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Face Recognition Based on Computer Vision: A New Way of Attendance Marking

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Abstract: *Computer Vision marked a significant contribution to the application of automated attendance marking. This technology captures the face of an individual facing in an image-capturing device such as a camera. This study developed a face recognition attendance marking based onthe machine learning method. Computer Vision libraries from OpenCV such as Haar Cascade Classifier and Local Binary Pattern Histogram were used for identification and recognition. Images were collected from 8 participating individuals. The images were clustered according to their name (label). These images were used for training to create a face recognition model. Real-time testing was performed to evaluate the system's performance. The results generated a mean recognition accuracy of 95% which implies a significant basis for the application of the system to attendance marking.*

Keywords: Attendance Marking, Computer Vision, Face Recognition, Machine Learning

I. INTRODUCTION

Every work environment created a system for reliable and robust attendance marking[1]. Monitoring of workers needs to be strengthened to attain a productive output. Recent advancements in computer vision accelerated its application to a more useful application, especially in attendance monitoring. With a real-time face recognition system, it automatically identifies and recognizes individuals from images or video frames[2][3]. Manual attendance marking is time-consuming, error-prone resulting in problems with record keeping[4]. Thus, this study wanted to address these challenges with the integration of face recognition technology into the automated marking system.

Two popular methods can be used for developing an attendance system using face recognition. The Haar Cascade Classifier is a machine-learning approach for the detection of computer vision problems[5][6]. It has the capability of detecting facial features by applying rectangular filters that responds to changes in pixel intensities, analyzing for face regions. In other ways, Local Binary Pattern Histogram (LBPH), is another texture-based approach to face recognition that generates local patterns of pixel intensities of faces in photos[7]. These intensities are analyzed based on small regions to generate binary codes. The process resulted in the creation of unique facial features of a person.

The combinations of these algorithms are valuable in developing an attendance marking system. 8 individuals were used as the dataset. Images were collected, experimented for training with different numbers of samples to create a face recognition model. Python programming language was used with the integration of OpenCV libraries. The marked attendance was recorded in a CSV file containing the name, time, and date captured by the camera.

The specific goals of this study are:

- To develop a real-time attendance marking using computer vision;
- To extract relevant information that can be used for attendance monitoring
- To determine the recognition accuracy of the system.

II. METHODOLOGY

2.1 Development

The development of the model shows in Fig. 1. Automatic collection of the image was performed by Python programming language. The number of image collections was based on the variable declared in the program. The

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images were arranged according to classes. The next process was the training to create a model. This model was used in the face recognition program for comparison with the detected image from the real-time video frame.

Fig. 1. Illustration of the model's development

2.2 Data

A sample of images was taken from 8 selected individuals. Each participant face the camera for facial image generation. The number of generated captured images was done by datasetcreator.py. these collected images served as datasets needed for the training. Fig. 1 presents the sample of images used in the process.In Table 1, a number of classes participated in this study with the corresponding number of images per trial. Per trial corresponds to the number of images used during the training.

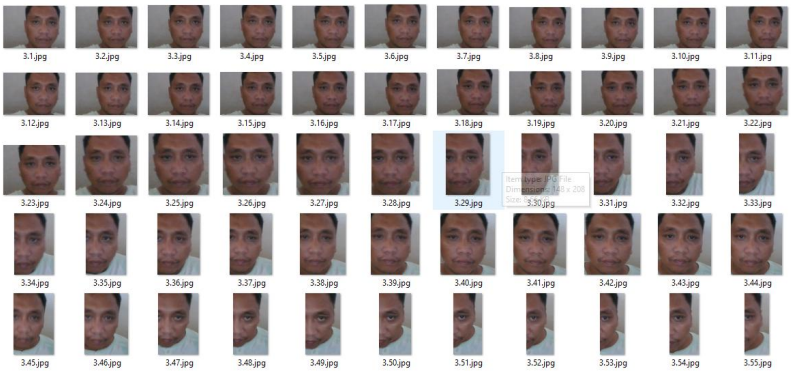

Fig. 2. Sample generated face images.

TABLE I: Classes and number of trials conducted

Classes	Trial 1	Trial 2	Trial 3
1	50	100	1000
2	50	100	1000
3	50	100	1000
4	50	100	1000
5	50	100	1000
6	50	100	1000
7	50	100	1000
8	50	100	1000

2.3 System Implementation

Fig. 1 illustrates the implementation of the system. A face of a person who appeared to the camera will be captured. The captured image was compared to the created model. The system conducted the identification/recognition process and extracted important information as to the requirements of attendance marking. The extracted data were saved in a CSV file.

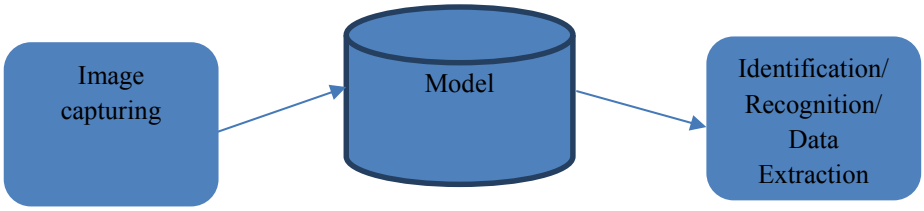

Fig. 3. Implementation flow

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2.4 Recognition Accuracy

The evaluation of the system was tested from 8 individuals for identification and recognition. The equation below was used to get the score of recognition accuracy.

$$Recognition\ Accuracy = \frac{number\ of\ face\ correctly\ recognize}{total\ number\ of\ face\ recognition\ trial}$$

III. RESULTS AND DISCUSSION

3.1 Model's Testing

Three models were created as to the number of trials. Trial 1 used 50 images and trial used 100 images. Both models generated wrong predictions. The face in Fig. 4 belongs to class 3 but the model recognized class 1. The solution from [8] suggested to increase the number of samples.

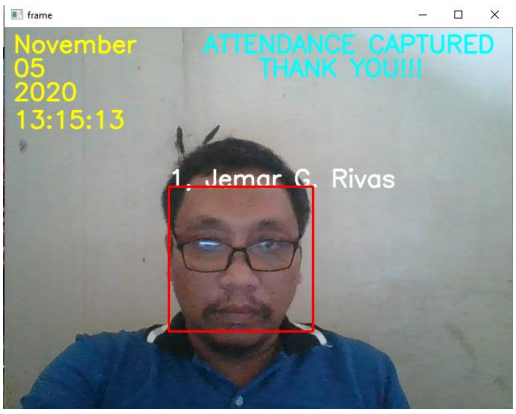

Fig. 4. Detection error as to 50 and 100 images used per class

Fig.5 shows the results of the testing from a model with 1000 samples. The image shows the correct recognition after increasing the number of images per class. The image was from class 3 and the name recognized was from class 3.

Fig. 4. Detection error as to 50 and 100 images used per class

The data extraction was presented in Fig. 5. Cell contained a class number, class name time, and date during the marking of attendance using the face recognition system.

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	A	B	C	D
189	1	Jemar G. Rivas	10:	10/01/20
190	3	Shem L. Gonzales	10:33	10/01/20
191	3	Shem L. Gonzales	10:33	10/01/20
192	3	Shem L. Gonzales	10:33	10/01/20
193	3	Shem L. Gonzales	10:33	10/01/20
194	3	Shem L. Gonzales	10:33	10/01/20
195	3	Shem L. Gonzales	10:33	10/01/20
196	3	Shem L. Gonzales	10:33	10/01/20
197	3	Shem L. Gonzales	10:33	10/01/20
198	3	Shem L. Gonzales	10:33	10/01/20
199	3	Shem L. Gonzales	10:33	10/01/20
200	3	Shem L. Gonzales	10:33	10/01/20
201	3	Shem L. Gonzales	10:33	10/01/20
202	3	Shem L. Gonzales	10:33	10/01/20
203	3	Shem L. Gonzales	10:33	10/01/20
204	3	Shem L. Gonzales	10:33	10/01/20
205	3	Shem L. Gonzales	10:33	10/01/20
206	3	Shem L. Gonzales	10:33	10/01/20
207	3	Shem L. Gonzales	10:33	10/01/20
208	3	Shem L. Gonzales	10:33	10/01/20
209	3	Shem L. Gonzales	10:33	10/01/20
210	3	Shem L. Gonzales	10:33	10/01/20
211	3	Shem L. Gonzales	10:33	10/01/20
212	3	Shem L. Gonzales	10:33	10/01/20
213		Jemar G. Rivas	11:07	11/03/20

endance

Fig. 5. Extracted data during the attendance marking.

3.2 Recognition Accuracy

TABLE II: Classes and number of trials conducted

Classes	Total Number of Face Recognition Trial	Number of Face Correctly Recognized	Recognition Accuracy
1	10	9	90%
2	10	10	100%
3	10	10	100%
4	10	9	90%
5	10	10	100%
6	10	10	100%
7	10	8	80%
8	10	10	100%
Accuracy			**95%**

IV. CONCLUSION

The study combines the use of the Haar Cascade Classifier and LBPH to create a face recognition model. Python programming language was successfully used for the development of this study for attendance marking. Observation as to the number of sample images found problems in using a smaller datasets representation. Although there were errors obtained as to recognition in trial 1 and trial 2, the challenge was given attention by increasing the number of sample images used for training. The system also successfully generated relevant information saved in a CSV file, needed for attendance monitoring. The evaluation of the system marked 95% in mean recognition accuracy, evidently proving a reliable and robust attendance marking using computer vision.

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