Food management and surveillance using Viola Jones algorithm and Local Binary Pattern Histogram

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Abstract. This paper proposes an efficient system to manage the online food ordering, maintenance of employee attendance and provides auto surveillance. In this system, a camera will be placed at the entrance of the company. Whenever a person enters into the company, their faces are detected by the camera and features are extracted. Then those features are compared with the extracted features of the trained database. Two databases one employee database and other VIP database is maintained. When the features of a face get matched, the system will check whether the features are from the employee database or Very Important Person (VIP) database. When the match is from the employees list, the employee will be marked present. Then a unique code and the food ordering link will be sent to their mobile number. The ordered food will be delivered to the employee at the food court at the respective time slots. Suppose when the match is from the VIP list, an alert message will be sent to the reception desk along with the VIP ID. On the other hand, when the person photo is not matched, it will be saved in the unknown person list. When an employee leaves the company before the food is delivered, the food cancellation link will be sent to their respective mobile number to cancel the food order.

Key Words: Food ordering, Surveillance, Attendance, Unique code, Unknown person.

1. Introduction

Today, the security is one of the essential things in all the places. In order to identify the correct person, biometric system is one of the best method comparing to all other authentication system such as RFID system, Aadhar system etc., Every person have their unique biometrics such as face ID, fingerprint, retina scan, etc., So, these biometrics can be utilized for authentication of a person. The advantage of this approach is that the person does not want to carry any other identities with him for the verification. The requirement for surveillance is also required by most of the people.

Nowadays, the population is drastically increasing and also the requirement of food supply has also reached to its greater extent. Many people cannot get adequate nutritious food daily because of poor food management system [4] and also there is a lack of awareness about the essence of food management among the public bodies. Today, many companies have in-build food court where food is prepared only by prediction without any specific amount. So, the food is wasted because the prepared food may not meet the requirements [12]. So, the food management and avoiding the food wastage has become essential in today’s life. So, the proposed system will pave a way for all these things [10].
In the proposed system, a face verification system is employed for verifying the identity of the person ordering food. Here face recognition technique is used in order to monitor the persons at the entrance of the company. The Viola Jones algorithm [1] is used for the purpose of face detection. This algorithm contains some predefined details of the face parameters such as eye, noise, mouth etc. By using that, the face can be easily detected from the image that is obtained from the live videos [7]. Then the system has to be trained for the stored face so that they can be able to recognize the trained faces. The Local Binary Pattern Histogram (LBPH) technique has been used for the face recognition [6] [1]. Because this technique will be better when compare to some other technique such as Fisherface and Eigenface. The Fisherface and Eigenface will take the datasets as a whole but the LBPH will analyse each image independently [5]. The LBPH will take less processing time when compare to Fisherface technique and also this technique were not very sensitive to the light [8]. So, this system will provide information about the persons entering into the company. The presence of a worker is also marked the attendance by the help of this system [2]. Then an 8-digit numerical unique code is generated for every employee [13] who is present. After the generation of the code along with the food ordering link is sent through SMS to the employee [9] [11]. Through the link, the employee can order the food [3] as per their wish with their required amount. So that, the food can be prepared with more appropriate amount.

2. Related Work

[11] Rajeev Ranjan, et al., proposed a Fast and Accurate System for Face Detection, Identification, and Verification, wherein the performance of face recognition task was improved by using convolution neural network with the help of various annotated data sets that are available for effective face identification and verification. The deep learning pipeline is used where deep pyramid single shot face detector is used for the fast face detection. For face verification and identification, the crystal loss function is created. This system reduced the distance of the positive subject and at the same time paved a way for increasing in order to subject pain distance. In this paper the identification and verification of face have been implemented accurately. [7] Jiwen Lu, et al., proposed their approach a Simultaneous Local Binary Feature Learning and Encoding for Homogeneous and Heterogeneous Face Recognition. Their proposed system was one of the effective face recognition systems. As the already existing systems such as local binary pattern and Gabor features require more details for the identification of face, but the simultaneous local binary feature learning and coding did not require such high details. It acquires the required details from the raw pixel. Also as the existing approach requires more details there were two stage feature extraction and it was eliminated in proposed system. This system was also compatible for heterogeneous face matching by using some common and specific data that are used for heterogeneous face samples. [8] Jiwen Lu, et al., proposed a Learning Compact Binary Face Descriptor for Face Recognition. Normally the local binary patterns were used as a binary feature descriptor for face recognition system because of its ability to overcome the adverse conditions and strong recognizing power. The hand craft was also one of the binary face descriptors but for that strong Prior knowledge is required. So, in the proposed system the difference between the neighbour pixels and the corresponding pixels is noted and their low dimensional binary vector is found. First the difference between the binary codes is maximized and minimizing the loss between original and learned value and stored in the learned bias. The unwanted information is removed and remaining binary codes are combined and converted as histogram futures and stored in each image. By using these binary codes, the heterogeneous face has been detected. [6] Idelette Laure Kambi Beli and Chunsheng Guo proposed an enhancing Face Identification Using Local Binary Patterns and K-Nearest Neighbours system related to image processing and computer vision to identify humans, objects like car, table, etc., in a video or in an image. This system combines two algorithms namely, Robustness Local Binary pattern and K-Nearest Neighbour for image classification. It has two modes, verification and recognition. Recognition of a face needs good computational analysis. It is important for security applications in order to access secure areas like military bases and also provide good service. Identification is to verify a person from a video by
matching process as it compares the captured face with all the faces stored in the database to determine the person. It has negative and positive outcomes and also costly for large database. It also gives correct face similarity measurements on extraction of features. This has been conducted on CMU PIE and LFW dataset. K-Nearest algorithm is mainly used for easy interpretation and less calculation time. All the above works are techniques of feature extraction and classification methods for face detection and not integrated with real time application and analysis.

3. Proposed system
The proposed system has the facility of surveillance, marking the attendance of the employees, ordering the food items in online and also to reduce food wastage using face recognition technique. The Viola Jones algorithm is used for the face detection and the LBPH technique has been used for face recognition. The local binary pattern histogram is calculated using 4 parameters such as radius, neighbour, grid X, grid Y. The circular local binary pattern is built using the radius. The sliding window is used, normally a 3*3 matrix for the operation. Figure 1 represents the LPB matrix calculation. In this matrix the neighbour pixel is compared with the center pixel and when its value is greater than the center value it is set as one or else the value is set as zero. All the 8 neighbour pixels are converted into binary around a centre pixel in 3x3 neighbourhood. Then they are converted into decimal value and the value is stored in the center pixel. This procedure is repeated for all the pixels, so that the new image is created. The histogram is calculated for all the regions and by concatenating all the histograms, the final histogram is created which represents the characteristics of the original image. Each histogram represents an image. For face recognition, the histogram of the captured image is to be calculated. Then it is compared with the dataset histogram, the image with the closest histogram is matched and gives the output result.

![Figure 1. Steps to calculate the Local Binary Pattern of the captured image](image1)

![Figure 2. Block diagram of proposed system by using Raspberry Pi kit](image2)
Figure 2 represents the block diagram of the proposed surveillance system. A camera is placed at the entrance to monitor the people who are entering into the office. For every employee, a unique employee ID will be given. For VIPs or other persons who are important to the organization are given with VIP ID. Each employee face in different dimensions and perspective, their ID, their mobile number and all their details are stored in the database. When the employees enter into the office, they can be recognized by the camera by comparing the captured face from the live video. The captured face is compared with all the faces in the database. When it gets matched the system marks attendance for that individual. Then creates a unique code for that employee and sent to that employee’s mobile number through SMS. Along with the unique code, a link for food ordering is also sent to the employee. Through the link, the employee can login using the unique code which has been sent to the employee’s mobile number. Then the employee can order the food items according to the available time slots. The food will be delivered to him/her at the food court during the ordered time slots. By this, the cooking department can come to know the requirement of food level for every dish and can cook only the required items. By this, the food wastage can be reduced and the time for waiting in the queue to order the food and getting it delivered can be reduced. If a VIP person enters into the company, the camera will recognize their face and an alert is sent to the reception desk. So that they can attend that person without any further delay. If an unknown person enters, an alert is sent to the reception that a new person has entered into the company. And also, the system shows the details about number of employee’s, number of VIP’s, number of unknown persons entering into the company. Another camera is placed at the opposite side of the entrance, to monitor the employee moving outside the company, their faces are recognized and automatically a food cancellation link will be sent to the corresponding employee’s mobile number.

Figure 3. Methodology of the proposed system

Figure 3 describes the process flow of the proposed system. The face ID of the employee was priorly stored in the database. Then the stored faces have to be trained for recognizing these faces. Then the system compares the captured image with the database, when it gets matched with the employee list, a unique code is generated and sent to the employee and the attendance is marked for the respective person. Suppose if it gets matched with the VIP list, an alert message is sent to the reception desk. At the same time, surveillance also is done whenever any new person enters into the company. The food will be delivered to the employee at the allotted time slot and also the feedback about the service is also collected.
4. Results and discussion

The hardware model for the proposed system is shown in the figure 4. The hardware model consists of Raspberry pi 3B+, Webcam and power supply. The proposed system has three applications; attendance monitoring, surveillance and food management. The webcam is used to capture the live video. The Raspberry Pi is interfaced with the webcam to detect the face of the people. The Raspberry Pi will process the captured faces and check whether the match is found or not. Figure 5 shows the faces that are present in the captured image. For this process, Viola Jones Algorithm has been used. The face which is present in the captured image is detected. The detected faces are stored in a separate folder. The folder can be accessed again for the purpose of face recognition.

The captured faces are stored in a separate folder. By using the similar process, multiple face images of the employee working in the organisation and VIPs are captured and they are stored along with their corresponding ID as shown in the figure 6. Then, the training process is carried out by extracting all the details from the stored images. And the same are used for recognition purpose. LBPH technique has been used for the recognition of faces. Here the system is going to use the .yml file which is generated during training process. This file contains the details of all the stored faces. These captured faces are compared with the details in the file in order to find whether the match is found or not. So, by this process, the face recognition is done as shown in figure 7.

After the match is found for the employee face, an 8-digit random numerical unique code is generated by the system. Then the unique code and the food ordering link will be sent through SMS to the corresponding employee as shown in the figure 8. So, by using that code, the employee can login into the food ordering webpage to order the food items. The figure 9 shows the list of ordered food items which are placed by the employee along with their quantity. In their respective time slots, the quantity of ordered food items will be sent to the chef. Based on the orders placed, the chef can prepare the food items according to the requirement. So the wastage of food can be avoided.
When the employee enters the company, the face is captured and recognised. Then the attendance for the particular worker is noted as shown in the figure 10. It also shows some added details such as the entering time of the employee coming into the company. It also gives the list of the workers who are all present for the particular day. Then the list can be sent to the admin through e-mail for recording purpose.

5. Conclusion
The proposed system helps to find the amount of food items that has to be prepared with the help of online food ordering portal. So, wastage of food at the time of preparation can be reduced in an effective manner. The proposed system also consists of attendance marking of the employee can be monitored easily along with food ordering process. Also, it provides a way for surveillance so that the VIPs and unknown persons entering into the company can be monitored easily. It is purely based on webpage system and it is platform independent so it can be used in any platform. With the help of proposed system, the employee can order the food easily and effectively based on the required time slots.

References
[1] Ramos ALA, Anasao MAM, Mercado DB, Villanueva JA, Ramos CJA, Lara AAT and Margelino CAN 2018 F-Locker: An Android Face Recognition Applocker Using Local Binary Pattern Histogram Algorithm International Journal of Computer Science and Information Security 16 2 129-135
[2] Amruta Surana, Diksha Ghare, Prajakta Katakdhod, Shraddha Ujgare and Komal Suskar 2019 Face Recognition Based Attendance System with Auto Alert to Guardian using Call and SMS International Journal of Trend in Scientific Research and Development 3 4 792-795
[3] Arnelyn Torres M 2016 Electronic Menu and Ordering Application System: A Strategic Tool for Customer Satisfaction and Profit Enhancement *International Journal of Science and Technology* **9** 4 401-410

[4] Erera and Chelsea White C 2017 Risk Assessment of Deliberate Contamination of Food Production *IEEE Trans. Syst. Man Cybern. Syst.* **47** 3 381-393

[5] Heung-jun Kim, Heung-jun Kim, Dong-seok Lee and Soon-kak Kwon 2017 Implementation of Nose and Face Detections in Depth Image *Journal of Multimedia Information System* **4** 1 43-50

[6] Idelette Laure Kambi Beli and Chunsheng Guo 2017 Enhancing Face Identification Using Local Binary Patterns and K-Nearest Neighbors Image *Journal of Multimedia Information System* **3** 1 1-12

[7] Jiwen Lu, Venice Erin Liong, Xiuzhuang Zhou, and Jie Zhou 2015 Learning Compact Binary Face Descriptor for Face Recognition *IEEE Trans. Pattern Anal. Mach. Intell.* **37** 10 1-16

[8] Jiwen Lu, Venice Erin Liong, and Jie Zhou 2018 Simultaneous Local Binary Feature Learning and Encoding for Homogeneous and Heterogeneous Face Recognition *IEEE Trans. Pattern Anal. Mach. Intell.* **40** 8 1979-1993

[9] Lixing Wang 2018 Design Optimization of Food Safety Monitoring System with Social Network Analysis *IEEE Trans. Comput. Soc. Syst.* **5** 3 676-686

[10] Maldonado-Siman E, Bernal-Alcantara R, Cadena-Meneses J.A, Altamirano-Cardenas J.R and Martinez-Hernandez P.A 2014 Implementation of Quality Systems by Mexican Exporters of Processed Meat *J. Food Prot.* **77** 12 2148-2152

[11] Rajeev Ranjan , Ankan Bansal , Jingxiao Zheng, Hongyu Xu, Joshua Gleason, Boyu Lu, Anirudh Nanduri, Jun-Cheng Chen, Carlos D. Castillo, and Rama Chellappa 2019 A Fast and Accurate System for Face Detection, Identification, and Verification *IEEE Transactions on Biometrics, Behavior, and Identity Science* **1** 2 82-96

[12] Verdouw C.N, J. Wolfert J, Beulens A.J.M and Rialland A 2016 Virtualization of food supply chains with the internet of things *J. Food Eng.* **176** 128-136

[13] Manoj Senthil, Praveen raj, Navin kumar, Narendran 2020 Food Management System Based on Fingerprint Authentication *International Journal of Scientific and Technology Research* **9** 3 1962-1965