit from two neighboring s1 units. In c1 unit,every points has the highest purpose of two neighborhoodsthe comparing two s1 units.s and θ compares to the scale of Gabor channels.

IV. EXPERIMENTAL RESULTS

In this part, the experimental illustration of the proposed system i.egabor filter's windowing technique is used for tracking down the object in the video sequence. Gabor filter-the impulse of gabor filters is represented using sinusoidal wave which is multiplied by a Gaussian function or factor. Because of multiplication convolution property the fourier transform of a gabor filter's impulse response is the convolution of the fourier transform of the harmonic function and the Gaussianfunction.It has a real and imaginary component representing orthogonal directions.

Fig. 2: Representation of Object Tracking in A Video

The fig2 represents tracking an object in a video sequence. To track an object the coordinates for the window size is selected, to identify the object or region of interest.The comparison done between the object in the initial frame and object in upcoming frames.

Fig. 3: Representation of Tracking An Object in Multi-Object Frame.

This fig:3 represents tracking an object in a multi-objects frame, where the single object is alone selected.The left corner black screen is the object model where the tracked object is displayed.In fig2, there is no obstacle beside the object thet is being tracked but in fig:3 there are too many disturbances besides the object being tracked.

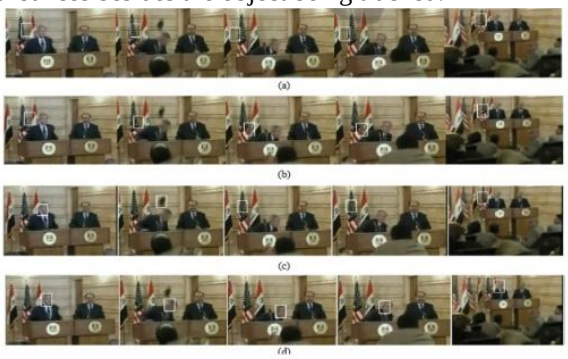

Fig. 4: Representation of Tracking Results of The Target Models Based on Shoe_attaque

The video sequence is of 115 frames and the resolution is 360×480. The region tracked in this video is 42×28.There are four target representations M1,M2,M3,M4 in this frame and their accuracies are compared based on target.Since no movement show is influenced in the model and in spite of change the abatement and increment in picture, the tracker adjusted enormously to the non-stationary character of the head's developments which interchanges suddenly with its quick response. The gabor filter proves to be robust to occlusion and clutter.

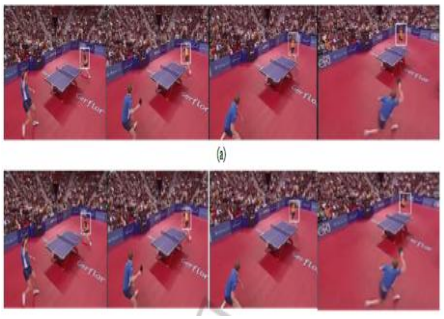

Fig. 5: The Target Representation Models Based on Table Tennis Sequence.

The targets illustrated in fig5 defines the tracking results based on gabor filters. since the starting frame of target area includes most of the background. Because of variations in camera motion there is an slight changes in the frame10 by the located target.To store space, experimental results for first 4 frames only represented.There are many disturbance in the frames such as difficulty in selecting the region of area, brightness variations, occlusions and shape deformations.These challenges are overcome by the gabor filter.

Table 1: The number of mean shift iterations by two methods

Video sequence	Frames	Target Represen-tations	Mean shift iteration	
			Total number	Average number
Shoe_attack	115	M1	402	3.49
		M2	438	3.8
		M3	386	3,35
		M4	427	3,71
Sprint	173	M3	1039	9,03
		M4	869	7,55
Racing	155	M1	838	5,4
		M2	1278	8,24
		M3	1034	6,67
		M4	919	5,92
Tennis_table	44	M1*	195	4,43
		M2	183	4,15
		M3	202	4,59
		M4	181	4,11

* Since the target is lost after frame 44 for M1, we only use the first 44 frame in the calculation for M1.

The above given dataset is the tracking results for the video sequences under various categories.

V. CONCLUSION

In this paper, gabor filter is used to overcome the challenges such as brightening variations, camera movement, impediments, shape distortion and posture variety. So as to enhance the strength of target portrayal and lessen the computational cost, we proposed a gabor channel. Our proposed strategy utilize just a single target portrayal and limit the new protest and background changes in each edge. The framework manages diverse articles and settings and is vigorous to point of view changes,heavy impediment and posture variety.The tracked object will be displayed in the object model and the future work will be the addition of image enchancement technique.

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