Face Recognition for a Student Violation Point System in Schools Using the Fisherface Algorithm

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Abstract. The violation point system is one of the policies to increase discipline in schools. If a student commits a violation, then the student will be processed by the teacher and record the violation into the violation note held by each teacher. If a student's violation record is contained in the notebooks of several teachers, it will be difficult to recapitulate the violations committed by students. This study makes a system approach and development that can centrally record student violations that run on the Android platform. To facilitate student recognition, the system is made using face recognition. Face recognition is implemented into this research because data retrieval can be done in real time with an Android smartphone camera so there is no need for additional devices. Face recognition uses the Fisherface method, which is a facial recognition method that uses Linear Discriminant Analytics for its feature extraction process. The accuracy obtained from the research is 90%.

1. Introduction

Every school has several rules that must be followed. However, there are also not a few students who violate the rules that have been made. Students who commit violations must be held responsible for their actions. Schools have their respective policies in taking action against their students.

One of them is the credit point system. However, recording violations has problems in recapitulation because it is done manually and not centrally. When you want to recapitulate the administration, you will check many books listing violations that take a long time. Manually recording violations also has problems with the appropriateness of writing violations. In a survey conducted by Uyub [1], the points of violation given by the teacher according to the size of the mistakes made by students, it was noted that students who always chose as many as 17 people or 26.2%, who often chose as many as 7 people or 10.8%, chose sometimes as many as 30 people or 46.15%, rarely as many as 9 people or 13.84%, never as many as 2 people or 3.1%. Therefore, a centralized recording system is needed and can determine points automatically. Another weakness of the manual violation point system is that the teacher does not recognize all students in school.

Facial recognition is a technology that is being used a lot these days. Previous research on facial recognition has only reached facial recognition. In this paper, we will make an innovation for a violation point system that applies face recognition to make it easier to find student data because it can replace the input id which has to remember the id or name of the student into face recognition on the camera.
without having to remember the id of the student. Based on the above problem, the writer made a research entitled "Face recognition for violation point system using fisherface".

Due to the difficulty of recording and recapitulating violations manually and the difficulty of recognizing all students, a system is needed that can take notes easily using an android smartphone that implements face recognition to facilitate student recognition.

2. Related Research

There are several face recognition studies that use fisherface algorithms. Leo [2] used a fisherface algorithm to recognize the faces of 20 students. The data used is as much as 20 for training and as many as 20 for testing. The results of this study produce an accuracy of 85%. Amri and Talita [3] detected faces using the Fisherface method to support the academic system. Putra [4] conducted a face recognition research using fisherface and 3 classification methods, namely; euclidian distance, square distance and canberra distance with the best accuracy on the square distance classification with an accuracy of 91.2% on the yaleface dataset. Samet [5] conducted a facial recognition research for the student attendance system. In this study, facial recognition was carried out by changing the maximum Euclidean distance. The distance is determined between 250 and 700. Arisandi et al [6] conducted a real-time facial recognition research using local binary patterns as a method for the process of detecting faces and detecting eyes. The fisherface algorithm is used as a method for facial recognition for pre-processed data. The accuracy of face detection is 100% and the accuracy for face recognition is 90%. Rahmat et al [7] conducted a facial recognition is in real-time using the fisherface method to improve the security system of a car when the engine is still on with an accuracy of 83.04%. This research, the author wants to implement face recognition in previous research into a violation recording information system. The violation recording system becomes easier than recording violations manually.

3. Methodology

In this research, there are several steps starting from the image acquisition process, pre processing, the detection process, face recognition, and violation records. For details, it can be seen in Figure 1.

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Figure 1. General architecture.
3.1. Grayscaling
Grayscaling is the stage where the image will be turned grayish by presenting the RGB (Red, Green, Blue) color which is changed to grayish. The grayscaling process aims to reduce the standards that will be used for the next process so as to simplify the next process.

3.2. Viola-Jones Face Detection
In this section the system will detect the faces contained in the image. In this method, a training data model has been provided to distinguish whether or not a face is present in the image. The face that is in the image will be cropped for processing to the next stage. Opencv has available a Viola-Jones model that has been trained. The model is saved in the file "haarcascade_frontalface_alt" of type xml.

3.3. Histogram Equalization
Histogram Equalization is by widening the histogram, so that the pixel difference becomes higher. So that information becomes more solid and can be seen in plain view of the information provided.

3.4. Bilateral Filtering
Bilateral filter is the process of refining and sharpening the image. This process restores the broken edges from the previous process [8].

3.5. Fisherface Feature Extraction
The Fisherface method is a combination of pattern grouping methods using PCA (Principal Component Analysis) and LDA (Linear Discriminant Analysis). The LDA used is its development, namely FLD (Fishers Linear Discriminant) which is an example of a class-specific method. Fisherface is available in the OpenCV library which requires pre-processed images as input. The results of this process will produce the LDA value and label for each class in the training data. The results will be saved into a file with the yml extension. The file is a learned model that will be used for the facial recognition stage.

3.6. Face Recognition
Face recognition is the stage of determining the class of testing data by finding the Euclidean distance between the LDA values stored in the learned model and the testing data to be tested. The output of this process will display student data from the face data being tested. In addition to student data, facial recognition produces a confidence value, namely the Euclidean distance value from the test. The smaller the distance, the testing and training face images are more similar.

3.7. Violation Input
Violation input is the user stage to enter violations that have been committed by students who have been recognized in the previous stage. Input of violations is carried out by checking past violations that have been committed by students. After selecting the violation, there is a confirmation page to make sure the input is correct. If it is confirmed, the violation has been recorded in the database.

3.8. Violation Summary Display
This stage is the stage to display all violations that have been committed by students.

4. Result and Discussion
In this study, 60 data were tested. And carried out in two stages, namely testing for face detection and testing for facial recognition.

4.1. Face Detection Test
Face detection is declared successful if the image will automatically crop only the face. And it is declared wrong if the image is not cut off at all. The results of facial recognition testing can be seen in Table 1.

Table 1. Face detection test.
Level of Accuracy = \( \frac{\text{amount of correctly recognized data}}{\text{total data count}} \times 100 \)

= \( \frac{60}{60} \times 100 = 100\% \)

Based on the above calculations, the accuracy value of student face recognition using the Viola-jones algorithm gets an accuracy of 100 percent.
4.2. Face Recognition Test
Face recognition is correct if the displayed output is the same as expected. Conversely, if the displayed output is not the same as the expected output, face recognition will be declared wrong. In this study, the maximum confidence value is 3000. If the confidence exceeds 3000, the face image is not recognized and is considered wrong. The results of facial recognition testing can be seen in table 2.

Table 2. Face recognition test.

| No | Citra | Expected Output | The Resulting Output | Information |
|----|-------|-----------------|----------------------|-------------|
| 1  | Fazar Abdullah | Fazar Abdullah | True | |
| 2  | Fazar Abdullah | Fazar Abdullah | True | |
| 3  | Dewi Irmayani | Unrecognized | False | |
| 4  | Dewi Irmayani | Unrecognized | False | |
| 5  | Putri Raudah Sofa | Putri Raudah Sofa | True | |
| 6  | Putri Raudah Sofa | Putri Raudah Sofa | True | |
| 7  | Siti Afifah | Siti Afifah | True | |
| 8  | Siti Afifah | Siti Afifah | True | |
| … | … | … | … | … |

In facial recognition testing, the system is able to recognize 54 facial images correctly. Six errors in facial recognition due to the resulting confidence exceeding 3000 resulting in an “unrecognized face” output.

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\text{Level of Accuracy} = \left(\frac{\text{amount of correctly recognized data}}{\text{total data count}}\right) \times 100
\]

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= \frac{54}{60} \times 100 = 90\%
\]
Based on the above calculations, the accuracy value of student face recognition using the Fisherface algorithm gets an accuracy of 90 percent.

5. Conclusion
After carrying out the stages of implementation and testing, several conclusions will be drawn in this research, including:
1. The difference in the light on the camera can affect the recognition result.
2. Face detection using the Viola-Jones Algorithm has an accuracy of 100 percent.
3. Face recognition using fisherface gets 90 percent accuracy.
4. The system for recording violation points can work well.

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