

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

This chapter explain about the detail of the research methodology to answer question number one that listed in problem formulation. This chapter include with the explanation about how to conduct this project. There are several steps to get this project done.

#### **3.1 Research Process**

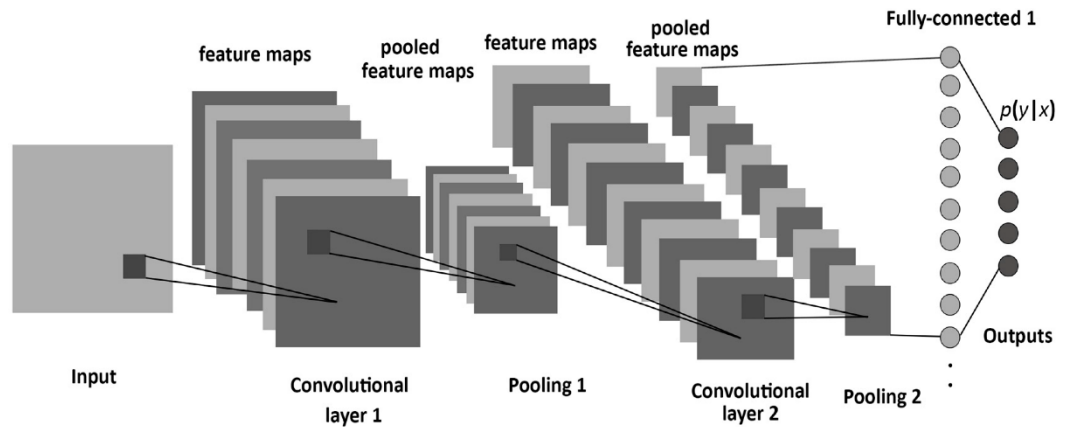
This first step, how convolutional neural network work for face detection. This project need to search many article and tutorial about CNN that already done by implementation in many condition such as, student attendance, staff attendance and many other things that same with this condition.

#### **3.2 Collecting Datasets**

Datasets for this project are already collected from my family photos and friend, for the description are family for family photos and stranger for friend photos. This already collected more or less 500 photos of family and friend photos before we continue to the next step which is Convolutional Neural Network process.

#### **3.3 Convolutional Neural Network**

In this next step, this research study how convolutional neural network work for face detection. Convolutional Neural Networks combines three architectural points, local receptive fields, shared weights, and the spatial subsampling in the form of pooling. Convolution is a matrix that serves to filter. In the process of filtering there are two matrices, namely matrix in the value input and matrix kernel. In Convolutional Neural Network There are several layers that serve to perform filters that have been set during the training process namely Convolutional Layer, Pooling Layer, and Fully Connected Layer. This is the architecture of Convolutional Neural Network.



Convolution Layer has several parameters, kernel size, skipping factors and connection table. The Kernel in CNN always shifts against the area in the input image, while skipping factor is the number of pixels shifting in the kernel.

$$M_x^n = \frac{M_x^{n-1} - K_x^n}{S_x^n + 1} + 1; M_y^n = \frac{M_y^{n-1} - K_y^n}{S_y^n + 1} + 1$$

Which are :

$M_x, M_y$  = Size of the feature maps

$S_x, S_y$  = Skipping Factors

$K_x, K_y$  = Size of the kernel

$n$  = The location of the layer during the process

The purpose of the pooling layer is to reduce the resolution of the maps feature. In the pooling layer, there are several operations such as: Max Pooling and average pooling. The new resolution of the feature maps max pooling can be obtain with:

$$a_j = \max_{N \times N} a_i^{n \times n} \mu(n, n)$$

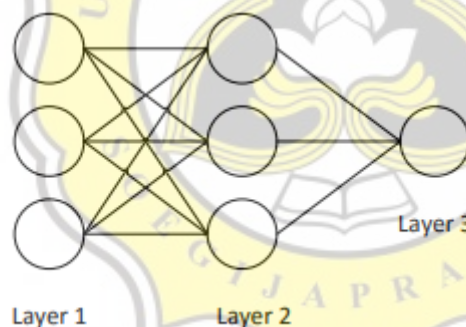
Which is :

$a_j$  = value from pooling map

$a_i$  = value from input map

$\mu(n, n)$  = window function

Fully Connected Layers connect each neuron from Layer to other Layer. Here is the example of fully connected layers:

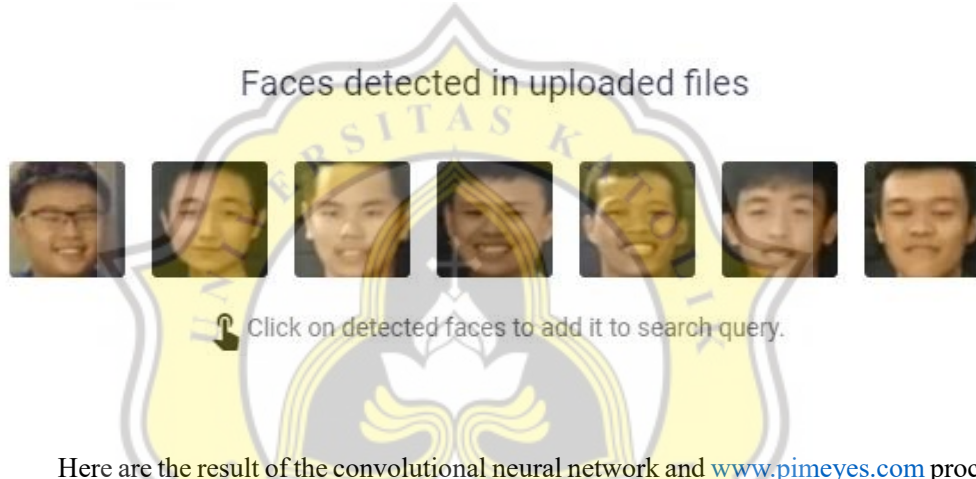


This convolutional neural network is work for looking the face picture in whole of picture, but it's not just using this method for looking the face I also using [www.pimeyes.com](http://www.pimeyes.com) for looking face in my datasets. This engine is very useful for my research when there are more than one face that detected in one picture.

Pimeyes is an engine that used to find people with similar faces. Pimeyes analyze million websites to provide the most accurate search result, but I only use this tools just to detect face that existing in my datasets. Cause this engine can detect many faces that located in 1 picture. For examples this photo consist many face:



By using [www.pimeyes.com](http://www.pimeyes.com) we can get the result like this picture below:

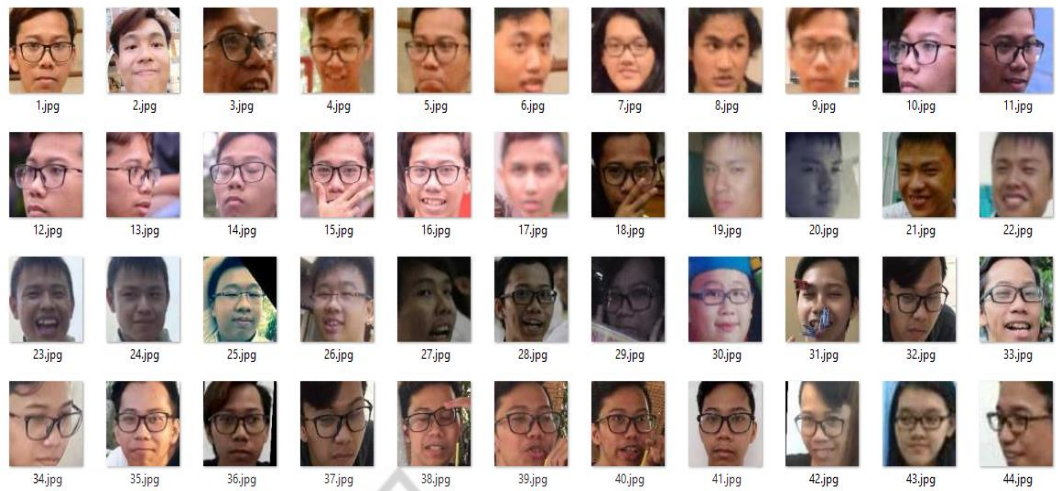


Here are the result of the convolutional neural network and [www.pimeyes.com](http://www.pimeyes.com) process:



Result of the family member that already done by convolutional step





Result of stranger that already done by convolutional step

### 3.4 Training

This section is useful to train the result of the dataset that already done by convolutional neural network process. We can train the result of the dataset that already done by convolutional neural network to give the label or description which person that detected by the camera, is it a family member or a stranger.