

Implementation of Deep Learning Using Convolutional Neural Network For Face Recognition System (Implementation in PT.Telkom Akses TREG 3 WITEL Bandung Divisi IOAN Sektor Lembong)

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Abstract:- The field of Artificial Intelligence especially face recognition is currently widely used in various fields, one of them for attendance using facial recognition. PT. Telkom Access Lembong Branch is a private company where the attendance system has not used a face recognition system so that it needs to be applied facial recognition system to increase the effectiveness of attendance and accuracy of attendance. This research aims to implement a deep learning field using the Convolutional Neural Network (CNN) method to make a facial recognition attendance system. The CNN method is used because it has proven well in some previous studies with good enough accuracy to detect faces, the implementation of the CNN method applied with the Python programming language. The result of this research is an attendance system with Android-based face recognition with incoming attendance features. When the face is detected then the system will take the employee name along with the hours of entry. This application will be implemented in PT. Telkom Access Lembong Branch.

Keywords:- Component; Facial Attendance System; Convolutional Neural Network; Python For Android.

I. INTRODUCTION

In recent years, face recognition system as a biometric identification technology has become a hot topic, particularly within the field of pattern recognition. Within the study of biometric identification, the additional widespread technique of biometric identification ways will be summarized in many ways, supported geometric, supported statistics and supported neural networks [7]. Face recognition system has been widely used in domestic and foreign companies to facilitate a system process one of them is an attendance system that already uses face detection. Pt. Telkom Access TREG 3 WITEL Bandung Division IOAN Sector Lembong is one company located in Bandung.

The company is still doing a fingerprint attendance system. The fingerprint system is given enough in terms of attendance, but according to the head of the IT section in PT

need to add Image detection for attendance system to make it easier for employees to do attendance. Needs owned by PT. Telkom Access TREG 3 WITEL Bandung Division IOAN Sector Lembong makes the author propose a face detection system by implementing Deep Learning.

A method that can be used in deep learning is one of the neural networks. The Neural network may be used not solely on face detection however also can be in use in facial identification, many different neural networks are used to detect and identify faces to enhance the introductory effect of one of them and the Convolutional Neural Network (CNN) [2]. The Artificial Neural Network (ANN) is an enormous, parallel distributed processor that has a tendency to store knowledge that is in the experience and makes it ready to use, ANN has a very large.

Parallel structure and has the ability to learn so that it is able to do generalizations, which is to produce the correct output for inputs that have never been trained [3]. The rapid development of the hardware development of ANN developed until the invention of CNN.

The Convolutional Neural Network (CNN) is one in each of the deep mastering ways which will be wont to find a virtual icon object, deep mastering is a sub of system mastering. Basically deep mastering is an implementation of system mastering that implements ANN's set of rules with greater layers. These previous couple of years deep mastering has proven notable performance. It is stimulated with the aid of using sturdy computing, big records sets, and strategies to educate deeper networks [6].

The Convolutional Neural Network (CNN) is made forward that the inputs used square measure pictures. This network encompasses a special coating named with the convolution layer wherever the input image is processed supported the predefined filter. From every layer, this can manufacture a pattern of some components of the image which will later be easier to classify. This system will build the image learning perform additional economical to implement [6].

Research using CNN has already done much for example a study implementing CNN to detect power transformer equipment [5], another study using CNN to improve underwater images [9]. The author proposed a CNN method on this study looking at pretty good accuracy from previous research when implementing CNN's methods. The CNN method was created with the Python programming language using the hard and Tensor flow libraries. As the dataset used is a private dataset which takes pictures of employees from 5 different positions.

The stages of this research include 1) The collection of Datasets, 2) the manufacture of CNN models using Python 3) Implementation of models on Android-based applications, 4) testing. The result of this research is an Android application for attendance at PT. Telkom Access Lembong Branch.

II. BASIC ELEMENTS OF CNN

A. Deep Learning

Deep Learning is one of the areas of machine learning that utilizes neural networks to implement issues with huge datasets. Deep learning techniques give a powerful vogue for supervised learning [4].

By adding any layers then the tutorial model will higher represent the labeled image information. In machine learning, there are techniques to use the extraction of features from the training data and specific learning algorithms to classify imagery and to recognize sound [4].

However, this technique still has some smart flaws in terms of speed and accuracy. The idea application of deep neural networks (many layers) will be suspended on existing Machine learning algorithms so that computers will currently learn with nice speed, accuracy, and scale [4].

This principle continues to develop until deep learning is progressively being employed by analysis teams and trade to unravel several issues in huge knowledge like laptop vision, speech recognition, and tongue process [4].

Feature Engineering is one in every of the most options of Deep Learning to extract helpful patterns from the knowledge that may create it easier for the model to tell apart categories. Featured Engineering is additionally the foremost vital technique for achieving smart leads to prognostic tasks. However, it's troublesome to find out and master as a result of totally different completely different knowledge sets and knowledge varieties need different techniques approaches additionally.

The rule employed in Feature Engineering will realize a standard pattern that's vital to differentiate between Deep Learning categories, the CNN technique, or the Convolutional Neural Network is nice at finding sensible options on a representational process to successive layer to create nonlinear hypotheses that may increase the complexity of a model. Twenty one a posh Model will need long coaching time so within the world of Deep Learning GPU use is extremely common.

B. Convolutional Neural Network

The convolution nerve network is also a representative network structure in deep learning and has become a hotspot among the sector of analysis and image recognition [1].

The weight sharing of the tissue structure makes it additional like the biological neural network that reduces the quality of the network model and reduces the quantity of weight. The advantage of this system is that the network input is additional obvious once flat input, that the image of the input bias on to the network, that avoids the extraction of advanced choices and reconstruction of information in ancient recognition algorithms [1].

The product network is also a multilayer perceptron designed specifically to identify two-dimensional forms that disagree greatly from the interpretation, scale, slope or another kind of deformation.

The necessary plan skeleton of the convolution nerve network is that the Perceptron native area; serious sharing; spatial sampling. The 3 characteristics of CNN is that the distortion of the input file within the house is extremely sturdy. CNN typically uses a convoluted coating and a consecutive ordered layer of samples, that is, the layers of a continuing layer area unit associated with the testing layer, the examining layer followed by the disarray. Associated with the testing layer, the examining layer followed by the disarray.

This convolution layer is for extracting options so combined to create a lot of abstract options, finally, forming an overview of the image object characteristics. CNN might also be followed by a connected coating. After you begin coming up with CNN, the primary step is to outline range the amount the quantity of layers and also the number of filters in every layer [8].

Typically, CNN has quite simply a convolution layer (in short), however, we'll begin victimization simply this layer. You'll be able to take a look at yourself to unravel such issues. First, the convolution layer investigates the building blocks of the form structure we tend to unit of measurement looking for. So, the primary question to spice up yourself is what's special in terms of a quadrangle compared to triangles and circles [8].

A parallelogram has four sides, 2 vertical sides, and 2 horizontal sides. We tend to might take pleasure in this info, however, we tend to ought to put together note that the properties contained within the quadrangle cannot exist within a different kind. Different forms have already got completely different properties. Neither of the other two shapes has two horizontal and a pair of vertical edges. Typically this can be often sensible. The following question is that thanks to producing the convolutional layer to acknowledge the presence of edges. Remember that CNN begins by recognizing several elements of a form and then combining them into a single unit. So we are not looking for the location of the four sides or looking for the location of the two vertical parallel sides and the two parallel horizontal

edges of the rectangle, but to able to determine the vertical or horizontal edges. So, the question becomes a lot of specific. However, will we tend to acknowledge a vertical or horizontal edge? This may be done employing a gradient.

The first layer can have a filter that appears for the horizontal facet and another for the vertical facet. This filter is shown in Figure one as a 3×3 matrix. So, we are going to skills several filters to use within the 1st convolutional layer also because of the performance of this filter. 3×3 size is used for filters because of its good size because of the clear horizontal and vertical side structures.

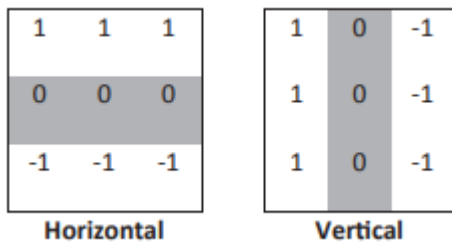


Fig. 1:- Filter to recognize the horizontal and vertical edges of 3×3 .

After applying the filter over the matrix on Figure 1, the convolution layer is going to be able to contain vertical sides in Figure two and horizontal sides in Figure three. This layer is in a position to acknowledge horizontal and vertical edges within the parallelogram. It conjointly acknowledges the horizontal edge at the bottom of Triangular. However, there aren't any sides within the circle. At the instant, CNN has 2 candidates to be rectangular that a kind that has a minimum of one facet is. Even though the third shape cannot be rectangular, CNN must still apply it to the other layers until it makes a decision on the last layer, because using two filters in the first convolutional layer will produce two outputs, one for each filter.

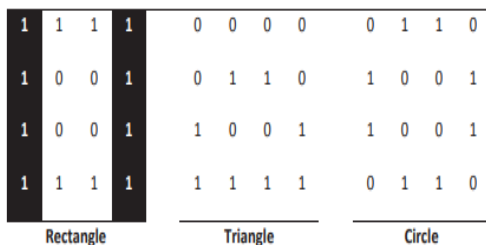


Fig. 2:- The recognized vertical edges are black.

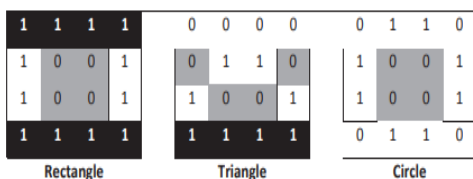


Fig. 3:- The recognized horizontal edge are black.

The next convolutional layer will receive the result from the first convolutional layer and continue accordingly. Let's repeat an identical question that was asked within the initial layer. What number of filters are used and what's their structure? Supported the oblong structure, we discover that every aspect is connected to the vertical aspect. Since there are 2 horizontal sides, this needs the employment of the 2 filters in Figure 4 of 3×3 size.

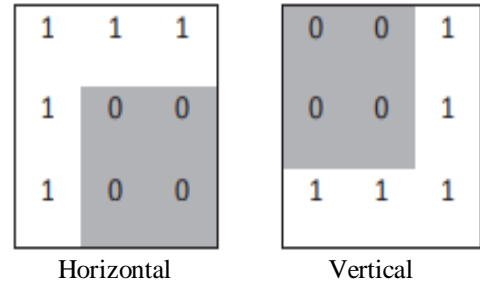


Fig. 4:- Filter to recognize horizontal and vertical connections at 3×3 edges.

After applying the filter to the resulting first convolution layer, the results of the filters utilized in the second convolution layer area unit shown in Figure 5 and Figure 6. supported the oblong form, the filter will notice 2 different sides and connect them. in an exceedingly triangle, there's just one horizontal edge with no vertical edges connected to that. As a result, there's no positive output for the Triangle.

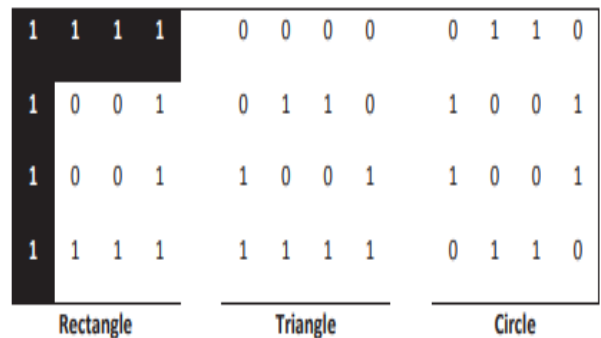


Fig. 5:- The results of the first layer filter are black.

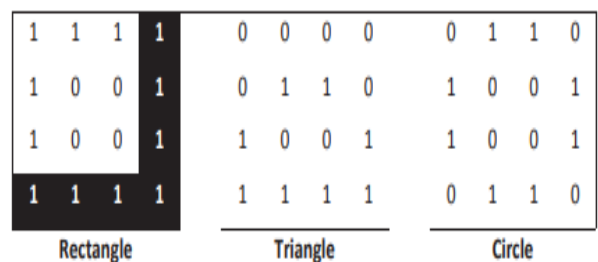


Fig. 6:- The results of the second filter in the second layer are black.

III. RESEARCH METHODOLOGY

1. How the Model Works

The workings of the model are explained in figure 7.

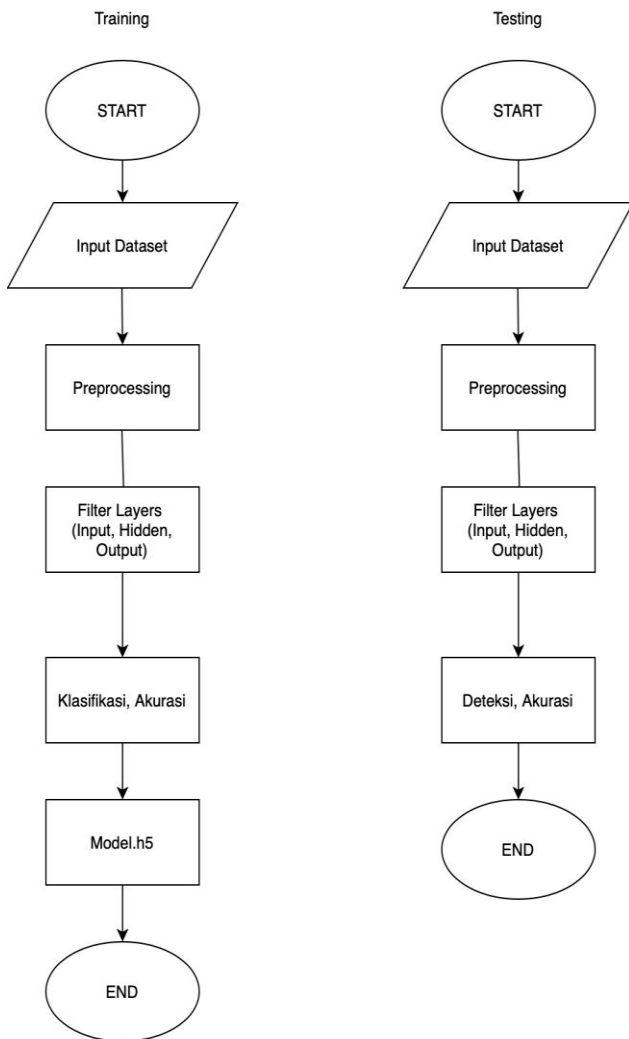


Fig. 7:- How the Model Works

Figure 7. Explains the workflow of the model created, namely the training phase and the testing phase. The training phase is the stage carried out to train the program to be able to recognize the type of face that will be detected later. The training process includes the input dataset where the dataset will later be taken 60% face data. After inputting the dataset, the preprocessing process is carried out by removing unnecessary random pixels. After preprocessing, filter layers are presented in the form of input, hidden and output filters where each filter has a node. The output filter amounts according to the number of face classes. The filtering layer process will produce a classification and accuracy process. After all, processes are modeled, the process is saved with the file name model.h5 to be tested in the testing phase.

The testing phase is the stage needed to test the model, at the testing stage the dataset is used as much as 40% or the rest of the training stage. The next process is still the same as the training stage, namely preprocessing and filtering layers. These processes are carried out by basing on the

model.h5 that was created at the training stage. After all, steps are completed, a detected face and accuracy will appear.

A. Data Collection

The data used in this research is data that the authors collect from the environment where the research is conducted. The data is in the form of photos of employees from 5 different sides. The number of employees is 35. So the total number of datasets in this study is 105 images. The following sample dataset in this study is in figure 8.



Fig 8:- Dataset

B. Model Making

This study uses the Convolutional Neural Network model, where the model is built using the Python programming language with hard back end and tensor flow. The way CNN works is dividing the data into input layers, hidden layers and output layers. Python acts as a programming language that builds the concept of how the CNN works.

C. Implementation Model

The CNN model is implemented through two stages, namely the training phase and the testing phase. At the training stage the program is given image data that has been classified based on the employee's name. The number of classes at the time of the training was 35 classes according to the number of employees. The training process was carried out by 30 epochs with a batch size of 64.

After going through the training phase, the testing phase is carried out to test the models that have been trained, the testing process. Was made. With the Python programming language.

D. Application of Models in Applications

After the model is created, the model is applied to the application. The application used is based on Android. Android is considered to be one of the right applications in facilitating the attendance process. The programming language used in making this application is the Java Language and the model created is implemented in Java using the API for python logs.

E. Testing

Testing is done by testing the employee absenteeism on the application.

IV. DISCUSSION

A. Metode Convolutional Neural Network

The face detection process uses CNN, with several stages:

1) Image is divided into pixels

The dataset that is needed and will be used by the CNN method will first be checked for width and height. Once the size is known, the image will go through a filtering process, this process is divided into several images. For example divided into 8 blocks x 100 PX.

The filtering process is to remove features that are considered unnecessary.

2) Detection process

During the input layer process, CNN provides layers for the dataset. This research determines the number of layers using Dense. Dense is a CNN feature that can be used in the Python programming language.

After determining the number of input layers, then there is the filtering process in hidden layers. The number of hidden layers can be determined by the researcher. Researchers use the MaxPooling1d code on hard python to make hidden layers. Dropout is used to remove layers that are not important. After the Dropout, Activation is then used to detect faces in the dataset.

In the Convolutional Neural Network (CNN) method, there are steps to determine the input layers, hidden layers, and output layers. Dense is the determination of input layers, hidden layers and output layers. Dropout is a function to eliminate unnecessary dense. The accuracy process is determined by the activation function. There are three types of activations namely Sigmoid, Relu and Softmax. Following are the results of the accuracy of Image detection with the employee dataset PT. Telkom Access TREG 3 WITEL Bandung IOAN Division of the Lembong sector using the CNN method in figure 9.

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31/31 [=====] - 88s 3s/step - loss: 0.044 - acc: 0.728
Epoch 21/30
31/31 [=====] - 89s 3s/step - loss: 0.043 - acc: 0.708
Epoch 22/30
31/31 [=====] - 88s 3s/step - loss: 0.079 - acc: 0.804
Epoch 23/30
31/31 [=====] - 88s 3s/step - loss: 0.091 - acc: 0.657
Epoch 24/30
31/31 [=====] - 88s 3s/step - loss: 0.032 - acc: 0.774
Epoch 25/30
31/31 [=====] - 88s 3s/step - loss: 0.044 - acc: 0.824
Epoch 26/30
31/31 [=====] - 88s 3s/step - loss: 0.036 - acc: 0.713
Epoch 27/30
31/31 [=====] - 88s 3s/step - loss: 0.000 - acc: 0.859
Epoch 28/30
31/31 [=====] - 88s 3s/step - loss: 0.015 - acc: 0.829
Epoch 29/30
31/31 [=====] - 89s 3s/step - loss: 0.009 - acc: 0.839
Epoch 30/30
31/31 [=====] - 89s 3s/step - loss: 0.002 - acc: 0.818
    
```

Fig 9. Accuracy results with 30 epochs.

In the application of CNN for this face attendance system, obtained an accuracy of 0.81 where this accuracy is said to be good enough for detection from previous studies. To improve accuracy, changes in the number of epochs can be made. Epoch is the number of times the machine has been trained.

3) These tools are used to create android-based applications.

After making the model using the Python programming language. Furthermore, the model will be implemented in Java programs. Tools used by the author include:

- Android studio
- SDK
- JDK
- Gradle

➤ These tools are used to create android-based applications.

The following is the user interface or appearance of the attendance system android application on PT Telkom Access Lembong Branch.

a) Timesheet page



Fig. 10:- Absent Page.

b) Settings page

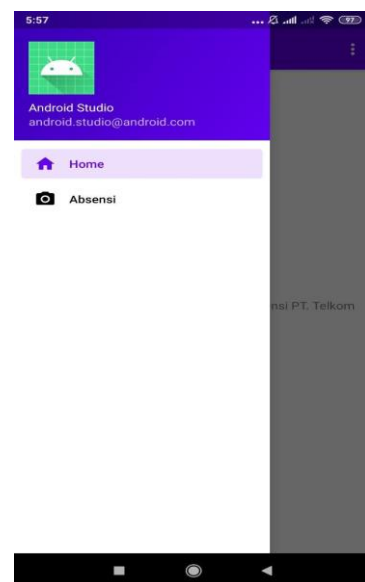


Fig. 11:- Settings page.

c) *Testing Scenarios*

The following is a test scenario in this study:

Scenario	Expectation	Results
The user directs his face at the camera to enter face data	The system stores employee name data	appropriate
The user directs other things besides the face on the camera to make attendance	The system will not detect faces	appropriate
The user directs the face at the camera to make attendance	The system detects faces and saves attendance and hours of entry	appropriate
The user directs the face at the camera and does time attendance again	The system will detect duplicate absences and delete last absences	appropriate

a. *Testing scenario*

d) *Test results*



Fig. 12:- Test results.

The application successfully made attendance, using the absentee pop up successfully.

V. CONCLUSION AND FUTURE WORK

A. *Conclusion*

The purpose of the authors conducting this research is to replace the fingerprint detection attendance system that has been previously applied at PT. Telkom Akses, becomes an attendance system with face recognition. In this study, the authors get a pretty good accuracy of 80%. Even so, the author is not satisfied with the results obtained, because the attendance system in the company must have 100% accuracy results where the attendance results will be decisive in the employee payroll system.

B. *Future Work*

This research needs to be refined to increase the effectiveness and benefits of this application as an attendance tool at PT. Telkom Akses, the authors agree to the researchers further approved are:

- For further research increasing the number of datasets and variations in taking face photos, face photos can be added to 10 photos on 1 person with different selections and expressions.
- Increase accuracy by training CNN repeatedly with more datasets getting accuracy results above 90%.
- Do as much testing as possible on finding the effect of light intensity on the output produced.

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