Samart Attendance System using Facial Recognition

Computer Vision Smester Project Using MATLAB

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***Abstract*— This report discusses the detail of smart attendance system by live image acquisition using web cam and then detecting the faces to match with the database by matching the extracted features of faces during live acquisition with the registered database to recognize the labels and show a message that attendance is marked. After this system store the registered name of the person in csv file to keep the record. This complete system of marking the attendance uses various concepts of computer vision for detecting the faces from whole image, extracting the facial features and then using descriptors to match with the features in the database for recognition purposes.**

Keywords—computer vision, facial detection, feature extraction, Live acquisition

I. INTRODUCTION

Attendance is marked in different way in different organizations for employees as well as for students in educational institutions. Some use traditional ways of marking attendance by calling the names of person and some use biometric system. But this pandemic restricts the use of biometric systems for marking attendance anymore. This requires advanced solution for automating the way of marking attendance to reduce the time as well as health risks. This report discusses the advanced and contactless solution of marking the attendance just by live image capturing.

In this way it reduces the time and avoid any kind of proxies marked by students or any other person in other organizations. It helps to monitor things in an easy and efficient way. This system first registered the images in the database along with the labels as name of the person and then use those registered images to match with the live images for marking attendance. It captures the images of person in such a way face is clearly visible in image and bounding box can be drawn up to given value of threshold. If image is validated and face is detected user is informed that image is captured and given option to add name.

After this different versions of captured image are created by applying different image enhancement techniques like histogram matching by converting into gray scale and then all these different versions are stored in the database for training purposes. Fast feature detection algorithm is used to detect features and then SURF is used to extract those features to create the bag of feature words. Then features from these bag of words are used to match with the features extracted from the live images. If these features are matched with any bag of feature words then user will be informed that attendance is marked and name will same in csv file indicating the presence status of particular person.

In this way this complete system works smartly and marks the attendance just by capturing correct image and validating it by matching with the image in the database.

II. LITERATURE REVIEW

A. Face detection and tracking using KLT and Viola Jones

This paper uses the kanade lucas tomasi (KLT) and viola jones algorithm for tracking the faces in video sequence and then detecting the faces for various purposes. It works to understand the movement of frames at different time intervals and detecting those frames to track and detect faces.

The flow chart used for tracking and detecting the faces in video sequence is given below

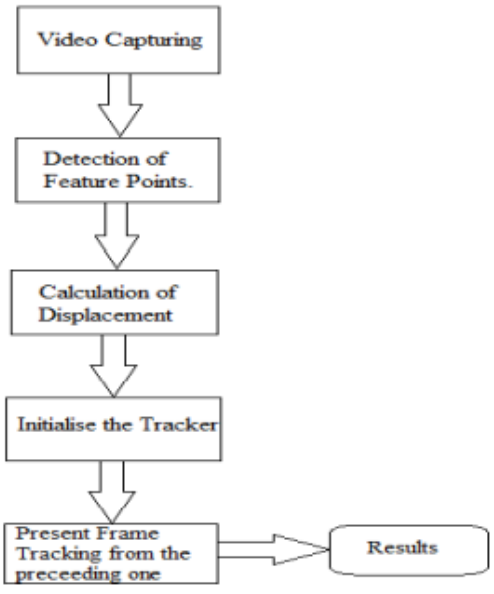


Figure 1: Flow chart for KLT algorithm [1]

And this algorithm update and predicts the movement of different frames like given below

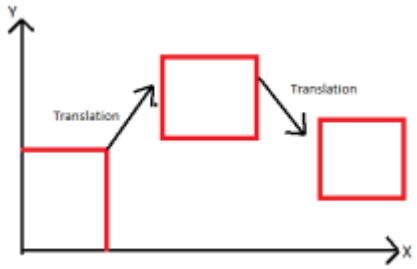


Figure 2: Translation of frames

This paper has reported the accuracy of 95 % for correct tracking and detecting the faces in given video sequence and they have claimed the testing of KLT algorithm under different environmental conditions. As in our system of marking the attendance requires live image acquisition which is like the video detecting face from the video sequence so we used this KLT algorithm for detecting the faces in live acquisition of images.

B. Feature Extraction Using SURF algorithm for object recognition

This paper used one of the most important and robust algorithm of feature detector used in applications of computer vision for detecting and extracting features of objects and recognizing the objects. This SURF algorithm is considered to be more robust and efficient than the other feature extractor algorithm and can work in different viewing angles as well as under different illumination.

In this paper first interest points are selected from the set of images in the database and local feature descriptor are constructed, then these features are extracted and matched with other features to detect and recognize the objects.

The flow of SURF algorithm that they have used for recognition purpose is given below

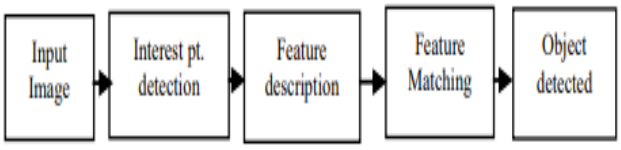


Figure 3: Flow of SURF algorithm [2]

Identify applicable funding agency here. If none, delete this text box.

Using this flow of SURF algorithm this paper has implemented the object detection and object recognition for given images.

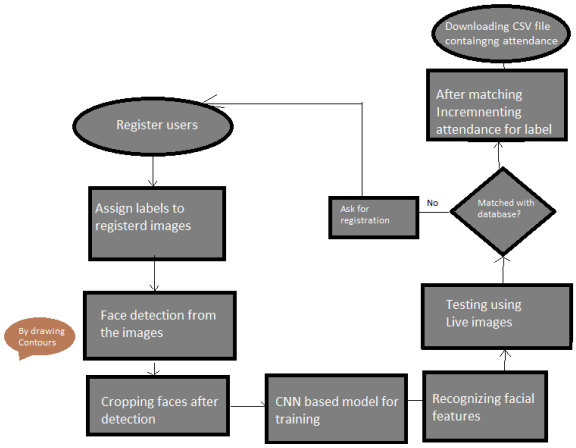
Apart from these, other papers have been reviewed for implementation of face detection and face recognition in the smart system of marking attendance using facial recognition.

Implementation of SIFT algorithm has also been reviewed in other papers but SURF algorithm is more robust and fit according to the given smart system of face recognition. So KLT algorithm is used for tracking and detection of faces and SURF is used for extracting the descriptors.

III. METHODOLOGY

System for marking the attendance the attendance using facial recognition is divided into two main parts i.e. Registering images in the database and capturing images for matching the features to perform facial recognition.

Flow Chart describing the methodology of the complete system is shown below



Firstly, user is provided an option to restart the system by removing all previous database or adding more users in existing database. If user selects to restart the system then all previous database along with previous attendance records will be removed from the directory and new users will be registered in the system. If user selects the option of registering more users then previous database will remain in the same directory and additional member will be registered.

Webcam is integrated with the MATLAB by installing external support package of Webcam in MATLAB. After successful integration of webcam, live acquisition of images is performed in MATLAB.

We need to track the face in the live image acquisition to detect the facial features and capture it by tracking the face. Different face detection and face tracking algorithms have been

tried to get robust and efficient results of smart attendance system. After experimenting with different algorithms and doing literature review, KLT algorithm have been found robust and more efficient compare to other algorithms for detecting and tracking the faces in live acquisition or videos. **KLT** (Kanade-Lucas-Tomashi) algorithm is the improved version of viola jones detector algorithm.

This KLT algorithm firstly calculates the displacements of frames from each other and then this displacement is used to track the object. KLT algorithm uses herris detector to detect the corner points of frames and then continues to predict the motion by using the movement of pixels in the images. For initial point (a,b) next points are determined and predicted by the following equations

a1 = a+ c1 and b1= b+c2

where c1 and c2 points are determined by the algorithm. In this way points estimation are performed to get updated values of next points.

Using herris point detector, value of displacement is updated in each case with the help of herris matrix. Following equation is used for estimation.

$$I(W([x,y];P+\Delta P)) \approx I(W([x,y];P)) + \nabla I \frac{\partial W}{\partial P}\Delta P \quad [4]$$

Where p represent the displacement and delta p represent the difference of displacement p.

After tracking and detecting the faces from live images, bounding boxes are drawn on the face to show that face has been successfully detected. Image pixels inside the bounding box are extracted and new image is formed containing only face of the user.

This image of the face is first converted into grayscale and different image enhancement techniques are applied to create different versions of the image containing the face of same person. These image enhancement techniques include rotation of image at different angles, histogram equalization, scaling of images and image contrasting.

These enhancement techniques are just used to create different versions of same image for storing in the database and getting improved results in feature matching.

After generating different versions of the same image, each version is stacked onto one another and built in fast features detector algorithm is used to detect features from different versions of the image and **SURF** detector is used to extract those detected features. These extracted features are then used to generate bag of feature words for each registered user with the label as name of the person.

SURF is more robust and efficient algorithm for dealing with feature detection and feature extraction. This algorithm uses hessian detector to get interest point. It has more powerful and useful attributes like scale invariance, translation invariance, rotation invariance and contrast invariance.

This algorithm consists of following four main steps

1. Construction of Integral Image
2. Hessian Detector for detecting interest point
3. Descriptor Orientation
4. Descriptor generation

Integral image is generated in the using the following equations where I shows the pixel values of images.

$$I\Sigma(x,y) = \bar{\Sigma}_{i=0}^{x}\Sigma_{j=0}^{y} I(\mathrm{i},\mathrm{j}) \quad [2]$$

After this bag of feature words are used to perform classification for marking attendance. For performing recognition of images, again webcam is used to perform live acquisition and after detecting face features are extracted from the image and matched with bag of features words placed in the database directory.

If features are matched with any bag of features words inside the database the bounding box is drawn along with the label name showing that attendance of this person is marked. Meanwhile the name of this label is stored in the csv file along with the present status.

CSV file is newly converted if there is no any previous attendance record and append the values of recognized person in csv file if it is already present in the directory. In this way, attendance of the person is marked just by capturing the clear picture and matching with the registered database without any direct contact like biometric system.

So this whole system works smartly using techniques of computer vision to mark the attendance and can register any number of persons in the database.

IV. Results

Various pictures have tried and training is performed to get improved results. Given system can recognize either one or more pictures in the video frame. Firstly, faces are tracked and detected from the live images. Results of three person's named as Fajar, Assad and momina are shown from the initial registration step to final recognition.

Following figures shows the initial face detection and tracking by drawing bounding boxes are shown below

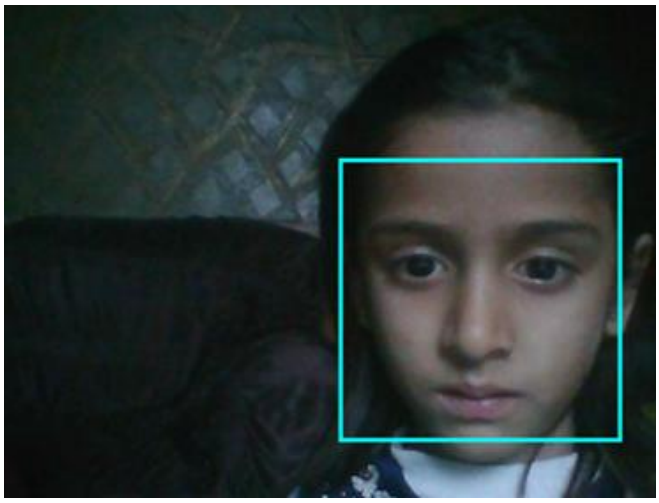


Figure 4: Detected face of Fajar

Figure 5: Detected face of Momina

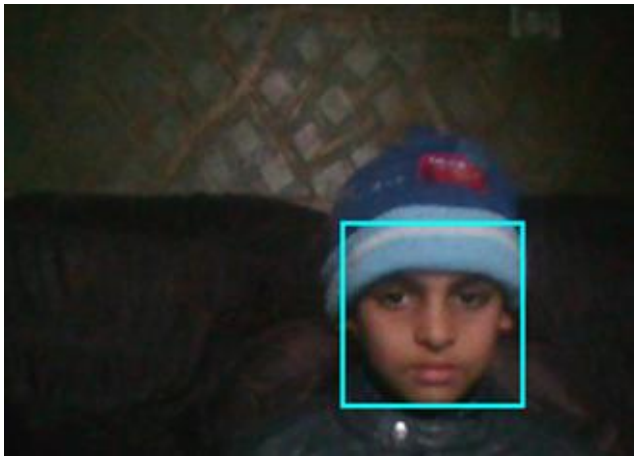


Figure 6: Detected face of Assad

After detecting the faces it asks the user to add labels for each detected face like in the figure given below

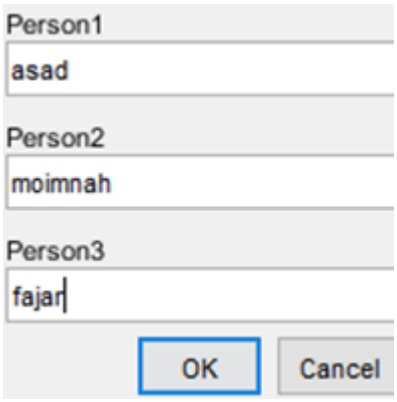


Figure 7: Adding labels of registered users

After this it crops the images containing region inside bounding boxes and create different versions using different image enhancement techniques as given below

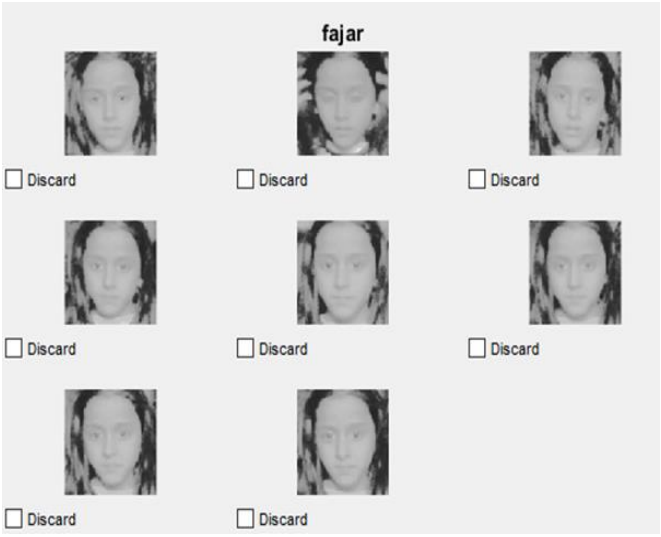


Figure 8: Different versions of face cropped from Fajar's Image

Figure 9: Different versions of face cropped from Asad's Image

In this way, for all the registered images such versions are created and used for training purposes. Features are extracted from these versions of images and these features are used for generating bag of feature words to be used for recognition purposes by matching features.

After this when person selects for marking the attendance then bounding boxes are drawn with the name mentioned along with the presence attendance to show that attendance of person is marked

Figure 10: Recognition of Fajar

Figure 11: Recognition of Assad

Figure 12: Recognition of Mominah

If more than one objects come in the image then this model can recognize more than one object in the image and can recognize them for marking attendance.

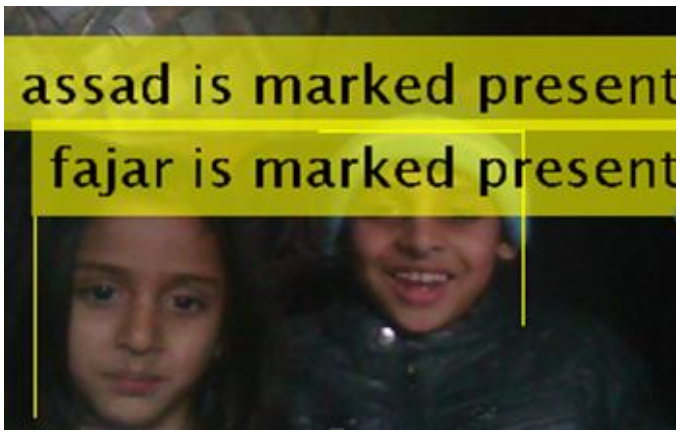


Figure 13: Recognition of Two Faces

After recognition of faces, label is saved in the csv file for maintaining the attendance record of registered persons. It save the attendance like given in the figure

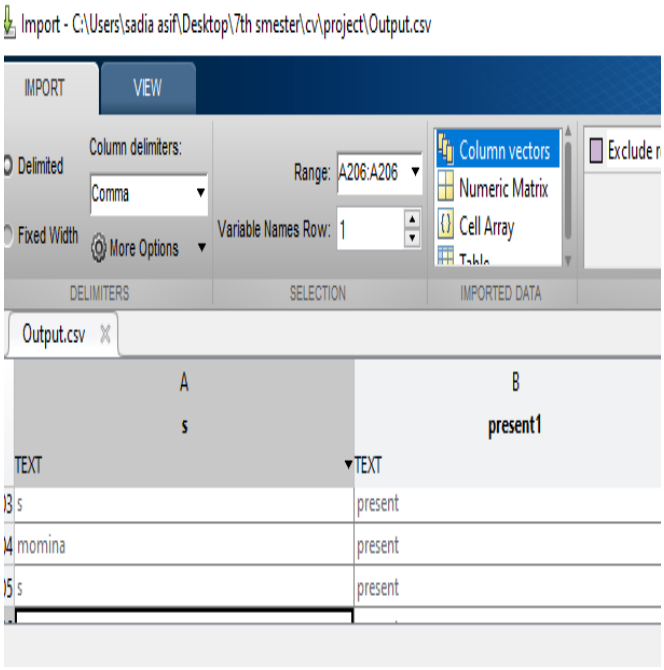


FIGURE 14: ATTTENDANCE SHEET

V. DISCUSSION AND CONCLUSION

Computer Vision plays an important role in developing many advanced technologies and useful applications in real world. Various useful techniques of computer vision exist for developing innovative and useful applications.

As in given case two major techniques of computer vision named as facial detection and facial recognition are used to develop completely automated system of smart attendance. These automated systems can be used in various organizations to save the time and cost as compared to traditional or biometric systems.

This system can be further improved to detect more faces and making the algorithms more robust so that it can learn more by training with diverse algorithms. Also it can be improved in terms of accuracy of models and attendance sheet can be made more advanced to make it more automated by improving the user interface.

Conclusively, this project provides more insight into concepts of computer vision. This system increases the security and time efficiency of the real time applications for marking the attendance of any number of registered users.

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[4] http://www.cse.psu.edu/~rtc12/CSE598G/LKintroContinued_6pp.pdf