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HUMAN WEIGHT MEASUREMENT PREDICTION WITH VISUAL IMAGES WITH ARTIFICIAL NEURAL NETWORK ALGORITHM

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ABSTRACT

The development of intelligent applications based on computer vision is very encouraging along with the increasingly high computer specifications and digital camera capabilities that produce excellent resolutions. Computer vision is expected to be a quick and smart alternative solution in a variety of cases including weight prediction which is discussed here. This paper aims to predict human weight based on image processing using Artificial Neural Network. Measuring instrument becomes very important to be able to know how much human weight is. Weight information is generally obtained from measurements by body scale. This work calculate body weight using back propagation method. The results of testing, analysis, and system accuracy of 97% indicate that the method of calculating body weight is very possible through image processing with various provisions and restrictions.

Keywords: *Weight Prediction, Computer Vision, Artificial Neural Network*

1. Introduction

Ideal body weight is the desire of all humans because both in terms of health and physical appearance of humans and become one of the important parameters to determine the condition of one's body. In addition, ideal body weight is also one of the references for institutions / government institutions such as entrance test for civil servants, public company, police, military, private companies or entering universities as one of the requirements for health tests.

Measuring instrument becomes very important to be able to know how much human weight is. Detecting human bodies by one or two numbers may not be a problem but in a larger scale it will be less efficient by using existing measurement tools.

Referring to the previous research written by Fadlur Rahman 2017 entitled "Analysis of the Measurement Method of Human Body Weight by Image Processing". The mathematical approach is based on the calculation of the Body Surface Area and the elliptical volume of the human body. Image processing in the form of digital photos is processed to produce information about a person's weight in the photo. [1]

That is the reason why the research taken is the use of computer vision with the Artificial Neural Network algorithm by using back propagation method to detect body weight.

2. Related Study

The authenticity of this study is based on several previous studies which have relatively the same characteristics in terms of themes, although they differ in terms of the object of research, the number and position of the research variables or the analytical methods used.

The research conducted is detecting human height by utilizing digital image processing and artificial neural network algorithms by back propagation method then classifying the results of the data taken.

Suci Aulia 2018 stated in his research "Morphological Image Processing Based Height and Weight Measuring System" this study has designed a system to measure Human Height (TB) and Weight (BB) based on Morphological Image Processing (MIP). The process starts by inputting

image in the form of a full body digital image that can be taken with a smartphone and then continues with the MIP operation consisting of a process of dilation, filling and labeling. The result of MIP is the number of pixel height of objects converted to TB (cm). While the BB calculation (kg) is obtained from the body surface area of the BSA-based object by modeling it into an elliptical tube shape. From the test results, the maximum system performance obtained is Approximate Value 98.42% for TB and 94.4% for BB. This value is obtained with the parameter taking distance value of 306 cm and the structure element in MIP is 2. [2]

Toni Efendi 2017 stated in his research entitled "Design a Digit Image Processing System to Determine the Ideal Body Weight" Formula Body Surface Area (BSA) by likening the human body to resemble a tube. To find out the height and width of human body objects in an image, an image processing process is made by using edge detection algorithm. Furthermore, with certain search algorithms, height and width of human body objects in the image will be known which will be used to calculate height and weight estimates. Then to determine the ideal body weight used the calculation formula Body Mass Index (BMI). The results showed that the system built had an average percentage difference of deviation of 1.63% for height and 11.6% for weight. Then for the accuracy of the system built has reached 75% of the actual body condition with the results of system calculations. [3]

Deddy B. Lasfeto 2008 stated in his research entitled "Application of image processing for estimating body weight of cattle" uses image processing to determine the physical body size of the cattle that appear (chest width and body length). Image processing is carried out by image segmentation process to separate the image of cattle from the background and eliminate objects in the image that are disturbing (noise), then the identification process is carried out to get the size of the chest length and chest width of the cattle. After getting these measurements, a computational process is performed to calculate the body weight of the cattle. In order to test it compared to direct measurement using a measuring tape. Stages of research through maximum segmentation and extraction where automatically will be determined the point of formation of daban length and width of a cow's chest. With this method we will calculate the weight based on the existing conversion formula. Analysis and testing results show that image processing can be used to detect weights. [4]

Muhamad Rido 2015 stated in his research entitled "Human Height Measuring Instrument Uses Template-Based Camera Matching" height measurement tool uses template-based camera matching. Template matching is one technique in digital image processing that functions to match each part of an image with a sample image (template). An image can be determined in height by calculating the ratio of background pixel lines and pixel lines of drawing objects. [5]

Restu Adiguna Throne 2018 stated in his research entitled "System of Detecting Ideality of Body Weight in Real Time Using the Gray Level Co-Occurrence Matrix and Body Surface Area" The results of this study the system can identify gender and can measure ideality of body weight in real-time, the value Maximum accuracy in body height and width testing is with an accuracy of 95.97% using a scale of 22.7. For maximum weight accuracy testing of 95.39% with a multiplier factor (K) of 0.98, based on the calculation of the Borcha formula calculation in men, the average accuracy value is 91.07%, while for women the average value of accuracy is 88 , 70%, based on the Body Mass Index test, it showed a classification accuracy of 83.34%, and the last test, based on the WHR in men, a classification accuracy of 26.67% and a classification accuracy of women of 66.67%.

3. Research Method

Data collection was carried out in July 2018 with 25 front-facing objects and 25 side-view objects displayed by female students at the Harapan Bersama Polytechnic of Tegal from several Study Programs. Retrieval of digital images using the camera is done directly on student objects with a size of 60 KB - 5 MB. Image in the form of photos with plain white background details. The format of the image to be processed is JPG / JPEG. The initial step after collecting images is to do preprocessing.

Taking a sample of data acquisition in one of the images which has dimensions of 1728x2592. Data acquisition is done by measuring body weight and original photos. Each photo will be counted pixel width from front, side and height.

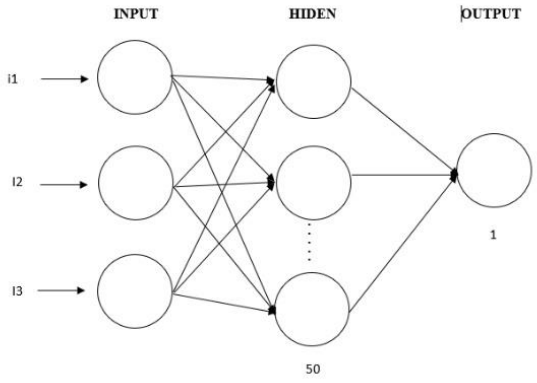
Data acquisition produces images with the type Red Green Blue (RGB), this type of image cannot be processed directly. The purpose of preprocessing is to use relevant techniques for further processing and analysis. The steps for calculating parameter A, T, B as bellow:

1. Calculate the value of A based on the maximal column and minimum columns in pixels that make up the front view object
2. Calculating the value of B based on the difference between the maximal column and the minimum column in the pixels that make up the side view object
3. Calculate the value of T based on the maximal line difference and the minimum row in pixels that make up the front view object

A = max (col) -min (col);
T = max (row) -min (row);
B = max (row) -min (row);

Calculating Value A
A = 1200-538
= 665 * 0.75
= 496.5
Calculate Value B
B = 1018-583
= 435
Calculate the value of T
T = 2427-109
= 2318
Normalization value
= 1200-538
= 665 * 0.75
= 496.5 / 610
= 0.813934

Model



Inputs i1 - i3 are obtained from the results obtained from image processing. After the input is obtained then the hidden layer with the number 50. The last result is the output with the value of human body weight.

The learning process of ANN uses the backpropagation method with sample images that have been collected on data acquisition of 50 images. Determination of the target size for human body weight. The learning process of ANN uses the backpropagation method with sample images collected on data acquisition of 50 images by dividing the two classifications, namely the front view 25 and the side view 25.

Artificial Neural Network Architecture and setup:

Input Layer	3
Hidden Layer	50
Output Layer	1
Learning Rate (α)	0,1
Maksimum epoh	1000
Target Error	0,000001

Input and target.
Input with variables a, b, t

A	B	T
496,5	435	2318

Target of input = 52
Initial weights are given a random value

Initial Weight of input to hidden (v)

v	1	2	3
1	-0,0149	0,036762	-0,00356
2	0,026897	0,006434	-0,01745
3	0,024506	-0,01428	-0,01673

Initial Weight is biased to hidden (v0)

	v0
1	22,58229
2	-85,573
3	59,97434

Initial Weight hidden to output (w)

	W
1	0,022128
2	-0,9445
3	0,980771

Initial Weight biased to output (w0)

w0 = -0,219138341075004

Hidden layer operation

	W
1	0,022128
2	-0,9445
3	0,980771

Z_in hidden unit output

$\mathbf{z\_in_1} = v_{11} * x_{11} + v_{21} * x_{12} \ldots + v_{13} * x_{11225+} v0_1$
$\mathbf{z\_in_1}$ = 496,5 *0,0149+ 435* 0,0367624685594625+ 2318* -0,00355773132114889+ 22,58229
$\mathbf{z\_in_1}$ = 22,93157

	z_in
1	22,93157
2	-109,866
3	27,14574

Hidden unit output z (activation)

$$z_1 = \frac{1}{1 + e^{-22,93157}}$$

$$z_1 = \frac{1}{1 + 2.71828^{-22,93157}}$$

$$z_1 = 1$$

	Z
1	1
2	1,93128E-48
3	1

Output layer operation (y)

The resulting output is only 1, then
Digital Image Results

$$y\_in = w_0 + w_1 * z_1 + w_2 * z_2 \ldots + w_{50} * z_{50}$$

$$y\_in = 0.276108 + 0.675514 * 1 + 0.800996 * 1 \ldots + 0.944675 * 1$$

$$y\_in = 1,978603$$

Jumlah Kuadrat Error = $(50,0214)^2$
Jumlah Kuadrat Error = 2502,14

Error = 52- 1,978603

Error = 50,0214

Y= y_in

Y=1,978603

Image processing through the stages of preprocessing up, importing training inputs and targets into the Neural Network on matlab. Lots of data to train and target 25 data. MultiLayer architecture with 3 inputs, Hidden Layer 50 and Output 1

Testing process Training input on the target to get an output value.

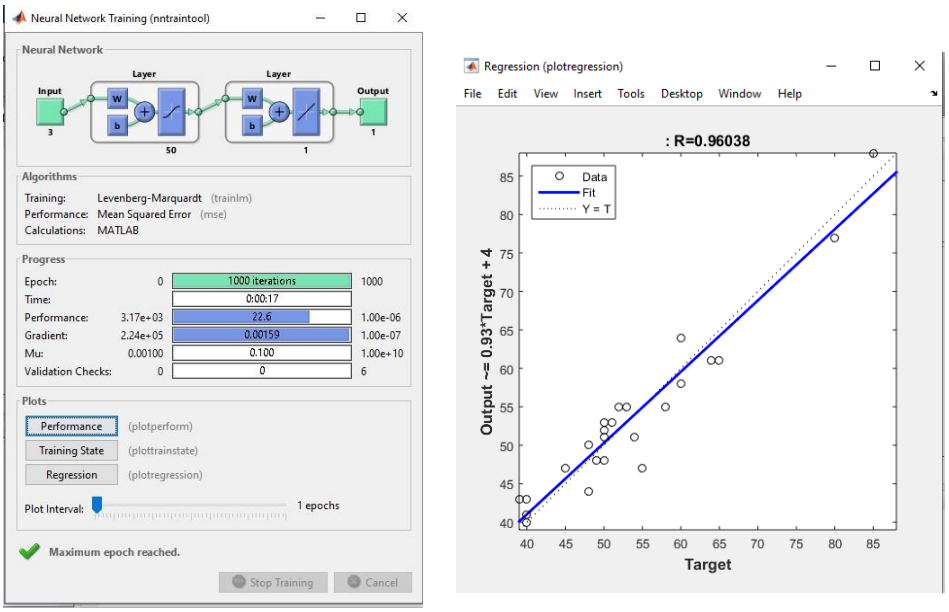


Figure 4.5 Testing process Training input to the target to get the output value. And Figure 4.6 The results of the regression around 0.96038 and the gradient between the outputs is approaching the target of around 0.93.

Figure 1.5 Guide

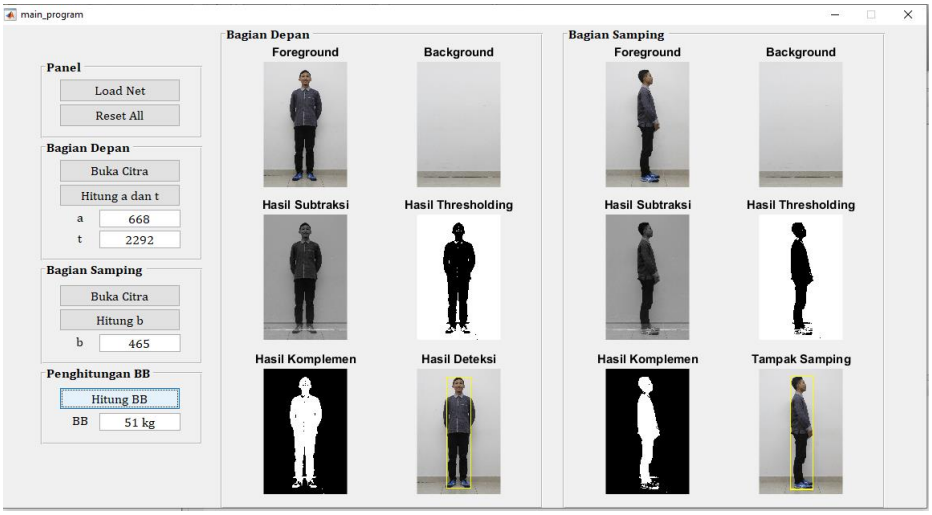


Figure 4.1 is a guide or interface of image processing where it can be seen the process of looking for variables a, b and t then counted with ANN to produce a weight close to the target specified.

NO	NAME	FRONT	SIDE	ORIGINAL WEIGHT	ANN PREDICTION
1	DWI HERDY S			52	51
2	M IRWAN			51	51
3	DIMAS B			60	72
4	ILHAM MUZAKI			54	51
5	NUR RIZQI			40	40

Table 4.6 is a comparison of the results of the calculation of artificial neural networks with targets, the accuracy of the results obtained based on the system output is around 97% with a total of 25 data objects.

5. Conclusion

Weight prediction that has been done using artificial neural networks with backpropagation method shows the achievement between output and target produces good classification accuracy and a small number of errors. The training process produces an average accuracy of 97%.

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