

Implementation of Real-time Face Recognition System based on SURF Algorithm

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Abstract— Main objective of this paper is to represent an approach for recognized faces of human being based on SURF algorithm. This approach concerned with registering a set of human faces to a face database, matching stored faces against real time faces . Matlab programming is implemented for this approach. KLT algorithm is used for detect faces as well as create face database. Surf algorithm is implemented for recognize detected faces.

Keywords- KLT Algorithm, Surf Algorithm, Face Detection, Face Recognition

I. INTRODUCTION

Human face detection and recognition is a major topic for modern day researchers. It is very important in many computer fields like criminal identification, access and security, E- banking, Online shopping site, Net banking etc. Real time face detection and recognition is not a simple problem. Many approaches [1] have been already implemented like template matching, neural network, MRC etc., Different algorithm have been used over the past few years. These algorithms have own some disadvantages. The techniques used in our paper are the most effective among those. The algorithms applied in this paper for face detecting and tracking is KLT algorithm and SURF algorithm is applied for calculating matching percentage of different features points for recognition process.

A. KLT algorithm:

KLT algorithm was proposed by Tomasi-Kandc and Lucas in 1982[2].It is most popular method for feature tracking in computer vision.KLT algorithm is used for detecting facial features points for tracking the required points.[3].

In my research work I use KLT algorithm for detecting and tracking faces of bank customers at the time of registration and login process in a continuously running video frame using a real time web camera.

The basic idea of KLT algorithm can be fall into three assumptions [4].

Brightness consistency: A pixel of an object in an image does not change in appearance from frame to frame when moving. So we can say that a gray scale image, brightness of any object does not change when tracking frame to frame.

Small movement: Motion of an image of surface patch changes very slowly in time. In this point of view we

can observe the objects in an image do not move much from frame to frame.

Special coherent: Adjacent points or nearest points in a picture belongs to the same surface have similar motion and project to nearest points on the image plane.

B. SURF algorithm:

SURF can be used as local object detector and descriptor that can be used to extract the key points from both database images and test images for image registration and recognition purpose. H bay invents SURF descriptor in 2008 .It is a scale and in-plane invariant features. It has two stages .One is interest point detector and other is interest point descriptor. SURF features are invariant of shifting rotation and scaling and partially invariant to illumination and affine transformation. Hessian blob detector is used to detect the intersect point for computing three integer operations for a pre-computed integral image. As a descriptor SURF uses first order Haar wavelet in x,y co-ordinate .SURF uses 64 dimension to reduce the time cost for feature matching and computation.

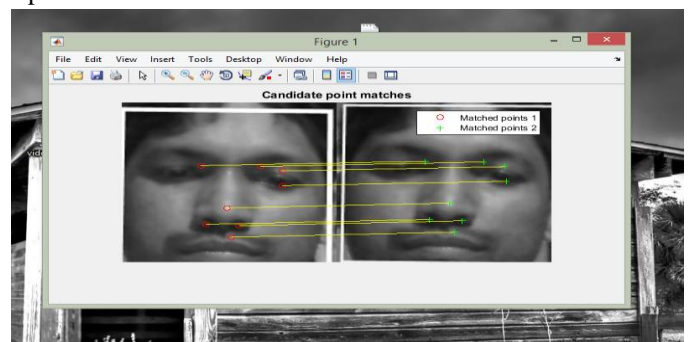


Fig 1 shows SURF Features

II. RELATED WORK

In 2015, Ekta Thaman, Ramanpreet Kour proposed an approach for a facial identification and tracking system for security purpose using spatio-temporal segmentation. Matlab technology used which allows immediate identification and strong detection of face in high- resolution videos. [9]

In 2015, Prof. Rushabh Shah ,Aalisha Sheth,Biyanta Shah,Ayushi Shah ,Dr. Priyanka Sharma proposed various types of techniques which are used to detect and track faces. Techniques they have used are KLT algorithm and CAM-Shift. They have used skin tone as a feature and converted the first frame to hue channel data and then detects the face in the rest of the video[10].

In 2015, Kapil, Anurag Singh have analysed two techniques cam shift and KLT algorithm and as per the visible results from the figures 1 and 2 we conclude that KLT algorithm is more accurate and advantageous than cam shift technique.[13]

In 2016, Ritesh Boda and M. Jasmine Pemeena Priyadarsini proposed two approaches for detecting and tracking human faces. They applied viola jones algorithm to detect faces and used KLT algorithm for tracking the face.[11].

In 2017, P.J Leo Evenss, Jennings Mcenroe .S, A.Prabhu Chakkaravarthy proposed an approach for face recognition using Viola jones and KLT algorithm.[12]

In 2015, Raajan.P,Muthuselvi.S,Agnes Saleema.A proposed an approach for preprocessing of images and compressing of filtered images with lossy and lossless compression is presented.Preprossesing is carried out with weiner filtering and compression of images with Harr segmentation[14]

In 2015, Prodip Biswas,Abu Sufian sarkar,Muhammed Mynuddin proposed an image processing method in Matlab environment. Then proved how an image can be effected by noise and how that noise is removed from image.[15]

III. METHODOLOGY

The overall system consists of two processes. One is training process and other is testing process. Training process is consists of following steps:

- Real time face capturing using webcam
- Detect faces
- Extract good features
- Track faces
- Store tracked faces to face database

Testing process consists of the following steps:

- Real time face capturing using webcam
- Detect faces
- Extract good features
- Track features

- Compare extracted features with features from face database.

A. Training process:

Real time Image capturing:

Image capturing is done by the use of webcam where user have to stand in front of camera .captured images are send to Matlab for detecting and tracking image .

Detect faces:

Faces which are captured from webcam are detected using viola jones algorithm using cascade object detector class. Here faces are cropped along with thier bounding boxes and pass to features extraction process.

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Extract good features:

After detecting faces KLT algorithm tracks a set of feature point across the video frames.

Track features:

Matlab uses vision.PointTracker System object to track various feature points. The point tracker find the corresponding point in the current frame. Then the estimateGeometricTransform function is used to estimate the translation, rotation, and scale between the old points and the new points. This transformation is applied to the bounding box around the face.

Track faces:

After detecting feature points matlab code tracks all points from frame to frame. estimateGeometricTransform function is used to calculate the motion of the face.

Store the tracked faces to database:

After tracking faces different faces are stored in to the database for further recognition process. In our project we store 10 various faces of a single person in to the database. imwrite function is used for storing faces to a image database.

Testing process:

Real time Image capturing:

Image capturing is done by the use of webcam where user have to stand in front of camera .captured images are send to matlab for detecting and tracking image features.

Detect faces:

Faces which are captured from webcam are detected using viola jones algorithm using cascade object detector class. Here faces are cropped along with thier bounding boxes and pass to features extraction process.

Extract good features:

After detecting faces KLT algorithm tracks a set of feature point across the video frames. Following are the matlab code for extract good features.

Track Features:

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Track faces:

After detecting feature points matlab code tracks all points from frame to frame. estimateGeometricTransform function is used to calculate the motion of the face.

Load database:

All faces from face database are loaded for access and results are used for Comparison.

Comparison of faces:

Test image is compared with images from the face database. Images with the closest features are matched. Comparison of various features of test images and trained image are done by SURF techniques. Faces are recognised from the matching result.

```

I1 = rgb2gray(I);
    %figure;
    %imshow(boxImage);
for j = 1 : length(srcFiles)
    %try
        filename =
strcat('face_database\',srcFiles(j).name);
        I2 = imread(filename);
        % I2 = rgb2gray(J);

        points1 =detectSURFFeatures(I1);
%strong1 = points1.selectStrongest(50);
        %imshow(I1); hold on;
        %plot(points1.selectStrongest(50));
        points2 = detectSURFFeatures(I2);
%strong2 = points2.selectStrongest(50);
    
```

```

%strong2 = points2.selectStrongest(50);
    %imshow(I2); hold on;
    %plot(points2.selectStrongest(50));
    [features1,valid_points1] =
extractFeatures(I1,points1);
    [features2,valid_points2] =
extractFeatures(I2,points2);
        indexPairs =
matchFeatures(features1,features2);
        matchedPoints1 =
valid_points1(indexPairs(:,1),:);
        matchedPoints2 =
valid_points2(indexPairs(:,2),:);
        figure; ax = axes;
showMatchedFeatures(I1,I2,matchedPoints1,match
edPoints2,'montage','Parent',ax);
    title(ax, 'Candidate point matches');
    legend(ax, 'Matched points 1','Matched points
2');

        numPairs = length(indexPairs);
        matching_perc=(numPairs/10)*100;
        if numPairs >= 7
            display('matches');
            display(matching_perc);
            %display(matchedPoints2);

            %display(indexPairs);
            %display(numPairs);
            %display(sz);
            display(numPairs );
            % display(matchedPoints2);

        imshow(filename, 'Parent', handles.axes1);
            % pause(10);

            url =
'http://localhost/EBanking_biometric/verify_se
cret_code.php?q=';
            base_url = strcat(url,filename);
            web(base_url , '-browser');
    
```

IV. SIMULATION AND RESULTS

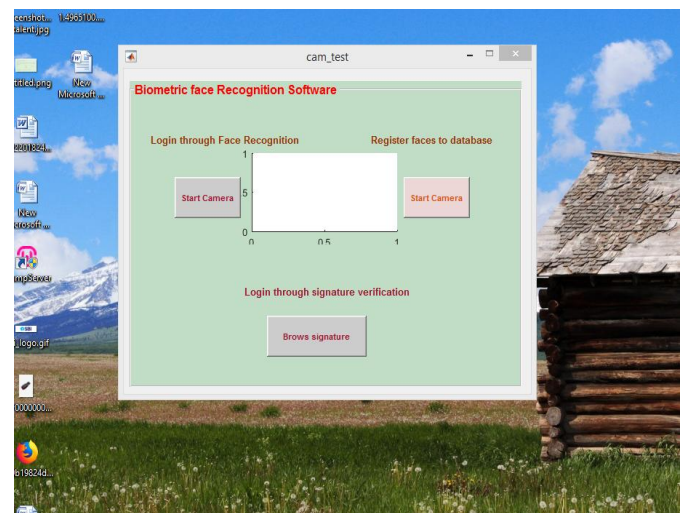


Fig1

Fig 1 shows graphical user interface of the project. Faces can be trained by register your face to database area. There is a start camera for open the webcam(Fig3) for training process where every person has to show their faces. There is another area login through face recognition. Start camera button is used for open webcam(Fig3) for recognition process.

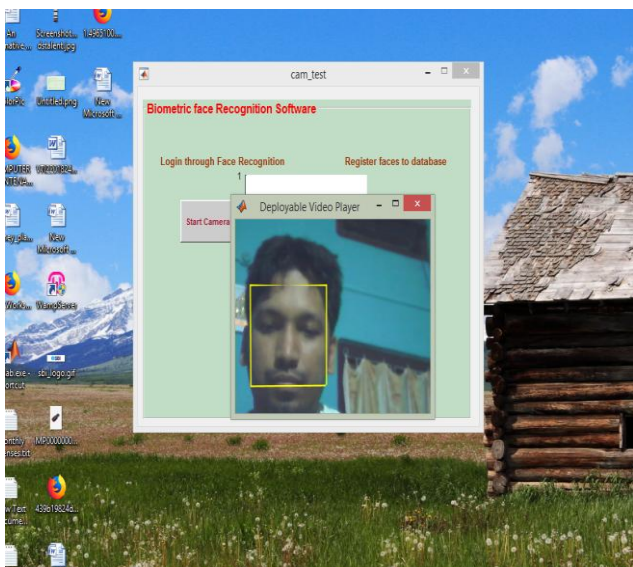


Fig2

Fig2 shows webcam with persons face in video frame.

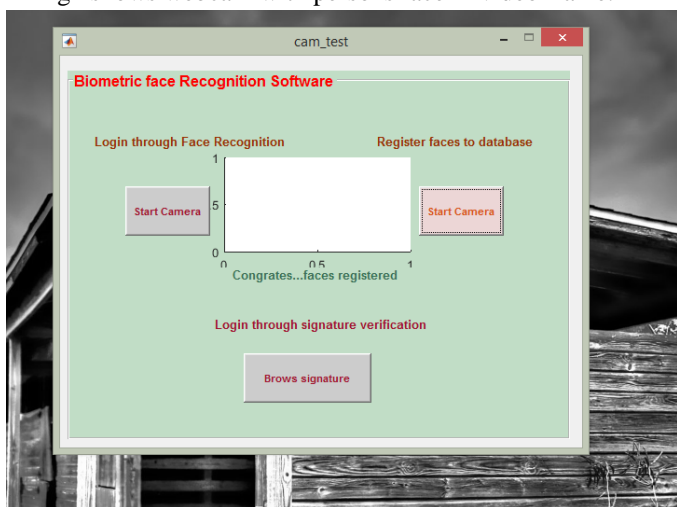


Fig3

Fig3 indicates trained faces are stored to database using webcam. A successful message will “Congrates....You are successfully registered” come after storing faces to database.

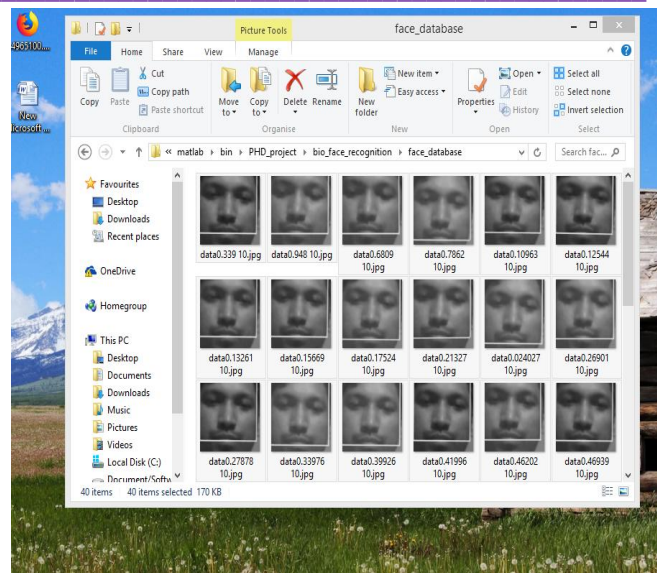


Fig4

Fig 4 shows trained images in database. All the images files of the database can be loaded for recognition process.

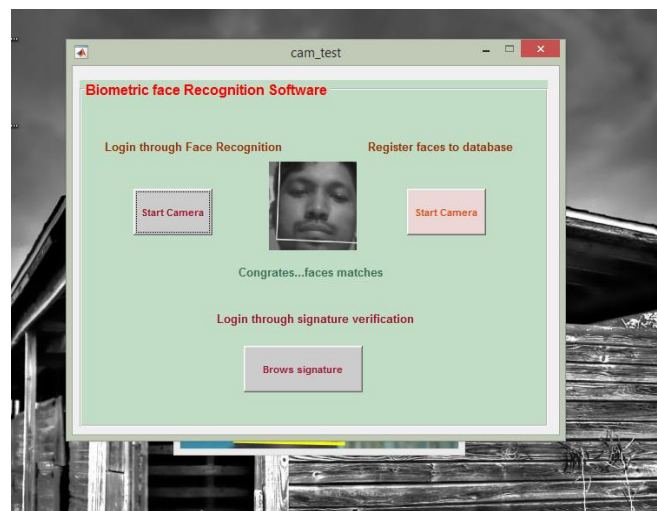


Fig5

Fig5 Shows the successful recognition message “congrates...face matches” if various features points of both trained and test images matched after taking real time test face of a person using webcam.

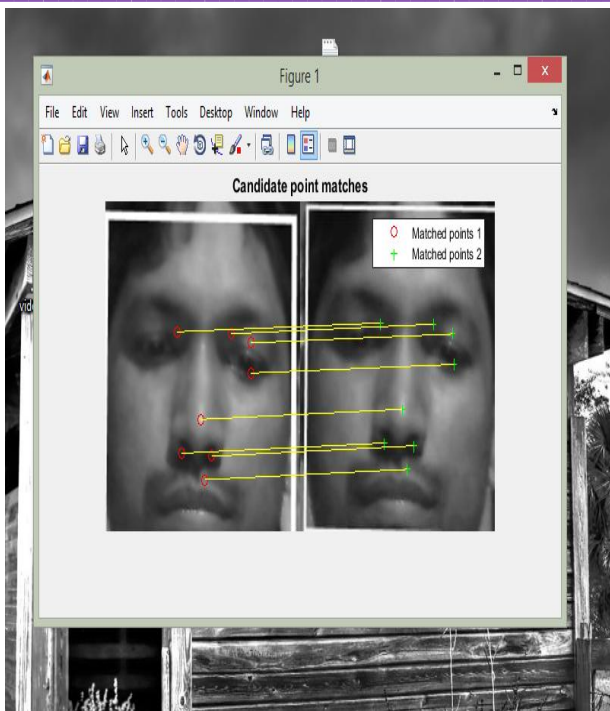


Fig6

Fig6 shows matched point between test image and stored image in the face database.

V. CONCLUSION

Our aim is to implement a face detection and recognition system using KLT algorithm and SURF algorithm. We used these two algorithms because both the algorithm finds the best alignment for each possible location in the search space and minimizes the overall mean square error in the process of inverse filtering and noise smoothing Frequency domain respectively. SURF algorithm is used to extract the features from face images for effective face recognition process. KLT algorithm is used for track and detect faces of a person. These are very powerful techniques and can be used in modern day security systems. This project can be extended in future for the fields like e-banking sector, Criminal investigation system, social networking site, national security system etc.

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