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Pelican crossing system for control a green man light with predicted age

Purnawarman Musa[1], Eri Prasetyo Wibowo[2], Saiful Bahri Musa[3], Iqbal Baihaqi[4]
[1,2,4]Gunadarma University, Indonesia
[3]Gorontalo Polytechnic, Indonesia

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ABSTRACT

Traffic lights are generally used to regulate the control flow of traffic at an intersection from all directions, including a pelican crossing system with traffic signals for pedestrians. There are two facilities for walker crossing, namely using a pedestrian bridge and a zebra cross. In general, the traffic signals of the pelican crossing system are a fixed time, whereas other pedestrians need "green man" traffic lights with duration time arrangement. Our research proposes a prototype intelligent pelican crossing system for somebody who crosses the road at zebra crossings, but the risk of falling while crossing is not expected, especially in the elderly age group or pedestrians who are pregnant or carrying children. On the other hand, the problem is that the average step length or stride length (distance in centimeter), cadence or walking rate (in steps per minute), and the possibility of accidents are very high for pedestrians to make sure do crossing during the lights green man. The new idea of our research aims to set the adaptive time arrangement on the pelican crossing intelligent system of the traffic lights green man based on the age of the pedestrians with artificial intelligence using two combined methods of the FaceNet and AgeNet. The resulting measure can predict the age of pedestrians of the training dataset of 66.67% and testing prototype in real-time with participants on the pelican crossing system of 73% (single face) and 76% (multi faces).

Corresponding Author:

Purnawarman Musa,
Department of Electrical Engineering,
Faculty of Industrial Engineering, Gunadarma University,
Email: p_musa@staff.gunadarma.ac.id

1. INTRODUCTION

Traffic volume is defined as the number of vehicles passing at a point on a road segment or in a lane during a specific time interval [1]. Traffic flow is the number of cars that pass a road point per unit time [2], expressed in vehicles/hour. The relationship between vehicle volume and traffic flow can sometimes cause a traffic jam. According to [3], traffic congestion is a common problem caused by heavy traffic at an intersection. Therefore, it is necessary to build a flyover at the intersection. Nevertheless, another problem is the loss of rights for other users who do not use motorized vehicles, such as pedestrians and cyclists. Control of a traffic jam can be attempted by regulating traffic density for motorized vehicles by regulating traffic flow from all directions by placing traffic lights [4]. According to [5], traffic lights are all traffic control equipment that uses electricity except light flashes, signs, and road markings to direct or warn motorized vehicle drivers, cyclists, or pedestrians.

Every traffic light installation is intended to function as follows:

1. Manages the use of traffic lanes and regular traffic movement,
2. Increase traffic capacity at crossroads,
3. Reduces the frequency of certain types of accidents,
4. Coordinates traffic under conditions of distance, and the traffic flow continues to run at a certain speed,
5. Cut off high traffic flow to make it possible for other vehicles, trains, pedestrian crossings, and the passage of emergency vehicles (Ambulance) or on a motion bridge,
6. Control the road meeting at the entrance to the freeway resistance.

One of the indications for urban cities to experience an increase in the economy is public traffic activities such as pedestrians. As a result, the government has provided facilities for pedestrians to walk more safely and comfortably, including the availability of a pelican crossing system. Therefore, an urban city develops techniques and technology such as integrated computer vision for visual perception, such as image acquisition, image processing, recognition, and decision making. Computer vision can imitate how it works like human vision and is very complex [6–8]. For this reason, computer vision has a high level of ability as human visual. Those abilities include:

1. Object detection: An object and interpreting motion in the scene.
2. Recognition: A label on the object.
3. Description: Assign properties to objects.
4. Inference: Interprets the 3D scene from the 2D view or otherwise.

In general, people walk on pedestrian paths either on the side of the road, sidewalks, particular paths for pedestrians, or crossing the street. Hence, the problem of safety between pedestrians and vehicles as road users, consequently, to protect pedestrians in traffic, pedestrians' requirement walks on the road and cross at the crossing provided for pedestrians.

The Government of Indonesia, represented by the Director-General of Highways, based on the traffic regulation decree No. 76/KPTS/Db/1999 dated December 20, 1999, concerning pedestrian paths is a path intended for walking. Pedestrian paths can be sidewalks, level crossings (zebra crossings or pelican crossings), and non-level crossings (bridge and tunnels) [9]. The general principle of pedestrian facilities has the following characteristics to meet the rules for planning pedestrian facilities [10] :

1. Perform system integration aspects, including environmental arrangement, transportation system, and inter-regional accessibility.
2. Satisfy the element of continuity, namely combining the source's location to the destination's location and vice versa.
3. Answer the aspects of safety, security, and comfort.
4. Adhere to the aspect of accessibility, where the planned facilities must be accessible to all users, including users with various physical limitations.

Zebra Cross is a crossing facility for pedestrians on a level equipped with signings to provide firmness or boundaries in carrying out the trajectory [11]. Zebra crosses are placed on roads with relatively few crossing flows or vehicle flows when pedestrians can still quickly get a safe opportunity to cross with the following conditions:

1. Zebra cross on roads with relatively low traffic flow, traffic speed, and pedestrian flow.
2. The location of the zebra cross must have sufficient visibility that anticipated vehicle delays caused using crossing facilities are still within safe limits.

Pelican crossing is a tool that will complete a zebra crossing location with regulating lights for pedestrians and vehicles [12]. The phase for crossing is generated basis on time with a predetermined length of the time series, a request crossing with the action push.

The need for the existence of a pelican crossing can take place in the following locations:

1. Vehicle speed in very high traffic.
2. Public users perform a high crossing rate.

3. Location of the pelican crossing on the road near the intersection and an integral part of the traffic sign.

The research [13] explained that the zebra, pelican, toucan, and other pedestrian crossing buildings each have a community in supplying pedestrians priority over vehicles in the U.K. Therefore, the factors that affect accidents should be least over these crossing facilities occurrences at the pelican crossing and signalized pedestrian area in Scotland [14]. [15] proposes a domain adaptation of an RGB-trained detection network that significantly improves pedestrian detection performance in the thermal domain to solve two related tasks simultaneously.

In general, research conducted by other researchers proposes automatic traffic regulation by setting the duration of time for the traffic lights to turn on according to the density of vehicles or the occurrence of traffic jams [16], [17]. However, activation of the duration of the traffic light is only on the path that experiences traffic congestion. For lanes experiencing traffic congestion, the traffic light will set the red light (accelerated), and the green light will be on for a longer time. Elements of traffic users are not only motors, buses, and cars. Pedestrians are also an element of road users and take advantage of traffic facilities such as crossing the road. The problem often occurs when someone uses a pelican crossing time that is permanently fixed and not adjusted to pedestrian conditions, e.g., the number of people crossing, the steps of walk, or the condition of people walking as pedestrians.

The analyzed descriptive statistics on respondents' perceptions of the availability of crossing facilities and the ease of crossing the road. Research conducted by [18], pedestrian variables analyzed include crossing speed, gender, and level of compliance. Driver characteristics and facility conditions are also analyzed to determine differences between zebra crossings and pelican crosses. For example, according to [19] in a review study of the risk of crossing safety on pelican crossings based on the style and behavior of pedestrians, women are more likely to risk unsafe crossings than men. In addition, according to [20], pedestrians must understand the flow of crossing signals by vehicle users and pedestrians based on crossing priorities.

The researchers use computers as artificial intelligence to solve complex problems by following the human reasoning process. The presents research from [21] analyzes the average delays time pedestrian and the total to pedestrians at specific examples of pedestrian crossings of all three types (pelican, puffin, and toucan crossings) and signal-controlled junctions during peak periods using simple mathematical. Approach by research [22] is pedestrian detection that utilizes the performance of cascade classifiers with the precision of deep neural networks that cascade deep nets and fast features, which is both very quick and very reasonable.

In research concerning pedestrian detection implements the manager of a smart city [23], [24], another study by [25] uses two different cameras and proposes with convolutional neural network (CNN) classifier as an adaptive time arrangement system on a pelican crossing. Finally, the research by [26] uses some approaches and methods to design intelligent systems, which combine the specific pattern the pedestrian detection and the pattern standard for a pedestrian to describe in general terms the type of information with an object recognition algorithm.

The research by [27], intelligent devices are essential in helping and solving, for example, the tool traffic congestion. However, there are different requirements, especially for children, the elderly, physically impaired people, blind and pregnant women, and so forth. The study by [28] to find a gap by observing the pedestrian accidents in Malaysia is serious, especially child pedestrians (children aged 6 to 10 years old) were classified third after car and motorcycle-related fatalities, in which 40% of the casualties involved. The factor of the accident is children's behavior as pedestrians in traffic environments or when they are accompanied by adults while crossing the roads. According to [29], comparing older pedestrians' usual walking speed of pelican crossings is specified against that required by the Traffic Management Guidelines (TMG) in Dublin city with linear regression analysis between age and observed walking speed. The result of predicted walking speeds at four different ages (i.e., 60, 70, 80, and 89) against minimum walking speeds required to cross standard.

The pedestrian crossing is not from a particular age group but various ages, including the elderly and children. Changes in walking patterns in the elderly cause behavior towards the speed of steps from elderly parents or children, where their footsteps are not fast, so it takes longer to cross the road. Based on scientific studies and literature reviews, the authors propose a system design on the pelican crossing device, which aims to make it easier for pedestrians to cross the road and produce a sense of security for people to travel and the risk of accidents zero. In addition, the pelican crossing system uses a camera to take images and approach functions to predict the pedestrian's age with the AgeNet method.

Novelty, our research proposes the pelican crossing with the addition of the adapting automatic by times system on the base of the ages of prediction of the pedestrian. The adaptation arrangement time will adjustment detects the age of 5 years and under in the children category or the age of 50 years and over in the older ages category, then the pelican crossing will add the time of traffic light green man (ON) in the 30 seconds from the average standard time. The time will be an adjustment when the light green man is active, and for the first time, the system detects children (under five years) or older ages (over 50 years).

2. RESEARCH METHOD

This research implements an intelligent system-based pelican crossing light adjustment (a green man light) prototype in adapting crossing times based on human age prediction as a pedestrian. The system was simulated and adjusted traffic lights (a green man light) for crossing people based on the age classification of faces using the AgeNet method. The proposed research method for regulating the pedestrian crossing light system can be seen in Figure 1.

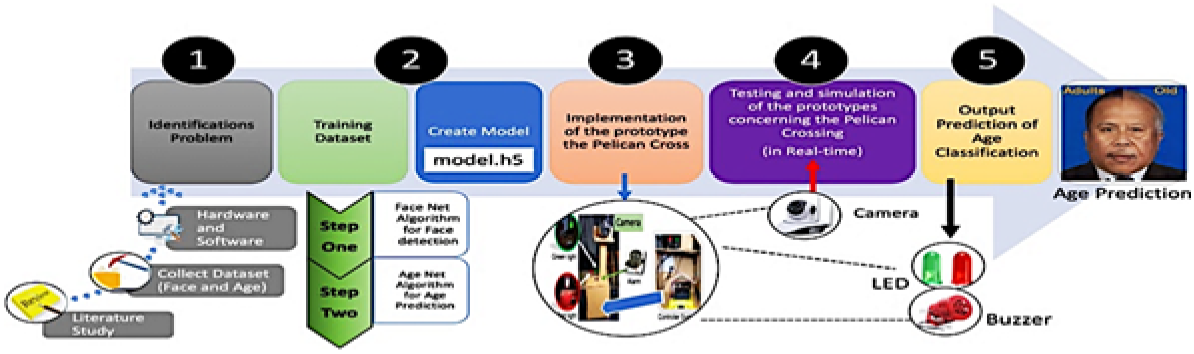


Figure 1. The research method of the pelican crossing system

The stages carried out in the research are shown in figure 1, namely:

1. Problem identification process
   The first stage as a whole is carried out by searching for books related to previous research and experimental results that have been published in several articles. In addition, the authors look for public data (datasets) that will be trained using the computer vision method. This stage also identifies and analyzes system requirements, such as hardware, software, and required libraries.
2. Process of training datasets and creating data models
   The research study used the training data set [30], which used the UTKFace dataset. UTKFace collects training data on large-scale faces aged 0 to 116 years in the five class datasets.

Table 1. Classification of the training dataset

Class Name	Number of Datasets	Categories	Ages (years)
Class 0	3650	Children	1-14
Class 1	3986	Youth	15-25
Class 2	9363	Adults	26-40
Class 3	4311	Middle age	41-60
Class 4	2397	Very Old	>61

Table 1 is training data totaling 23707 faces in facial images, including the ground truth of age, gender, and race are estimated through the DEX (Deep Expectation) algorithm and double-checked by a human annotator. The labeling of each face image from the training data is embedded in the file name in the following format.

(a) In Computer Vision, pattern recognition is a step that is carried out after image processing, such as human face identification. However, infrequent face recognition difficulties appear due to facial variability such as expression [31], aging, mustache variation, and so forth. Training dataset with FaceNet method in Figure 2 shows a face verification and recognition algorithm to learns the mapping from looks toward a class in a multidimensional area, anyplace the length separating attributes direct matches a pattern of face similitude [32].

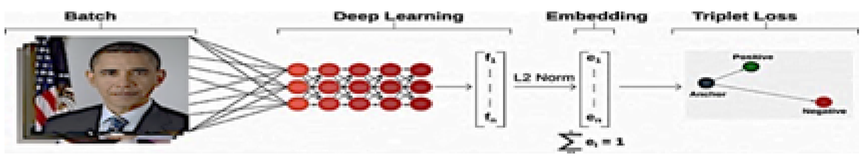


Figure 2. FaceNet method for face verification and recognition (Source: [33])

(b) The information contained on the face is age. Human age is a personal trait that the human sense of sight can infer by seeing different faces patterns. With age, the human face undergoes fundamental changes such as more wrinkles, changes in cheekbones, and the distance between the main features of the face, such as the eyes, nose, and mouth [34]. Therefore, the training dataset with the AgeNet method in figure 3 is represented an age estimation algorithm that can be predicted after face detection. In general, the following three steps are image pre-processing (landmark detection and face alignment), the second is features extraction (extracting the valuable features from the face image), and the last step is classification.

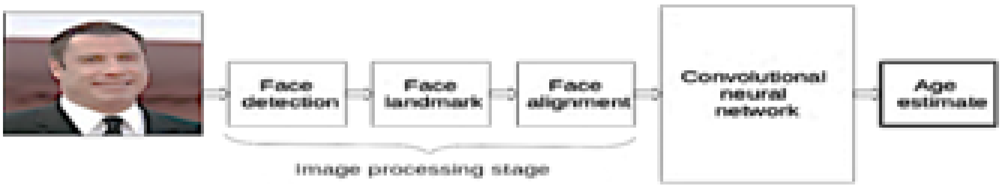
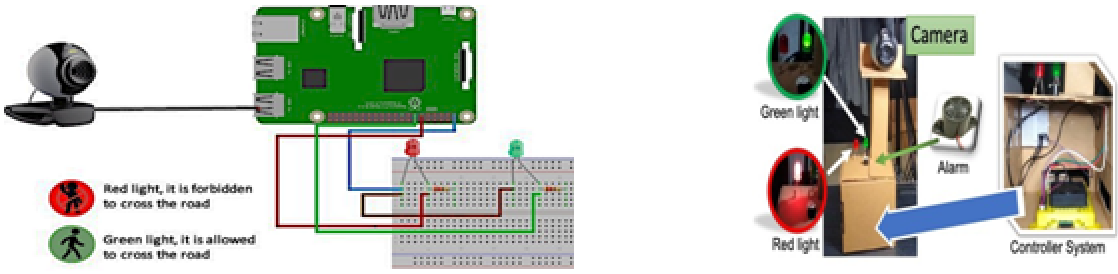


Figure 3. AgeNet method for age verification and recognition (Source: [35])

(c) It creates a data model when the results of the training data that have been done previously produce a good accuracy value.

3. Design and implementation of the prototype pelican crossing
The research step uses a descriptive method by simulating the activities of pedestrians crossing the road using pedestrian crossing facilities. Figure 4 is our proposed methodology of the research to implement an applied application to adapt the time of crossing actions based on the age of the pedestrians.



(a) (b)

Figure 4. The implementation of the pelican crossing system for predicting the pedestrian age, (a) Schematic, (b) Our Prototype

4. Simulation and testing on the pelican crossing system
The prototype is a representation of the working system on the pelican crossing. The architecture of the prototype (figure 5) of the design results in this study was carried out descriptively as the initial stage of testing and simulation with streaming video in real-time. Streaming is a technology used to view audio or video directly or with a pre-recorded camera without saving.
The training data results as a data model with test data will be processed to predict the age of someone caught by the camera. The pelican crossing system is added an intelligent system that can detect the faces and ages of pedestrians. The final result of the wader age detector will set the time on the green light by adapting it based on a certain age.

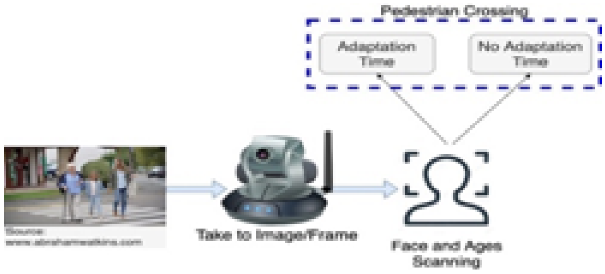


Figure 5. The architecture of the prototype for predicting the pedestrian age

5. The result of the pelican crossing system
   The output results using the age prediction of pedestrians using the AgeNet method can be shown in figure 6. The picture shows the test results of 2 images caught on camera, classified into adult age (figure 6a) and old age (figure 6b)

(a) (b)

Figure 6. Age predicted of the pedestrian using AgeNet method, (a) Age of adult, (b) Age of old

Based on the results of the age prediction in figure 6a, the pelican cross will not adapt when the green light is on because the system only gets measurable information about the age of pedestrians aged 36 to 40 years.

3. RESULTS AND ANALYSIS

3.1. Training dataset

Table 1, as training dataset can do train to prediction the age using the CNN classification with backpropagation applies feedforward and learning. Feedforward starts after the training process is carried out on the training dataset, where the feedforward work process is a vector image that will go through a convolution process and max-pooling to reduce the size of the image and increase the number of neurons. Consequently, many networks are formed that add data variants to be studied. The results of the feedforward process are in the form of weights that will use to evaluate the neural network process. Our studys CNN design used the training dataset from UTK Face shown in Figure 7.

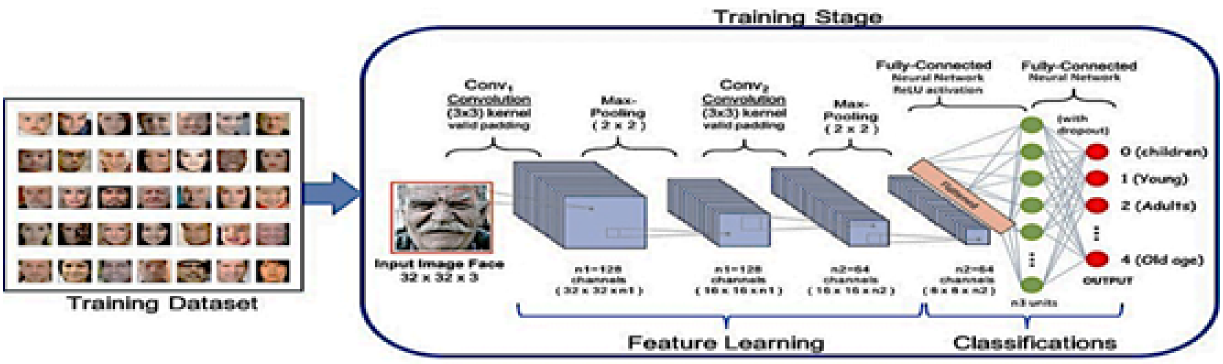


Figure 7. Learned with CNN for age predictions of faces image

There are several main components in CNN, including:

a) The convolution layer is an essential main layer in the CNN method, where h is a new image that shows the features of the input image. The convolutional layer consists of neurons arranged to form a filter with length and height (pixels) and produce a linear transformation of the input data according to the spatial information in the data. The weights in this layer specify the convolution kernel used so that the convolution kernel can be trained based on the input to the CNN. In our research, the convolution process is carried out twice for the first convolution using a 32323 and the second convolution using a 16163 with each the kernel is a 33.

b) The max-pooling layer is a function layer for feature extraction input and processes it with various statistical operations of nearest pixel values regularly after several convolution layers. The pooling layer inserted between successive convolution layers in the architectural array of the CNN measure can progressively decline the size of the resulting image in characteristic extraction, reduce the number of parameters and computations in the network, and manage to overfit. The most common form of layer pooling is to use a 22 filter.

c) The Fully-Connected layer has a fully connected or multi-layer Perceptron and aims to process data to be classified. However, the second characteristic extraction result is always in the condition of a multidimensional exhibition to flatten or reshape the attribute map into a vector into one-dimensional data before it can be connected to all neurons in the Fully-Connected Layer. The fully connected layer is where all activity neurons from the last layer are connected to neurons in the following layer like an artificial neural network.

d) The dropout layer is a process to prevent overfitting and also accelerates the learning process. The dropout layer work system eliminates hidden and visible neurons in the network. Dismissing a neuron represents temporarily extracting it from the current network. The neurons to be dismissed will be unsystematically specified. Separately neurons will be given a possibility that is between zero. This technique is straightforward to implement in the CNN model and will impact the models performance in training and reduce overfitting.

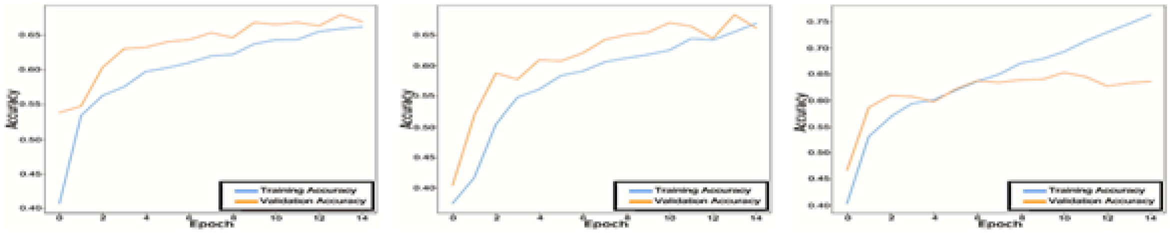
The CCN model can define the input shape in the neural network layer in figure 8, a sequential illustration at the model summary.

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 32, 32, 128)	3584
max_pooling2d (MaxPooling2D)	(None, 16, 16, 128)	0
dropout (Dropout)	(None, 16, 16, 128)	0
conv2d_1 (Conv2D)	(None, 16, 16, 64)	73792
max_pooling2d_1 (MaxPooling2	(None, 8, 8, 64)	0
dropout_1 (Dropout)	(None, 8, 8, 64)	0
flatten (Flatten)	(None, 4096)	0
dense (Dense)	(None, 256)	1048832
dropout_2 (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 5)	1285

Total params: 1,127,493
Trainable params: 1,127,493
Non-trainable params: 0

Figure 8. The model summary of CNN Algorithm

Dataset training by changing the size parameter of the training data image resolution, determining the training data and testing data as much as 80% and 20% of the training dataset, respectively, and providing an epoch parameter of 15. The training dataset experiments with three times: 3232, 6464, and 128128. Dataset training aims to analyze the test and get the best accuracy results. The first experiment was carried out with image data measuring 3232 pixels; the accuracy reached 67% (see Figure 9a). Although the accuracy value was 66% in the second experiment, there was a decrease in accuracy from the first experiment (Figure 9b). While the third experiment with the image resolution parameter on the data train is 128128 pixels, the accuracy is 67% (Figure 9c).

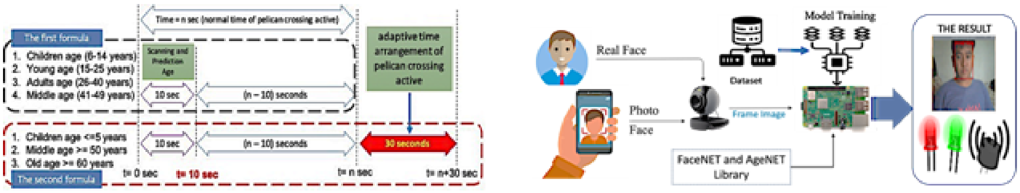


(a) (b) (c)

Figure 9. The graph of accuracy results from three experiments with the parameter of size pixels, (a) 32x32 pixels, (b) 64x64 pixels, (c) 128x128 pixels

3.2. Implemented of application of pedestrian age prediction system

Based on Figure 4, the application of pedestrian age prediction uses artificial intelligence with the AgeNet method. First is the scanning of the age prediction, and second, the set time duration adapts the time by adding 30 seconds or not adjusting from the regular time (Figure 10a). Figure 10b is a diagram block for predicting the age of a pedestrian crossing.



(a) (b)

Figure 10. The illustration of the pelican crossing system, (a) The adaptive or not adaptive time, (b) Diagram block

For example, the age scanning process is carried out in the first 10 seconds, and the system scans the age of the crossing person. If successfully predicts the age of pedestrians over 50 years old or children under five years, there will be an additional pedestrian crossing time process of 30 seconds from the regular time as a system decision in adapting time at the pedestrian crossing facility. The diagram block in Figure 10b represents the illustration of the process adaptive time arrangement system for pedestrian crossings demonstrated in Algorithm 1.

Algorithm 1 Prediction of the pedestrian age for time arrangement of a walker crossing in the real-time

Input:

1. Model of the training dataset
2. Image original the real-time from the camera

Output: The result of prediction of the age to time arrangement process of pedestrian crossing (adaptive or not adaptive time)

1: **Initialisation:**
Define time = 0 second
Configure LED Red ON AND LED Green OFF
2: **While** (Pedestrians Crossing = TRUE) **Do**
3: Configure LED Red OFF **AND** LED Green ON
4: Capturing image from the camera (real face or photo face)
5: Identification of Face with FaceNet method
6: Counter time with step 1
7: **If** (Face = TRUE) **AND** (time $<$ 10 seconds) **Then**
8: The prediction of the age with the AgeNet method, plus shown the result of an image with class and age

```
If (age >= 50 years) OR (age <= 5 years) Then
The Adaptive time arrangement of pedestrian crossing for the traffic light green man
Else
The time of the traffic light green man for pedestrian crossing is Normal
 End If
 End If
End While
```

3.3. Testing and simulation of the pelican crossing system

Our research prototype testing the pelican crossing system when functioning will stream video in real-time for the first 10 seconds using a webcam. After that, the capture of an image will continue to perform the face detection process using the FaceNet algorithm and predict age using the AgeNet algorithm.

FaceNet is a neural network that maps a persons face into Euclidean space (a collection of geometrical points) where later the geometrical points determine the value to measure the level of facial resemblance, while AgeNet is a neural network that maps a persons face age from the FaceNet results. Some problems in face recognition usually originate due to facial variability and different distinct faces to predict the ages. Our research of the pelican crossing system with classification age is the step that uses information given by the embedding process formulated in two stages:

1. The first stage is the training dataset of the UTKFace dataset, a quadrangular picture possessing only an individual's face. An invariant dataset helps decrease variance when using the FaceNet and AgeNet methods when training limited computational resources. In addition, the result of the training dataset will embed a technique essential to how pelican crossing functions, which realizes models of faces and ages in a multidimensional area where length approximates a measurement of the face.
2. The second stage is testing data in real-time from the camera. The pelican crossing can predict the age using AgeNet Metode after the result of characteristics of facial features from testing data. Obtain the facial feature are:
   (a) Pre-processing data from the image sensor with a method used to capture pictures and transform them all to a consistent format as the testing data with the characteristics of facial features in the image.
   (b) Category of age classes is made established on facial characteristics. Therefore, age classification founded on facial photographs needs to be done additionally accurately to be helpful in human age recognition systems.

3.4. Quantitative evaluation in the experiment

The experiment of predicting the age with a single person for pelican crossing system

The analysis of quantitative evaluation was conducted on six participants, only one face with a real face and photo face. The results can see in Figure 11a until 14b, the prediction of age mapping from a pedestrians face, including the mention of adaptive time arrangement if the ages over 50 years or under five years. In addition, outside the category of conditions of age above 50 years or conditions of age under five years, the prediction system for the age of pedestrians does not experience an adaptive time arrangement.

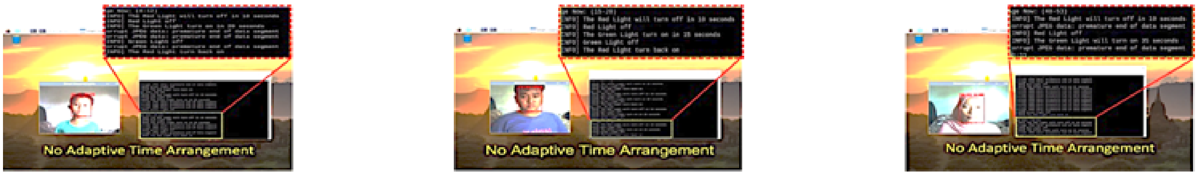
The eight participants simulated two method experiments; the first method was conducted directly with the original face until the third test participants. The first test participants were aged nine years for the children category, and the second test participant was 21 years for the youngth category. Furthermore, the third test participant was 41 years in the middle age category.

The second method of experiment, while conducting experiments fourth until eighth test participants are faces taken on a smartphone and will be assumed as input through capture by the camera. Testing is the same as the previous process, with ten experiments per participant. The fourth test participant was aged 67 years for the old age category. The fifth test was aged under one year (five-month) for the children category, the sixth test participant was aged 39 years for the adult category, while the seventh test participant was aged 23 years for the adult category. Moreover, the last participant (eighth participant) was aged 45 years for the middle age category.

The result of the participants with simulated ten times experiments are:

1. Participant of testing one
   The first testing participants were in the category of children aged nine years (see figure 11a), where the correct age prediction results were eight times (predicted results between the ages of 8 - 13 years) from 10 trials. Meanwhile, for two unfair practices in predicting by the application, the participants indicated their age to be considered a youngth category with predictions for both ages is 15 years. As a result, these experiments get an accuracy of 80%.

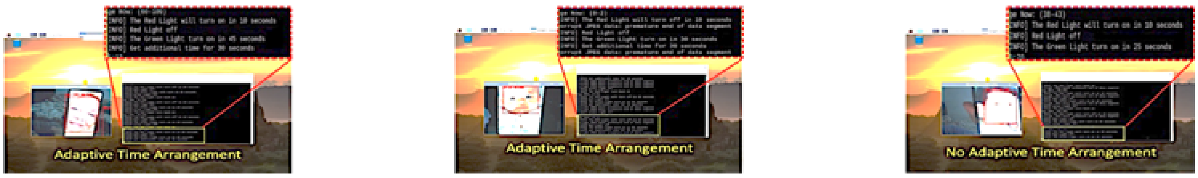
2. Participant of testing two
   The second testing participant is in the youngth category, and the participant is 21 years old (see figure 11b). Of the ten experiments that resulted in the correct age prediction process nine times (the prediction results between 21 - 22 years) from 10 trials. The experiment incorrectly predicted an adult category with predictive results at 25 years. These experiments get the results of accuracy of 90%.
3. Participant of testing three
   The following experiment was conducted by a third participant, where the participants were 41 years old and included in the middle age category (see figure 11c). Participants tested ten times, but the experiment results that correctly predicted eight times of age estimation were declared correct in the middle age category with a range from 41 - 49 years of age. Another experiment got predictive results at 61 years as much as one trial. At the same time, other experiments yielded no results. The investigation was unable to detect faces. These experiments get the results of accuracy of 80%.



(a) (b) (c)

Figure 11. The result of the experiment of predicting the age with a single person, (a) 1st Testing (Children's age), (b) 2nd Testing (Youth age), (c)3rd Testing (Middle age)

4. Participant of testing four
   The fourth testing participant is in the old category, and the participant is 67 years old (see figure 12a). The correct age prediction process results were seven times (the prediction results were 61 - 68 years) from 10 trials. In addition, three tests were wrong in predicting the middle age category with predictive results between 57 - 60 years of age. These experiments get the results of accuracy of 70%.
5. Participant of testing five
   The fifth testing participant is in the category of children, who is five months old (see figure 12b). The correct age prediction process results were six times (the system detects age one year with the assumption under one year) from 10 trials. Moreover, it was not found for the other experiments in predicting. Unfortunately, the system cannot detect faces, so it cannot predict age. These experiments get the results of accuracy of 60%.
6. Participant of testing six
   The sixth testing participant is in the adult category and is 39 years old (see figure 12c). The correct age prediction process results were six times out of 10 trials with 36 - 40 years of predictive results. The testing participants were also categorized as middle age by the system based on their prediction results at 41 - 45 years is three times experiment. However, it was found youngth for one other experiment in predicting. The system cannot detect faces, so it is impossible to predict age. These experiments get the results of accuracy of 60%.



(a) (b) (c)

Figure 12. The result of the experiment of predicting the age with a single person, (a) 4th Testing (Old age), (b) 5th Testing (Children's age), (c)6th Testing (Adults age)

7. Participant of testing seven
The seventh testing participant is young and aged 23 years (see figure 13a). The correct age prediction process results were seven times out of 10 trials, with prediction results ranging from 22 - 25 years. The system also categorized the test participants as adults based on their prediction results between 26 - 28 years for the other three trials. However, it was found for seven other experiments in predicting. The system cannot detect faces, so it is impossible to predict age. These experiments get the results of accuracy of 70%.
8. Participant of testing eigh
The eighth participant was 45 years old and included in the middle age category (see figure 13b). Participants who tested ten times succeeded in predicting the age of 7 trials, ranging from 43 - 50 years of age. In contrast, the experiment that failed to predict was three times trials same in 40 years. These experiments get the results of accuracy of 70%.

(a) (b)

Figure 13. The result of the experiment of predicting the age with a single person, (a) 7th Testing (Youngth age), (b) 8th Testing (Middle age)

The eight experiments on testing the age prediction of pedestrians who only tested for one face detected by the pelican crossing system did show in table 2. The quantitative evaluation analysis results can be seen in table 2, with the average error of the accuracy being 73%.

Table 2. Analysis of the evaluation quantitative with testing of a single person

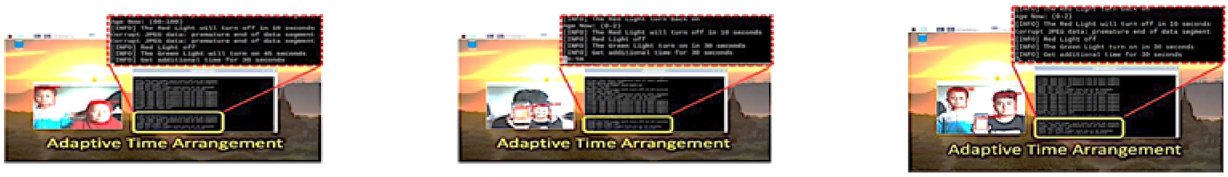
Number Testing	Categories	Experiment	Classification of Age					Accuracy
			Children	Youngth	Adults	Middle	Old	
1	Children	Ten times	8	2				80%
2	Youngth	Ten times		9	1			90%
3	Middle	Ten times				8	2	80%
4	Old	Ten times				3	7	70%
5	Children	Ten times	6					60%
6	Adults	Ten times		1	6	3		60%
7	Youngth	Ten times		7	3			70%
8	Middle	Ten times			3	7		70%
Average of the accuracy								73%

The experiment of predicting the age with the multi-person for pelican crossing system

Previously, the quantitative analysis used a persons face to experiment with pelican crossings to predict the age of pedestrians. However, a combination does use to predict age with multiple faces from various age categories in the following:

1. In the first experiment shown in Figure 14a, the test uses a cameras direct capture of 2 faces. The experiment results predicted the age of the first participant to be 6 to 12 years old, and the measure of average error of the accuracy is 60%. The second participant predicted the age of 60 to 100 years, and the standard of average accuracy error is 100%. Based on these results, one of the participants is in the age category above 50 years, which causes the greenlights to turn on with adapting the arrangement time for 30 seconds to the green light.
2. Figure 14b is a test with the capture of 2 face photos directly and real by the camerathe prediction of age in the first participant aged 0 to 2 years in the child category and the measure of average error of the accuracy is 100%. At the same time, the second participant in the middle class predicted 45 to 55 years, and the measure of average error of the accuracy is 70%. The system detects that both participants take longer to cross the road based on age predictions. The results shown in Figure 14b show that the system selects the one noticed first to control the lights on while adapting the arrangement time for 30 seconds on the green light.

3. The third experiment combines system testing to capture three faces consisting of 2 real faces and one photo face displayed from a smartphone. The two original faces were predicted in children aged 6 to 12 years (children 1), with the average error of the accuracy being 70%. The young age category of 15 to 20 years and the average error of the accuracy is 60%. Meanwhile, from facial photos, the system predicts ages 0 to 2 for the child category (children 2), with the average error of the accuracy being 70%. The experimental results are shown in Figure 14c, where one of the participants belongs to the age category under five years, which causes the lights to turn on while adapting the arrangement time for 30 seconds.



(a) (b) (c)

Figure 14. The result of the experiment of predicting the age with multi persons, (a) 1st testing with two persons (used real face), (b) 2nd testing with two persons (used photo face), (c) 3rd testing with three persons (used two real faces and one photo face)

The results of three experiments on testing the age prediction of pedestrians tested for multiple faces detected by the pelican crossing system are shown in table 3. The results of the quantitative evaluation analysis can be seen in table 3, with the measure of average error of the accuracy being 76%.

Table 3. Analysis of the evaluation quantitative with testing of multi-person

Number Testing	Categories	Experiment	Classification of Age					Accuracy
			Children	Youngth	Adults	Middle	Old	
1	Children	Ten times	6	3	1			60%
	Old	Ten times					10	100%
2	Children	Ten times	10					100%
	Middle	Ten times			1	7	2	70%
3	Children 1	Ten times	7	3				70%
	Adults	Ten times		3	6	1		60%
	Children 2	Ten times	7	3				70%
Average of the accuracy								76%

4. CONCLUSION

Our research has experimented with an adaptive time arrangement, "the traffic light green man on the pelican crossing system based on predicted age-pedestrian. It can conclude that the application of artificial intelligence using the Convolution Neural Network (CNN) to measure the accuracy of the training dataset produces an average accuracy of 66.67İn addition, real-time testing of prototypes with video streaming can be carried out at pelican crossings and successfully predicts the age of pedestrians with an average accuracy of 73 with an experiment of the single face and 76 with the experimentation of multiple faces using the AgeNet method.

The results of our study are that contribution is applied to help older does crossing and a novelty implanted in the traffic light system, especially the timing of crossings. Furthermore, light intensity as noise influences the predictive factor for face identification and age. Therefore, the future of research suggests adding a setting function to reduce light intensity.

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