Face Recognition for Attendance System Using Neural Networks Technique

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ABSTRACT
Face recognition have come from considering various aspects of this specialized perception problem such as apply for help checking attendant. In order to solve this problem, many systems have been completely changed due to this evolve to achieve more accurate results. This research aims to develop the facing attendant system to be more effective and the mechanic of the system, which students can easily verify. The cloud storage was used for Attendance System. The experiment of this research is to find the way to recognize the face by using the technique of Neural Networks, which can correctly recognize up to 95%. This model can apply with school and university.

CCS Concept
• General and Reference • Cross-Computing Tools and Techniques • Experimentation

Keywords
Face Recognition; Neural Networks; Attendance System.

1. INTRODUCTION
Class attendance checking is important to the teaching style in order to gather information on the number of intentions of the student. In general, the instructor will call each student's name and ask the students to respond. Such method waste time of teaching each session with checking student name in the classroom in which there are many students. Which may sometimes cause errors in the class attendance checking, such as the instructor forgets to check the attendance, the students do not hear when they are called, crossing names, etc. Moreover, in some courses, collecting data for class attendance checking in paper list makes it difficult to use because the data is stored unsystematically. In order to solve the problems mentioned above, it is necessary to study the methods that can monitor the attendance of students by using the minimum time for checking the attendance.

Face recognition is a powerful technique by recognizing the face characteristics of the person. The method starting by get the image and find the feature on the face and saving to the database. Next, the identification step is calculating the difference between current face data and the face in database. By using facial recognition techniques working with applications related to identity verification. The advantages of identity verification with face recognition techniques compared to other identity verification, such as fingerprint scanning [13] RFID identification [12] or a QR code scanning [3] is a time for quick identification and is not a burden to the person who confirms the identity and can verify many people at the same time. Because of these advantages, face recognition techniques have been applied in the examination system [9], [14].

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At present, many research that have developed a system to monitor the attendance of students by applying facial recognition methods [1],[4],[10],[17],[20],[21]. To solve the problem of prolonged use in examining the list of students. This research applied neural networks technique to apply to check the students' name coupled with the use of the attendance system, testing for identification methods that provide the most accurate value and to increase the accuracy of identification from traditional methods. In addition, the system has added an online identification display so that the wrong identifiable students can edit their information.

2. RELATED WORK
Face detection is a classic technology of human-computer interaction [2]. This technique can get information from the faces in pictures or video. Face recognition technology analyses the face image to extract the facial feature, and then identify specific target.

Many researchers research on face recognition using back propagation neural network technique by compare with k-means and fuzzy c-means. This technique gave better results as compared to these two [6]. Meng joo er et all using radial basis function network with face recognition by used ORL database and extracted features by using principle component analysis. The performance of system achieved excellent both in terms of error rate and in terms of learning efficiency [7].

Pilawan Kongtongnok and Pijitra Jomsri proposed the monitoring in the computer laboratory when there is no schedule by using infrared sensors and CCTV with a notification system through Line application to administrators[15]. Mohammod Abul Kashem using PCA with back propagation. The system was more than 90% accurate [8]. Moreover, some researchers apply face recognition using back propagation neural network [5], [11], [16], [18], [19].

Paul Viola and Michael Jones proposed Haar feature-based process which uses the machine learning process, as the Cascade function is taught through image analysis. Their research was published in the topic Rapid Object Detection using a Boosted Cascade of Simple. [22].

The remainder of this paper is organized as follows. Section 3 Introduces with the proposed methodology of system. In Section 4,

the implementation is proposed for attendance system. The conclusions are presented in Section 5 and future work is presented in section 6.

3. RESEARCH DESIGN FRAMEWORK

In this section, discuss the framework, and methods to increase the accuracy of identification used in developed systems.

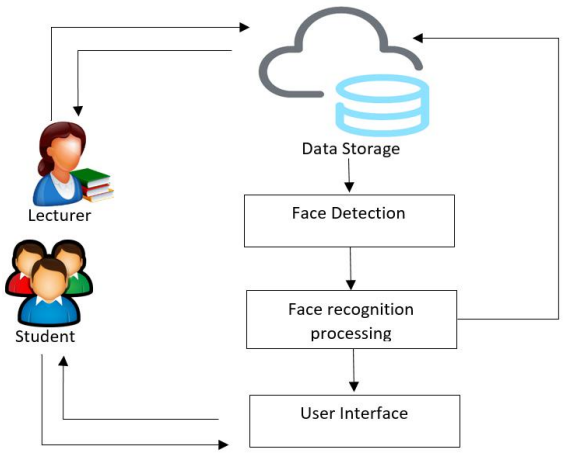

Figure 1. The Framework of Face Recognition for Attendance System Using Neural Networks Technique.

The system for checking student attendance with face recognition consists of five parts: Face detection, Face recognition processing section, Data storage, User Interface, and Attendance System by having the work instructions as shown in Figure 1 and each section has details as follows:

3.1 Convolutional Neural Networks

Convolutional Neural Network (CNN) is one of the neural networks in the group bio-inspired, in which CNN simulates the human vision of seeing areas as fragments and combining groups of sub-areas together to distinguish what they see. When looking at a sub-area of a human, there will be separate features of that sub-area, such as lines and contrasting colors, in which humans know that this area is a straight line or a contrasting color because humans look at both the point of interest and the area around together.

The CNN concept is quite good, but the complexity of it is that the calculation system corresponds to its own concept and requires mathematic to support it. By calculating this concept using the same principles as spatial convolution in image processing. This calculation starts with the configuration in the kernel that helps to remove the features used in object recognition. Normally, a kernel can pull out one feature of interest. So it also need to have multiple filters in order to find many spatial characteristics.

CNN has two major components, the hidden layers and the classification. In section hidden layers or feature extraction there are 3 sub-sections that work together: First, convolution is the process of scanning images from input. The filters (kernels) are created in the form of a matrix. After that, the feature is checked for characteristics or elements of each image. Next, ReLU is a step that allows CNN to learn the information obtained from previous image verification procedures. Which the data will be converted to non-linear. It will use an activation function like the Rectified Linear Unit (ReLU) to help increase CNN's efficiency. The last sub-section is Pooling, which reduce the size of the image to make CNN work faster and also reduce the use of memory.

After going through the steps of the hidden layers or feature extraction, the classification will consist of layer fully connected that will link to all nodes of the previous layer. In the classification section, it can only receive one dimensional data. Then the flatten process use to help transform data from 3 dimension to become 1 dimension.[23].

3.2 Haar Feature-Based

Previously, the process of detecting objects or distinguishing objects was a process that consumed a lot of energy and resources. Haar feature-based process was developed to enable faster work. This method was introduced in 2001 by Paul Viola and Michael Jones to publish their work on "Rapid Object Detection using a Boosted Cascade of Simple Features." [22]. Which uses the machine learning process, as the Cascade function is taught through image analysis, which is divided into two groups: the correct image group, which is the image of the object that needs to be detected in various ways, but must be cut off the other part issued to only the desired part. And the other group of common images that don't have anything to be detected in the image at all, in order to be able to take the data to be detected in other images.

Paul Viola and Michael Jones invented this, which greatly reduced the use of resources and processing time, which they called Fast computation of Haar-like features. The method is to divide the image area with the 4 ready-made formats that they have defined from Haar-like features as figure 2.

Then calculate the color table of the image by integrating the color table in the area in the white box, minus the color table in the area in the black box. In the process of integrating the images and then using the results in Adaboost, a learning algorithm known as the Adaptive Boost Learning Algorithm. Due to the enormous amount of data (24 x 24 slots, there are 162,336 possible formats.) Therefore, choosing Adaboost is the best and most suitable solution. Then using Cascading Classifiers to enable the system to learn through a number of valid data examples and other unrelated data so that the system can learn the difference.

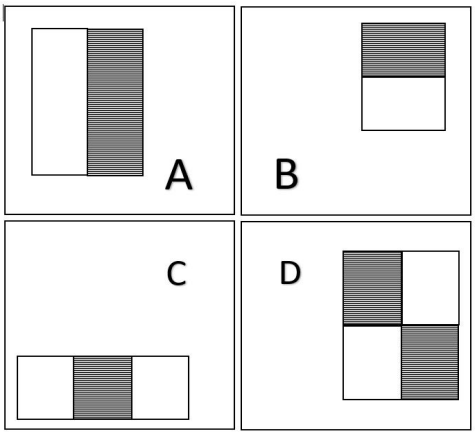

Figure 2. Example of Fast computation of Haar-like features [22].

3.3 Face Detection

This research uses the Haar Cascade Technique to detection, which is a highly accurate and takes relatively little processing time. Therefore suitable for real-time face detection in preview when the inspection system finds a person's face going up a

square frame by which the developed system can detect many faces at the same time, and in the actual system installation, the instructor can bring the camera installed in front of the room to check the attendance during teaching.

3.4 Facial Recognition Processing

This part is the core of the system. Process is a program developed and installed on the instructor's computer. The facial recognition processor will retrieve data from the database to compare the face recognition of the tester with the information contained in the system. If the tester is similar than the system sets a minimum threshold, the system will check who the tester when the students walk through the camera attached in front of the room and look at the camera. The system can identify correctly.

Artificial Neural Network Model Backpropagation Process
1. Create the input layer for calculate each processing element through the outer layer.
2. Calculate the error from the difference between the actual data and the target.
3. Transform the error on the input side of the processing element.
4. Propagation of errors on the output of each processing element to the error contained in the input.
5. Repeat Propagation process until input is reached.
6. Change the weights by using the error on the input side and the output of the connected processing element.
7. Backpropagation learning method uses the Mean Square Error.

Figure 3. Artificial Neural Network Model Backpropagation Process.

Artificial Neural Network Model Backpropagation is applied in this research. The technique is systematic method of multilayer training of artificial neural networks. This algorithm use coefficient values by minimizing the sum of the squares of error through the developed model. Process of Artificial Neural Network Model Backpropagation was show in figure 3 and figure 4.

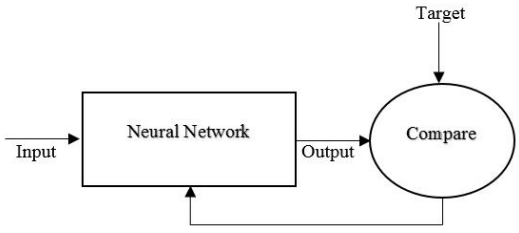

Figure 4. Artificial Neural Network Model Backpropagation Process.

3.5 Data Storage for Attendance System

Once the identification for student is completed, the results of the identification will sent to the attendance records for recording the results of checking attendance in each class, applying Google Cloud as a database.

3.6 User Interface for Attendance System

User interface for attendance system. This research using the Google Cloud system of Suan Sunandha Rajabhat University.in addition students to access information more easily and can inform the instructor about correcting identity information when the system is working incorrectly within the class. In addition, in the face recognition processing section, there will be a screen showing the attendance results along with a comparison page to agree.

3.7 Attendance System of the Students

This process manages student's attendance data in the courses such as enrollment, the student list checking system and showing reports, attendance statistics, absences, and eligibility for examinations or ineligibility to each subject. This data allow users to know the information and manage user's information in order to be able to manage the information in the responsible subject by importing the name verification information to use the information obtained to proceed which each time checking the name list, system will show the percentage as being in the class.

4. EXPERIMENTAL SETTING

Implementation consists of methods as follows:

4.1 Information Preparation and Test Method

The experiment begins with a collection of 60 students by allowing each student to make a straight face, face to the left, face to the right and bend down the head consequently with the light shining to the face of the students during the record. When filming all the videos, the face was recorded in each frame in the video of all 60 students. Take a photo each person is 86 images, so there are totally 5,160 face pictures. After that, have a test by dividing information into 2 sets, which are Training dataset and testing dataset. An Example of face information was show in figure 5 and figure 6.

Figure 5. Example of Face Information.

Figure 6. Example of Face Detection.

4.2 Defining Parameters for Learning Data Sets

This research has selected 1 to 5 images to represent 1 student to find the number of images that are suitable for personal identification whereby each picture consists of a straight face, 15 degrees left face, 15 degrees right face, down the face, and the lift-up face consequently. The remaining data from the training set used as test data. In addition, the threshold value for selecting images to compare and identify as a condition for increasing the efficiency of data classification with the threshold of the Neural Network.

4.3 Experiment and Analysis

The results of proposed work of back propagation neural network technique are shown in Table 1. When researcher have training ratio 60-40 then accuracy is 86%. When ratio increased to 90-10 then accuracy of BPN system is 95%.

Table 1. Accuracy Face Recognition for Attendance System Using Neural Networks Technique.

Training size	Face Recognition Accuracy
60-40	86%
80-20	90%
90-10	95%

4.4 Satisfaction Assessment

The results of the satisfaction assessment from all 60 students found that the system can check the student list quickly and suitable to ally in academic organization. The system can be easily accessed and can store attendance data throughout the activation period at the highest level ($\bar{x}$= 5.00, S.D. = 0.25). The system can store the information of the checklist correctly at a high level ($\bar{x}$= 4.31, S.D.=0.76). The system can support adding information, checking the list of students at the highest level ($\bar{x}$= 4.53, S.D.= 0.42). The system can help to reduce the name list checking time at the highest level ($\bar{x}$= 4.74, S.D.= 0.01) and the placement and composition on the screen of the system is appropriate largely at a high level ($\bar{x}$ = 4.51, S.D. = 0.35). Therefore, the summary in the whole picture found that the evaluation of the usability of the system at the highest level ($\bar{x}$= 4.55, S.D. = 0.42).

5. CONCLUSION

From the problem of spending the time to check the list of students for a long time in the case of a large number of students, or the teacher forgot to check the attendance, students do not hear when they are called, Crossing the name, and wasting a lot of time in checking attendance. Therefore, this research has developed a student monitoring system to study with face recognition methods to reduce such problems. The system develop the Artificial Neural Network Model Backpropagation for Facial Recognition process in real time and apply the Google cloud system so that students can check the information. This research examined the suitable face recognition method.

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