

Human Face Detection and Tracking using Skin Color Combined with Optical Flow Based Segmentation

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Abstract

The present paper deals with face detection using the skin color combined with optical flow and spatio-temporal segmentation. Some case studies have been carried out on a set of video sequences of several facial expressions. It has been concluded that the proposed method based on 'spatio-temporal segmentation & KLT method' performs better in comparison to existing method based on 'Viola Jones & KLT method'.

Keywords: Face Detection and Tracking, Skin color, Optical Flow, Spatio-temporal Segmentation, KLT tracker

I. INTRODUCTION

Face detection is demanding task in the computer vision applications. Face detection method is use to detect the images in the video frames [1]. The main aim of the face detector is to estimate the position of the folks. Those positions estimates are used by the face detector to trim the search space of probable face locations This task relies on the number of corresponding feature points over frames between detected objects. When tracker finds the path of target object then tracker segmenting the interested region like as expression, pose of folks, directions and positions [2].

II. RELATED WORK

Gupta and Tiwari [1] proposed modified Viola Jones algorithm for face detection in the images to detect the unlike portions of the face. Khan et al [2] implemented the enhanced hybrid method for efficient eyes and mouth detection using combination of skin color pixel detection and Viola Jones method. Sukare [3] implemented Viola Jones algorithm for frontal human face detection and was able to recognize the frontal human face clearly. Najdawai et al. [4] used Kalman algorithm to find optimal features and detect shadow for human face. Panchal et al [5] implemented face detection and tracking algorithm using pyramidal Lucas Kanade Tracker algorithm. Agarwal and Khatri [6] implemented Viola Jones algorithm to detect the face in the video frames.

III. METHODOLOGY

Viola Jones Algorithm for Face Detection

Face detection method have many evils pertaining to light, pose, facial expression and quality of image. Viola and Jones introduced real-time face detection system contains three techniques for face detection in video: Haar like feature selection, Adaboost algorithm and Cascade classifier. Viola-Jones method establish out the positions of the human faces in video sequences. Using this method, face in the image is found out after deciding its location. Next, dissimilar sized windows are shifted in the entire image. The windows that are shifted over the whole image depend upon size of the image and scaling factor. A positive result from the first classifier triggers the estimate of a second classifier that has been used to attain good detection rates. A positive result from the second classifier triggers a third classifier, and so on. A negative result at any point leads to the instantaneous refusal of the sub-window.

Kanade-Lucas-Tomasi (KLT) Algorithm

The KLT tracker has been used to track the points of interest in video frames. The face track is formed by detecting the face in different video frames by sharing the large tracked points. The KLT algorithm detects the scattered set of feature points having sufficient texture for tracking them automatically [3]. It starts by capturing the video from the video sequence. Next, the features from the region of interest are extracted for detection of the face. Then current frame is tracked from the previous frame to detect the features of the face. The tracker is used to estimate the scale, rotation and translation between previous and new points.

Proposed Methodology

The methodology based on the ‘spatio-temporal segmentation & KLT method’ for the proposed implementation used has been discussed in the following steps:

- 1) Acquire image from the video.
- 2) Apply skin color based segmentation.
- 3) Obtain face and hand as blobs.

- 4) Apply Spatial-Temporal Segmentation based on velocity of the blob.
- 5) Obtain the facial region.
- 6) Apply Eigen feature extractor
- 7) Use the feature for the tracking algorithm
- 8) Apply KLT tracking algorithm and track the face.
- 9) Repeat steps 1-8 for each frame in the vide

IV. RESULTS

The code has been implemented in MATLAB R2010a. The software application with 320x240 frame size has been tested on the videos. Face detection process works once every 20 frames. The calculation official feature for face recognition takes 44ms per frame. For tracking purpose, minimum Eigen values are considered as feature points. Dynamic face modeling has been called once every seven frames. In dynamic collection, each subject has almost five clusters and each one contain maximum 20 samples.

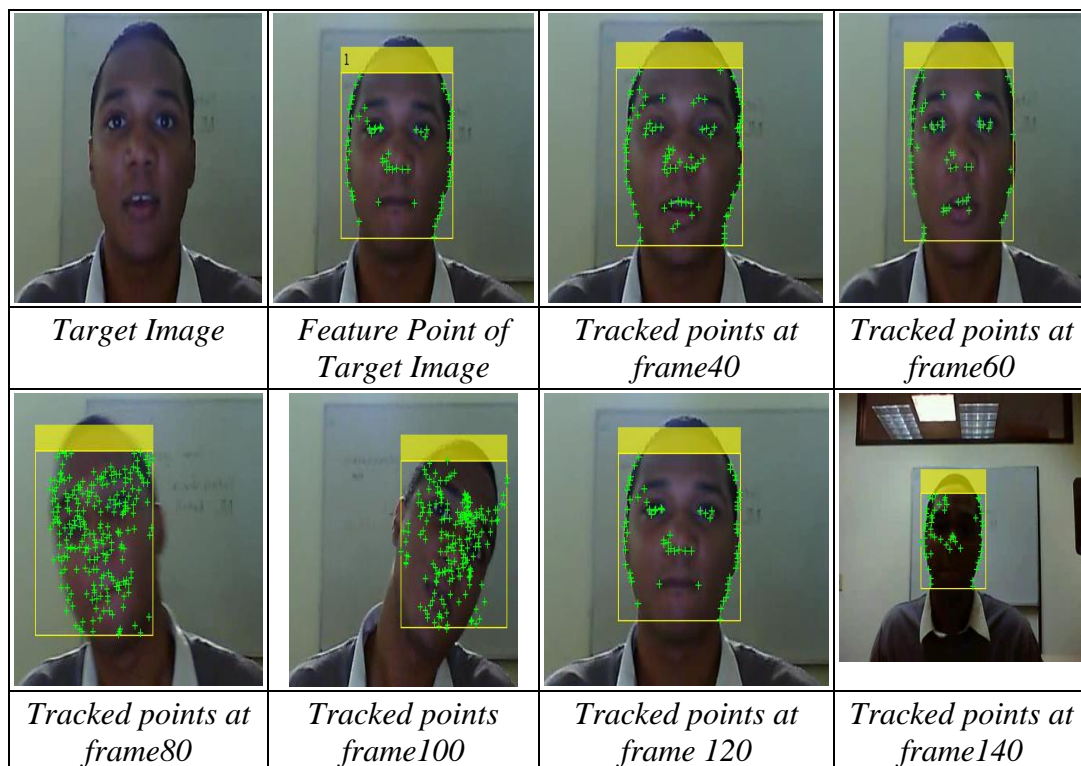


Figure 1: Significant tracked points using proposed method

Figure 1 shows the facial feature tracking at different frames in video sequence using spatio-temporal segmentation and KLT method. The “+” symbol represent the tracked Eigen feature at every face image. The face can be easily distinguished in the exact feature selection, from the figure 1, It can be concluded that the detection and prediction is closely related to face representation.

Table 1 shows the results of the implementation of the proposed method based on number of tracked points of the image of each frame in the video sequences.

Table 1: No of significant tracked point comparison

<i>S. No.</i>	<i>No of significant tracked points</i>		
	<i>Frame Number in video</i>	<i>Viola-Jones & KLT method (Existing Method)</i>	<i>Spatio-temporal Segmentation & KLT method (Proposed Method)</i>
1.	Frame20	60	63
2.	Frame40	58	60
3.	Frame60	55	61
4.	Frame80	232	240
5.	Frame100	197	200
6.	Frame120	162	200
7.	Frame140	43	50

Figure 2 shows the graphical results as detailed in table 1. It can be clearly observed from the figure 2 that proposed method performs better as compared to the existing method taken for study. It can also be observed that increase in the values of the significant tracked points leads to efficient recognition of the image.

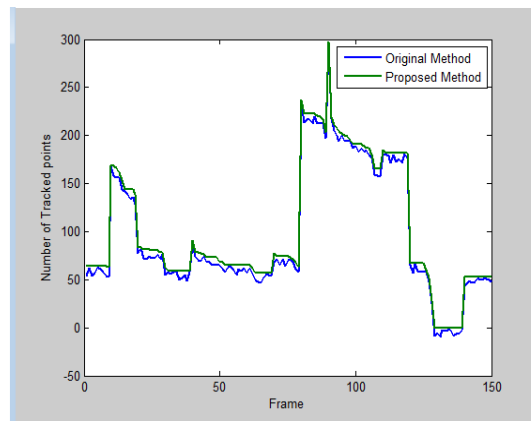


Figure 2: Comparison graph for both methods based on significant points tracked

V. CONCLUSION

In this paper, a facial identification and tracking system has been presented. A method based on using spatio-temporal Segmentation & KLT method has proposed and results have been compared and validated against well-known Viola Jones & KLT method. It has been concluded that the proposed method performs better in comparison to existing method for face detection in video frames.

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