Object Detection and Tracking using KLT Algorithm

M. Sushma Sri
Faculty in ECE,
Government Institute of Electronics

***Abstract*- Object detection and tracking is an important task and challenging in areas like video surveillance and vehicle navigation. Video surveillance is a technology which works in dynamic environment in various events such as sports, public safety, and management of traffic. Object tracking by Kanade Lucas Tomasi (KLT) algorithm that is used to track face based on trained features. In this paper reviews the various challenges and aspects of detection and tracking of objects.**

***Keywords*- Object Detection, Object Tracking, KLT algorithm.**

I. INTRODUCTION

In recent days, capturing images with high quality and good size is so easy because of rapid improvement in quality of capturing device with less costly but superior technology. Videos are a collection of sequential images with a constant time interval. So video can provide more information about our object when scenarios are changing with respect to time. Therefore, manually handling videos are quite impossible. So we need an automated devise to process these videos. In this paper one such attempt has been made to track objects in videos. Many algorithms and technology have been developed to automate monitoring the object in a video file. Object detection and tracking is a one of the challenging task in computer vision. In this field facial tracking is finding more growth of use in security and safety applications to detect various situations [2]. Mainly there are three basic steps in video analysis: Detection of objects of interest from moving objects, Tracking of that interested objects in consecutive frames, and Analysis of object tracks to understand their behaviour.

For past several years object detection and tracking have been introduced in which a simple and effective one technique is called Kanade Lucas Tomasi algorithm. This technique track the features of an object extracted from capture image or video. Basically video sequences provide more information than a still image. It is always a challenging task to track a target object in a live video. This algorithm is used for detecting scattered feature points which have enough texture for tracking the required points in a good standard [6]. Kanade-Lucas-Tomasi (KLT) algorithm is used here for tracking human faces continuously in a video frame. This method is accomplished by them finding the parameters that allow the reduction in dissimilarity measurements between feature points

II. OBJECT DETECTION

Object detection is simply about identifying and locating all known objects in a scene [3]. Object detection in videos involves verifying the presence of an object in image sequences and possibly locating it precisely for recognition [7]. Object tracking is to monitor an object's spatial and temporal changes during a video sequence, including its presence, position, size, shape, etc. This is done by solving the temporal correspondence problem, the problem of matching the target region in successive frames of a sequence of images taken at closely-spaced time intervals. These two processes are closely related because tracking usually starts with detecting objects, while detecting an object repeatedly in subsequent image sequence is often necessary to help and verify tracking as shown in "Fig.1."

III. OBJECT TRACKING

Object tracking is the problem of determining (estimating) the positions and other relevant information of moving objects in image sequences [3]. Object tracking is about locking onto a particular moving object(s) in real-time.

It includes:

- Motion detection: Often from a static camera. Common in surveillance systems. Often performed on the pixel level.
- Object localization: Focuses attention to a region of interest in the image. Data reduction. Often only interest points found which are used later to solve the correspondence problem.
- Motion segmentation: Images are segmented into region corresponding to different moving objects.
- Object tracking: A sparse set of features is often tracked.

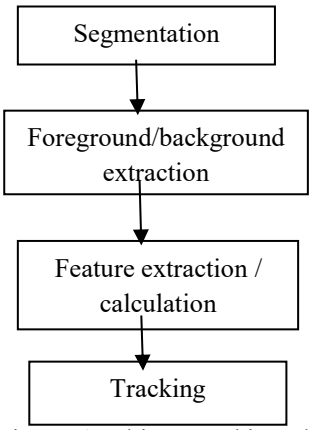

Figure. 1: Object Tracking Flowchart

IV. PROPOSED METHOD

In this we develop a simple face tracking system by dividing the tracking problem into three parts:

- First detect a face from a input image.
- Identify facial features from image to track
- Track the complete face

V. KLT ALGORITHM

This algorithm is used in feature extraction and feature tracking. In order to avoid having to track all pixels in the resulting image and within a given foreground object, a variety of techniques for tracking objects based only on a limited set of feature points have been proposed in this literature. Out of these techniques Kanade-LucasTomasi (KLT) method has been chosen as a basis/benchmark for many algorithms proposed in previous literature [11]. In this work, the authors use the first part of the KLT (selecting trackable features) and subsequently track the whole set of features together instead of tracking each feature separately.

This algorithm is used for tracking human faces from a captured video frame. Firstly we calculate the displacement of tracked points from one frame to another frame. This displacement calculation is easy to compute the movement of head then the feature points of a human face is tracked. This is due to its simplicity and limited assumptions made about the underlying image/ video as shown in "Fig.2".

KLT Feature Tracking

The KLT tracks an object in two steps; it locates the trackable features in the initial frame, and then tracks each one of the detected features in the rest of the frames by means of its displacement. The displacement of the specific feature is then defined as the displacement that minimizes the sum of differences. This is done continuously between sequential images so that all the features can be tracked.

Tracking features

The fundamentals of tracking can be explained by looking at two images in an image sequence. Let us assume that the first image was captured at time t and the second image at time $t + \tau$. It is important to keep in mind that the incremental time τ depends on the frame rate (capture rate) of the video camera and should be as small as possible. A higher frame rate allows for better tracking. A greyscale image is a pattern of intensities where the intensity values range from 0 to 255.An image can be represented as function of variables x and y. We add the variable t as the time the image was captured. Thus, any section of an image can be defined by an intensity function $I(x, y, t+\tau)$. If we now define a window in an image taken at time $t+\tau$ as $I(x, y, t+\tau)$.

The basic assumption of the KLT tracking algorithm is

$$I(x, y, t+\tau) = I(x - x, y - y, t) \quad (1)$$

From (1) it is clear that every point in the second window can by obtained by shifting every point in the first window by an amount (x, y). This amount can be defined as the displacement d = (x, y) and the main goal of tracking is to calculate d.

Calculating feature displacement:

The basic information has now been established to solve the displacement d of a feature from one window to the next. For simplicity, we redefine the second window as $B(x) = I(x,y,t+\tau)$ and the first window as $A(x - d) = I(x - d) = I(x-x, y-y,t)$ where x = (x,y).

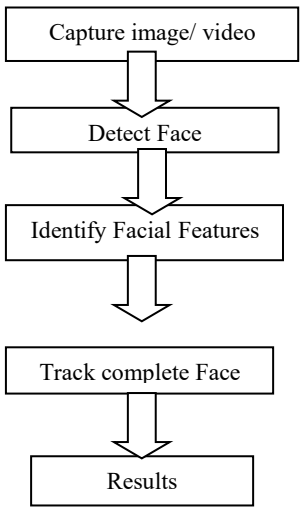

Figure. 2: KLT Algorithm Flowchart

VI. RESULTS & DISCUSSIONS

In this paper the capture video is taken and firstly the object is tracked from the video which is shown in "Fig.3". Next the identifying the one of the features from the object i.e., here we use facial features as shown in "Fig.4". And then by using KLT algorithm we track complete face in the video as shown in "Fig.5". We found that the proposed method which gives simple fast and efficient results.

Figure.3: detected face

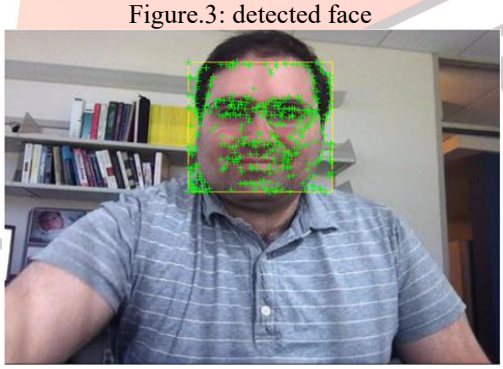

Figure.4: detected features

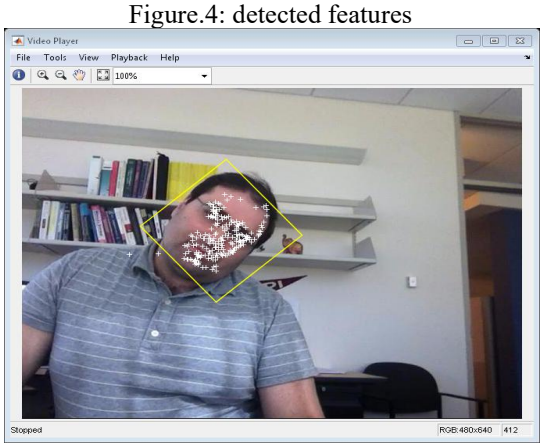

Figure.5: Track the face

VII. APPLICATIONS

Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and image database management. Some recent digital cameras use face detection for autofocus.

VIII. CONCLUSION

Tracking of a face in a video sequence is done using KLT algorithm used for detecting facial features. Not only in video sequences, has it also been tested on live video using a webcam. Using this system many security and surveillance systems can be developed and required object can be traced down easily. In the coming days these algorithms can be used to detect a particular object rather than faces.

REFERENCES

[1] DorinComaniciu and Visvanathan Ramesh, Robust Detection and Tracking of Human Faces with an Active Camera. IEEE Visual Surveillance,2011.
[2] Dmitry Mikhaylov, Anton Samoylov, Peter Minin and Alexey Egorov, Face Detection and Tracking from Image and Statistics Gathering. IEEE Conference on Signal-Image Technology and Internet-Based Systems,2014.
[3] Face Detection and Tracking from Image and Statistics Gathering. IEEE Conference on Signal-Image Technology and Internet-Based Systems-2015.
[4] Face tracking for expressions simulations. International Conference on Computer Systems and Technologies-2003.
[5] Float Boost learning and statistical face detection", IEEE Trans. On Pattern Analysis and Machine Intelligence. Vol. 26, No. 9, pp. 1112-1123-2004.
[6] Face Detection Methods and Algorithms, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 www.ijert.org Vol. 2 Issue 6, June – 2013.
[7] Nandita Sethi and Alankrita Agarwal, Robust Face Detection and Tracking Using Pyramidal Lucas Kanade Tracker Algorithm. IJCTA, vol. 2, 2011.
[8] Ragini Choudhury Verma, Cordelia Schmid and Krystian Mikolajczyk. 2013. Face Detection and Tracking in a Video by Propagating Detection Probabilities. IEEE Transactions on Pattern Analysis and Machine Intelligence. 25(10).
[9] Mamata S. KalaS,Real Time Face Detection and Tracking Using OPENCV. International Journal of Soft Computing and Artificial Intelligence, 2014.
[10]. Robust Detection and Tracking of Human Faces with an Active Camera. IEEE Visual Surveillance.-2011.
[11] Robust Face Detection and Tracking Using Pyramidal Lucas Kanade Tracker Algorithm. IJCTA, vol. 2-2011.