Literature Survey - Improved Intuitive Automated Attendance System Using Unorthodox Algorithms

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***Abstract* —** Face recognition is a difficult task in video and does not give accuracy. Whether a person is a male or female is an easy task for a human to recognize but it is very difficult for a machine or robot to identify. Gender identification using the voice of a person is comparatively easier than that from facial images. This is a binary classification which is useful in many applications such as targeted advertising, surveillance system, human-machine interaction, content-based indexing, and searching, demographic collection, bio-metrics etc.

Different methods are proposed by the researcher to detect the face with varying accuracy. None of the systems can give 100% accuracy in face detection. We are giving a brief survey of the techniques used for detection of the faces.

***Keywords* —** *Face Recognition, Images, Haar-feature classifier, Support Vector Machines, attendance*

I. INTRODUCTION

Computer vision methods are used in numerous areas like traffic control, event monitoring, marketing, health care field, quality control, military technology, etc. Face identification is extensively used in a lot of applications such as system security and door control system. Face recognition has accentuated researchers in the fields of security, image processing and computer vision. Face detection has also proven helpful in multimedia information processing areas. One of the areas under computer visualization is automatic student identification for attendance marking.

Authentication is an issue in computer-based communication. The use of face recognition is evidently seen in applications such as system security and home automation door control system. This system has been implemented by taking student's attendance using face recognition.

The manual work of the person identification and marking the attendance is quite complicated and time-consuming task. The chances of the attendance proxies are more in manual attendance system. Manual Attendance maintaining is difficult to process, especially for a large group of students. Some automated systems developed to overcome these difficulties have drawbacks like cost, fake attendance, accuracy, etc. So, there is the need to implementing an easy attendance system which avoids all the above problems, by recognizing and identifying the face. The system will provide the facial features that are extracted from the face images for the classification of person.

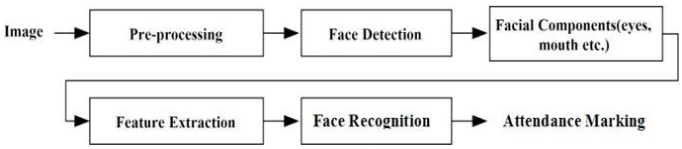

Fig. 1: Basic flow of attendance marking

Here we are taking live images and then processing it in real time to produce result set for automatic student's attendance marking system. Recognition is a process performed by humans or computers, which consist of:

1. Locating faces in the images; also known as face detection.
2. Facial feature extraction from the detected face region.
3. Examining the movement of facial features and the changes in the appearance of facial features.
4. Classifying this information for detecting the face of particular students.

II. LITERATURE SURVEY

Age estimation is active topics today due to the growing necessity of understand requirements or preferences in

different aspects of the daily life of a person. The proposed system [1] can extract and use dynamic features for age estimation with the help of a person's smile. Since the smile is one of the easiest emotional facial expression to pose voluntarily. In addition, the novel hierarchical age estimation architecture based on adaptive age grouping including an exploration of spontaneous versus posed smile dynamics, and gender-specific age estimation which gives the error reduction up to 21 in appearance-based age estimation.

The paper proposes the approach of predicting face attributes using CNNs [2] trained for face recognition. Combining with conventional face localization techniques we get the CNN with off-the-shelf architectures and publicly available models like Google's FaceNet with the conventional pipeline to study the prediction power of different representations from the trained CNN. The face descriptors mentioned; are constructed from various levels of the CNN for different attributes to best facilitate face attribute prediction. By properly leveraging these off-the- shelf CNN representations, we achieved accurate attribute prediction with current state-of-the-art performance using the two datasets LFWA and CelebA.

The paper gives [3] the facial attribute classification using a multi-task learning approach is given. The shared feature representation is used for multiple attribute classification. An iterative learning approach consisting of a bottom-up/top-down pass is used to learn the shared representation. Restricted Boltzmann Machine (RBM) based model, enhanced with a factored multi-task component to become Multi-Task Restricted Boltzmann Machine (MT-RBM) model is used for shared feature representation. The Celebrity Faces (CelebA), the Multi-task Facial Landmarks (MTFL), and the ChaLearn challenge dataset are used to give the performance of the given system.

The paper [4] gives the recurrent attention convolutional neural network for fine-grained recognition, that recursively learns discriminative region attention and region-based feature representation at multiple scales. The proposed RA-CNN is optimized by an intra-scale classification loss and an inter-scale ranking loss. It is done in order to mutually learn accurate region attention and fine-grained representation that gives the accuracy gains of 3.3%, 3.7%, 3.8%, on CUB Birds, Stanford Dogs, and Stanford Cars, respectively.

The simple and fully automatic panoramic image-based pose-invariant face recognition method [5] is presented which gives the face image captured at an arbitrary angle within 45 in yaw and 22.5 in pitch during identification to give an excellent accuracy with low complexity. The local morphing treatment is used to deal with all of the possible geometric distortion problems in the recognition phase. This morphing technique was more widely accepted then.

In this paper, the face is recognized [6] using (HOG) features extraction and fast principal component analysis (PCA) algorithm. Haar-feature classifier is used for the original data. Furthermore, the HOG features are with- drawn from the given image data and the PCA dimension reduction is processed, and the Support Vector Machines (SVM) algorithm is used to recognize the face. In this paper the PAC algorithm used for face detection and recognition.

The paper [7] gives a conceptual model for automated attendance system through facial recognition using an integral validation process which enhances the reliability of the model.

S Poornima et al. [8] gives a system that can automatically detect the student in the classroom and marks the attendance by recognizing their face. This system is developed by capturing real-time human faces in the class. The detected faces are matched against the reference faces in the dataset and marked the attendance for the attendees. Finally, the absentee lists are said aloud through voice conversion system for confirmation. Secondly, the system is trained to classify the gender of the students present in the class.

Hemant Kumar Rathod et al. [9] proposed Automated attendance system by using algorithms like Viola-Jones and HOG features along with SVM classifier are used to detect the face.

Yueqi Duan, et al. [10] gives a context-aware local binary feature learning (CA-LBFL) method for face recognition. The main feature of CA-LBFL is that it exploits the contextual information of adjacent bits by constraining the number of shifts from various binary bits so that eventually additional robust information can be exploited for face representation. It also gives two methods to heterogeneous face matching by coupled learning methods (C-CA-LBFL and C-CA-LBMFL).

Samuel Lukas et al. [11] propose a method for student attendance system in the classroom using face recognition technique by combining Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT). The features of student's face are thereby extracted and by applying the Radial Basis Function (RBF) facial objects are classified.

The paper [12] compares facial recognition accuracy of three well-known algorithms namely Eigenfaces, Fisher- faces and LBPH. The accuracy obtained from LBPH is 81.67% off in still-image-based testing. So, LBPH is the most suitable algorithm to apply in a class attendance to get better accuracy. More often, it is efficient than being accurate.

The approach combines appearance features with facial expression dynamics. The method deduces that the input video initiates with a slight frontal face, and has the entire duration of a smile (or disgust) expression. For smile and disgust

expression in proposed system they use UvA-NEMO Smile Database. The alteration in dynamics of smiles for different ages is analyzed [13]. The system extracts the features as in below fig. 2.

Feature	Definition
Frequency Components:	$[\ \psi(1)\ ,\ \psi(2)\ \ldots,\ \psi(10)\ ]$
Duration:	$\left[\ \frac{\eta(\mathcal{D}^+)}{\omega}\ ,\ \frac{\eta(\mathcal{D}^-)}{\omega}\ ,\ \frac{\eta(\mathcal{D})}{\omega}\ \right]$
Duration Ratio:	$\left[\ \frac{\eta(\mathcal{D}^+)}{\eta(\mathcal{D})}\ ,\ \frac{\eta(\mathcal{D}^-)}{\eta(\mathcal{D})}\ \right]$
Maximum Amplitude:	$\max(\mathcal{D})$
Mean Amplitude:	$\left[\ \frac{\sum\mathcal{D}}{\eta(\mathcal{D})}\ ,\ \frac{\sum\mathcal{D}^+}{\eta(\mathcal{D}^+)}\ ,\ \frac{\sum\lvert\mathcal{D}^-\rvert}{\eta(\mathcal{D}^-)}\ \right]$
STD of Amplitude:	$\mathrm{std}(\mathcal{D})$
Total Amplitude:	$[\ \sum\mathcal{D}^+\ ,\ \sum\lvert\mathcal{D}^-\rvert\ ]$
Net Amplitude:	$\sum\mathcal{D}^+ - \sum\lvert\mathcal{D}^-\rvert$
Amplitude Ratio:	$\left[\ \frac{\sum\mathcal{D}^+}{\sum\mathcal{D}^+ + \sum\lvert\mathcal{D}^-\rvert}\ ,\ \frac{\sum\lvert\mathcal{D}^-\rvert}{\sum\mathcal{D}^+ + \sum\lvert\mathcal{D}^-\rvert}\ \right]$
Maximum Speed:	$[\ \max(\mathcal{V}^+)\ ,\ \max(\lvert\mathcal{V}^-\rvert)\ ]$
Mean Speed:	$\left[\ \frac{\sum\mathcal{V}^+}{\eta(\mathcal{V}^+)}\ ,\ \frac{\sum\lvert\mathcal{V}^-\rvert}{\eta(\mathcal{V}^-)}\ \right]$
Maximum Acceleration:	$[\ \max(\mathcal{A}^+)\ ,\ \max(\lvert\mathcal{A}^-\rvert)\ ]$
Mean Acceleration:	$\left[\ \frac{\sum\mathcal{A}^+}{\eta(\mathcal{A}^+)}\ ,\ \frac{\sum\lvert\mathcal{A}^-\rvert}{\eta(\mathcal{A}^-)}\ \right]$
Net Ampl., Duration Ratio:	$\frac{(\sum\mathcal{D}^+ - \sum\lvert\mathcal{D}^-\rvert)\omega}{\eta(\mathcal{D})}$
Left/Right Ampl. Difference:	$\frac{\lvert\sum\mathcal{D}_L - \sum\mathcal{D}_R\rvert}{\eta(\mathcal{D})}$

Fig. 2: Extracted Features

Evaluation Comparison: The features which were extracted from the aligned face images were independent of the network, they selected the corresponding approach as the baseline method. The current state of the art in [14] is denoted by Two-stage CNN" and LNet+ANet".
The process has two phases as follows:

- Extract Raw Data: The original input data is collected under non-limiting conditions, some of the data due to its different acquisition path, resulting in a greater difference in imaging results. Such as facial mask, facial expression is too exaggerated, large deviation angle of the face, etc.

- Face Detection and Extraction: Haar feature classier is introduced into the preprocessing of raw data for face detection and face region extraction. The Haar feature classier is based on the AdaBoost algorithm by Viola and Jones [14], which is formed by cascading the trained strong classier.

For face detection under complex background and illumination [15], a detection method that combines the skin color segmentation and cost-sensitive Adaboost algorithm is pro- posed in this paper. First, by using the characteristic of hu- man skin color clustering in the color space, the skin color area in YCbCr color space is extracted and a large number of irrelevant backgrounds are excluded; then for remedying the deficiencies of Adaboost algorithm, the cost-sensitive function is introduced into the Adaboost algorithm; finally, the skin color segmentation and cost-sensitive Adaboost algorithm are combined for the face detection. Experimental results show that the proposed detection method has a higher detection rate and detection speed, which can more adapt to the actual field environment [15].

III. PROPOSED SYSTEM

In existing automated system there are more chances of the attendance proxies. Manual attendance maintaining is difficult process, especially for large group of students and time-consuming task. Some automated systems which can mark attendance automatically have drawbacks like cost, fake attendance and accuracy. In addition, the chances of attendance proxies are more in manual attendance system. Here we are developing a system i.e. Improved Intuitive Automated Attendance System Using Unorthodox Algorithms" to automate the attendance work.

We are developing an application that can be used in educational institutes, societies and companies for attendance or maintaining Daily Visitor log for an apartment or for keeping the records for in and out the timing of the employees. The application has features like capturing the image and based on facial features, the system is able to detect the face of the user and mark its attendance.

User uploads a video/grabs images using a live camera on the application, the application then extracts frames from the video. These frames are saved on the local machine. Frames are usually 640x480 formats. Apply the Haar cascade Classifier for the face detection in images. Once we get the faces, we apply pre-processing on images like noise removal, normalization
etc.

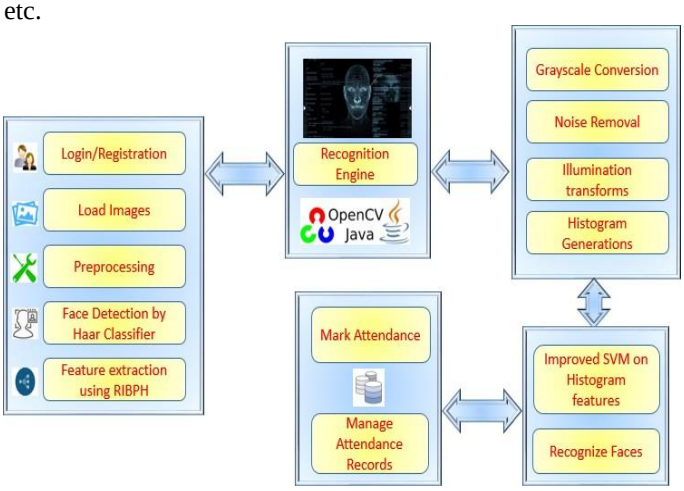

Fig. 3: Architecture Diagram

1. RGB to Gray Scale Image:
   Convert the image into Grayscale by taking the average of each pixel RGB.

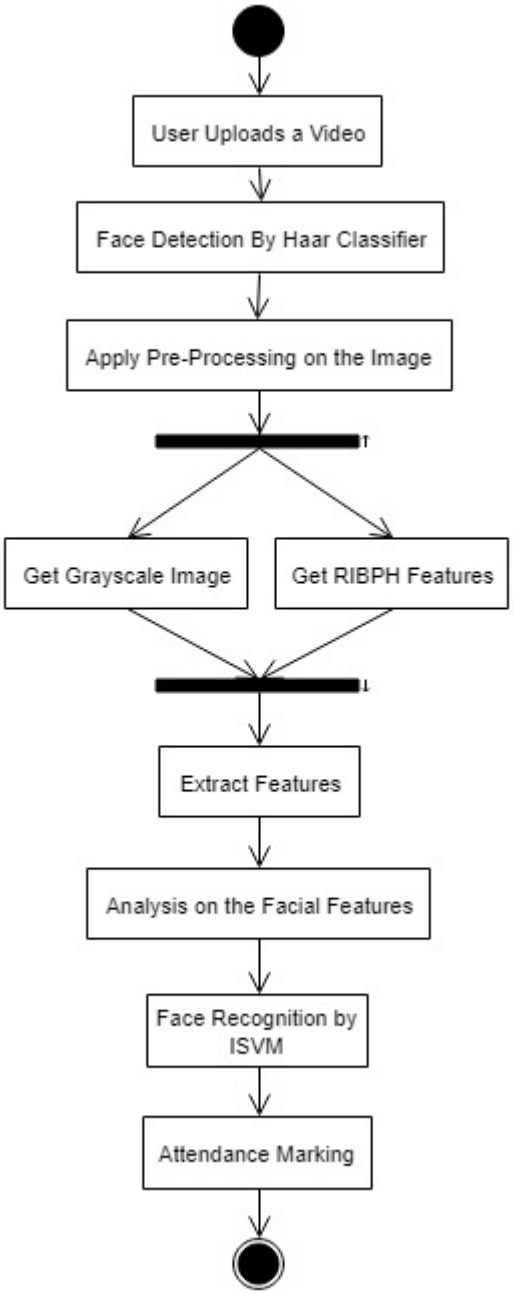

Fig. 4: Flow Diagram

2. Local Binary Patterns Histograms:
   a. Divide the examined window into cells (e.g. 16x16 pixels for each cell). Juxtapose the pixel to each of its 8 neighbors for every pixel in the cell. Follow the pixels along a circle, i.e. clockwise or counter-clockwise.
   b. Where the center pixel's value is greater than the neighbor's value, write "0". Otherwise, write "1". The 8-digit binary number is converted to decimal for convenience.
   c. Evaluate the histogram, over the cell, of the frequency of each "number" occurring. This histogram is a 256-dimensional feature vector.
      i. Optionally normalize the histogram.
      ii. Concatenate the (normalized) histograms of all cells. This gives a feature vector for the entire window.

3. The feature set is then saved to a model for later matching process.

4. Using Support Vector Classification algorithm analysis on the LBP facial features, detect the face of the user and mark his/her attendance

Methodology is carried in a very holistic and heuristic approach:

1. Frame Extraction / Live Camera: User uploads a video / grabs images using live camera on the application, application then extracts frames from the video. These frames are saved on local machine. Frames are usually 640x480 format.

2. Face Detection: The Haar cascade Classifier is coherently used for the face detection in images.

3. Pre-Processing on images: Apply the preprocessing on images like illumination changes, grayscale conversion, noise removal, normalization etc. after we accumulate the faces from the images.

4. Face Recognition and attendance marking: Using Improved Support Vector Classification algorithm analysis on the RIBPH facial features, detect the face of the user and mark its attendance.

IV. CONCLUSION

Here we discussed various methods used by researchers for face detection that can be used for educational or commercial organizations for monitoring student's attendance in a lecture by detecting the faces of the student. Haar-Feature Algorithm is used for face detection. No such Haar cascade algorithm has high performance as compared to the system which exists that can give 100% accuracy with Naive Bayes and KNN, but the performance is not easily estimated. So, in the next step, we are trying to build up a system with Haar classifier and Improved Support Vector Machines (IVSM) for the classification of the faces.

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