

SMART ATTENDANCE USING REAL TIME FACE RECOGNITION (SMART - FR)

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ABSTRACT

This paper presents an automated system for human face recognition in a real time background for a company to mark the attendance of their employees. So Smart Attendance using Real Time Face Recognition is a real world solution which comes with day to day activities of handling employees. The task is very difficult as the real time background subtraction in an image is still a challenge. To detect real time human face Haar cascade is used and a simple fast Principal Component Analysis is used to recognize the faces detected with a high accuracy rate. The matched face is then used to mark attendance of the employees. Addition to this there is a method to handle employee leaving requests through Natural Language Processing by approving or rejecting leaves and replies for all requests. This product gives much more solutions with accurate results in user interactive manner rather than existing attendance and leave management systems.

Keywords— RealTime Face Recognition, PCA: Principle Component Analysis, NLP: Natural Language Processing, Face recognition, Haar Cascade Classifie

1. INTRODUCTION

Person identification is one of the most crucial building blocks for smart interactions. Among the person identification methods, face recognition is known to be the most natural ones, since the face modality is the modality that uses to identify people in everyday lives. Although other methods, such as fingerprint identification [5], can provide better performance, those are not appropriate for natural smart interactions due to their intrusive nature. In contrast, face recognition provides passive identification that is the person to be identified does not need to cooperate or take any specific action [1]. So a company can recognize its regular employees while they are entering the company.

Basically this research is aimed for implementing a system that is capable of identifying the employees in an organization, marking their attendance and handling their leave requests. Therefore face recognition is used to mark the attendance of the employees. Smart Attendance using Real Time Face Recognition (SMART-FR) provides flexibility to identify several employees at the same time separately rather than identifying one by one. To increase the accuracy, efficiency and reliability of the recognition, algorithms are needed. Principle Component Analysis (PCA) and *Haar cascade* are used to address those tasks [6]. The PCA is one of the

most successful techniques that had been used in image recognition and compression [2].

Another practical use of this system is managing leave requests of the employees in an automated way.

As far as the leave process of today organizations are concerned, most of them are using manual process to handle leave requests of employees. If an employee wants to apply for a leave he or she needs to come to workplace. So it is time consuming, inefficient and unreliable. This system allows employees to request a leave by using a simple SMS. To process these requests Natural Language Processing (NLP) technology is used within the system [7]. NLP is a field of computer science, artificial intelligence and linguistics concerned with the interactions between computers and human (natural) languages. As such, NLP is related to the area of *human-computer* interaction. Many challenges in NLP involve natural language understanding that is enabling computers to derive meaning from human or natural language input [3]. Through practices, this system is proved to be easy-to-use and effective.

2. RESEARCH METHODOLOGY

This system has a standalone application and web based application. Stand alone application deal with the face recognition process and the attendance

marking process. Web based application is mainly dealt with the NLP process. Both applications are linked to a centralized database.

2.1. Detailed System Design of Face Recognition

Face recognition is the most important part of this project.

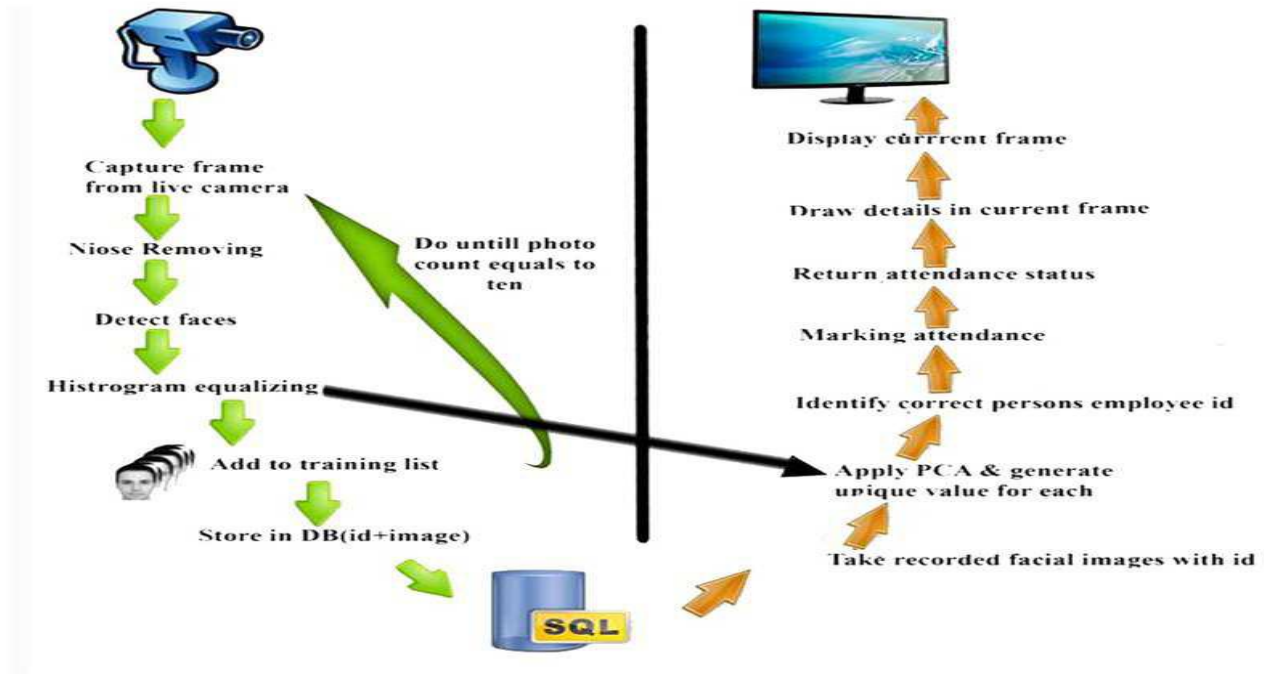


Figure 1: Detailed system design of face recognition

Figure 1 illustrates the detailed system design of face recognition process. It explains the two main processes involved in the system, namely detecting faces or training process and recognition process.

2.2. Face Recognition Implementation Methodology

PCA is an ideal method for recognizing statistical patterns in data. The underlying concept of face recognition with PCA is used in this approach. PCA is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension [2].

This section will take you through the steps you needed to perform a PCA on a set of data.

- Stage 1: Subtract the Mean of the data from each variable
- Stage 2: Calculate and form a covariance Matrix
- Stage 3: Calculate Eigenvectors and Eigen values from the covariance Matrix
- Stage 4: Chose a Feature Vector (a fancy name for a matrix of vectors)
- Stage 5: Multiply the transposed Feature Vectors by the transposed adjusted data

2.3. Haar Cascade Method

Detecting human face require that Haar classifier cascades first be trained. In order to train the classifiers, this PCA algorithm and Haar feature algorithms must be implemented.

The core basis for Haar classifier object detection is the Haar-like features [4]. These features, rather than using the intensity values of a pixel, use the change in contrast values between adjacent rectangular groups of pixels.

“haarcascade_frontalface_default.xml” file is used in this research. It produced the best results from testing. However it may prefer one of the alternatives as many of these only detect faces in certain conditions i.e. facing the camera directly. This can help improve the accuracy of the recognizer and require less training data.

2.4. Detailed System Design of NLP

NLP is the other research application developed in SMRT-FR and it is used to process and handle leave requests of employees. NLP process running throughout the system is illustrated in Figure 2.

Employees can request leaves easily by sending a SMS or using web interface and those leave requests are processed using NLP application, and accept or reject result is generated by considering several conditions and rules.

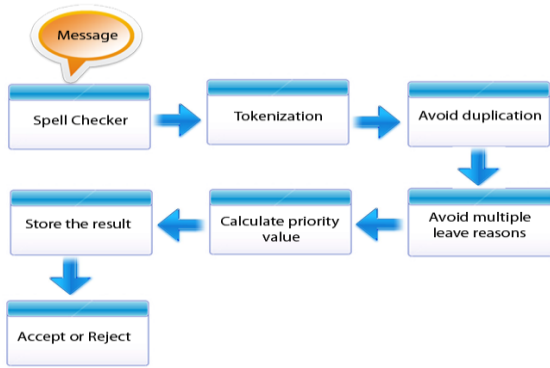


Figure 2: Detailed system design of NLP

Figure 3 represents the main processes of NLP and how it is used for handling leave requests.

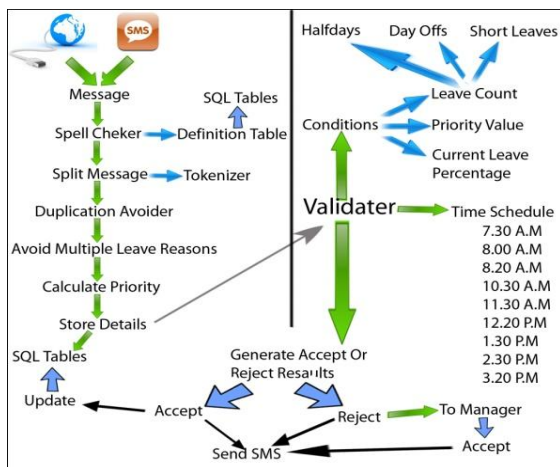


Figure 3: General steps of NLP process

3. RESULTS AND DISCUSSIONS

PCA was chosen for face recognition algorithm because it is the most efficient technique, of dimension reduction, in terms of data compression. This allows the high dimension data, the images, to be represented by lower dimension data and so hopefully reducing the complexity of grouping the images. And also PCA gave better results for varying processes.

The system proposed is a real-time system. It takes input image through a web camera continuously. The main camera and attendance identification display can be placed at the entrance of the organization to get better result. When the employees are entering through the main camera their attendance will be marked automatically. It is shown in Figure. 4.

Red, green and white frames are shown in the Figure 4. And also some key words are displayed on the particular colored frames. It is a way of identifying different conditions of attendance marking.



Figure 4: Face recognition attendance marking

The system is developed in away that the employee should face directly at the camera. They should appear as same as their photos saved in the system. For example if the employee is not wearing glasses in the photos then he should remove the glass when he marks attendance. And also if there's a significant change in the face such as growing a beard then it is recommended to change the saved photos of him in the system. Then the particular employee can check, whether their attendance is marked or not.

The system could detect faces with 68% of accuracy so far. The accuracy depends on the clarity of the picture. The camera should be installed in a place with good light in the background and free of obstacles. However the system also consists of a component where the employee can manually mark attendance by entering the employee number in case of a delay or mal functioning in the detection system. This is done to avoid any inconvenience caused in the day to day activities of the company.

In SMART-FR, there is a facility which allows employees to request leaves via a SMS message. So it is a huge task to convert those messages to a language which computers can understand. For that NLP and Tokenization method is used [8].

When a leave request comes to the system initially spell checking is done to correct the wrong key words of the messages. Then the message is split into words (tokens) and removes unnecessary words. Then the Leave type, reason, request date were discovered by comparing separated words with token words which were already stored in database. Each of these tokens was assigned an integer value and sum of the values of each word is calculated as the final result. This sum (integer value) is the output for forward processes.

NLP is mainly used in decision making process and within this system it is used to imitate the brain and to make decisions. If this decision making process

gives correct result within the system, sometimes it is not compatible with solutions of real world problems, because machines cannot think exactly like the human brain.

The NLP system tested with various test cases. These cases include various types of leave request messages. Out of 100 it successfully processed 71 cases. So the accuracy of this NLP system as percentage is 71%.

4. CONCLUSION

It can be concluded from the above discussion that a reliable, secure, fast and an efficient system has been developed replacing a manual and unreliable system. This system can be implemented for better results regarding the management of attendance and leaves. This system will save time, reduce the amount of work the administration has to do and will replace the stationery material with electronic apparatus. Hence a system with expected results has been developed but there is still some room for improvement.

Under future development of face recognition, it should be capable of detecting any faces under any light conditions.

In the NLP process currently this system can identify only limited number of words. So in future this system should be able to handle and identify large number of key words.

5. REFERENCES

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