Bu fau

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Identification of hand motion using background subtraction method and extraction of image binary with backpropagation neural network on skeleton model

Identification of hand motion using background subtraction method and extraction of image binary with backpropagation neural network on skeleton model

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Abstract. Capturing and recording motion in human is mostly done with the aim for sports, health, animation films, criminality, and robotic applications. In this study combined background subtraction and back propagation neural network. This purpose to produce, find similarity movement. The acquisition process using 8 MP resolution camera MP4 format, duration 48 seconds, 30frame/rate. video extracted produced 1444 pieces and results hand motion identification process. Phase of image processing performed is segmentation process, feature extraction, identification. Segmentation using bakground subtraction, extracted feature basically used to distinguish between one object to another object. Feature extraction performed by using motion based morfology analysis based on 7 invariant moment producing four different classes motion: no object, hand down, hand-to-side and hands-up. Identification process used to recognize of hand movement using seven inputs. Testing and training with a variety of parameters tested, it appears that architecture provides the highest accuracy in one hundred hidden neural network. The architecture is used propagate the input value of the system implementation process into the user interface. The result of the identification of the type of the human movement has been clone to produce the highest acuracy of 98.5447%. The training process is done to get the best results.

1. Introduction

Computer vision a field that aims to make a useful decision about a real physical object and state based on an image. Computer Vision is a combination of image processing and pattern regocnition the output of the computer vision has been processed into the result of image understanding. Development of this field is done adapting the ability of human vision in taking information. In the dicipline, computer vision deals with supporting theories such as artificial intellegent can extract information from the displayed image. Image data can be obtained with some from video, with some camera or multidimensional data from scanner. Area contained in computer vision include: pattern recognition,and classification, image segmentation, image restoration, and other area related to computer vision. Digital Processing is widely used to study matter relating to image quality improvement contrast enhacement, image transformation, colour, image restoration, selection of image characteristic (feature image) is optimal for the purpose analysis, making the process of with drawing information or object. Description or the introduction of objects contained in the image, compression, or reduction and for data processing time and input from image processing result [13]. The feature extraction process in image processing is used to perform the recognition process the

objects in the image, or the video used by using feature extraction can be known to the existing classes and search for significant feature areas on an image or video object on the intrinsic elemen used [14]. Feature Extraction is general used to perform the identification process of the charateristic can form the best representation of an object to distinguish one object from another object. The feature extraction of forms is used to match an image or object with another object exists with the region used, the process of feature extraction involves the computation of a number of feature characteristic, values of an object shape independent of size or orientation, form feature extraction can be calculated for each object can be identified on each image or image stored, two types of feature are used global features (feature extraction that include aspect ratio, cilcularity and moment invariant) local feature extraction is a sequential boundry segment). Background method is one of the methods used to perform the separation process of one object with another object, doing background image reduction process. Background subtraction known as foreground detection is on of the tecniques in digital image processing and computer vision to perform the process of detecting or detecting an image to detect or retrieve the foreground of the approriate background based on human objects, text and another object movements [3]. In general background subtraction method is used to perform the process of moving object detection of an image or object on the video based on the difference between the reference background with the frame or reduce from the video, identification process is a determination of the identify of people, and objects [15][10].The definition of identification in general is the provision of sign on the class of goods or something with the aim of providing one component with another. Artificial Neural Network is one system that process information that has information idential with biological nerves. Artificial Neural Networks are used as pattern regocnition, signal processing and forecasting [6].

2. Theory

2.1. Digital Image Processing.

Digital image processing is a dicipline that studies things to image quality improvement(contrast enhacement, transformation, colour(image restoration), image transformation, selection of image feature (featuring image) is optimal for the purpose of analysis, making the process of with drawing information or object description or the introduction of objects contained on the image, perform compression or reduction and for the purposes of data storage, data transmission, and data processing time.

2.2 Computer Vision

Computer Vision is a combination of image processing and pattern regocnition, the output of the computer vision process has been processed into the result of image understanding. Area contained in the computer vision include recognition, motion, image restoration, and other areas related to Computer Vision the most common function performed by include: image acquisition, pre processing, feature extraction, detection, segmentation, high level processing, decision making [7].

2.3. Stage Of image Processing

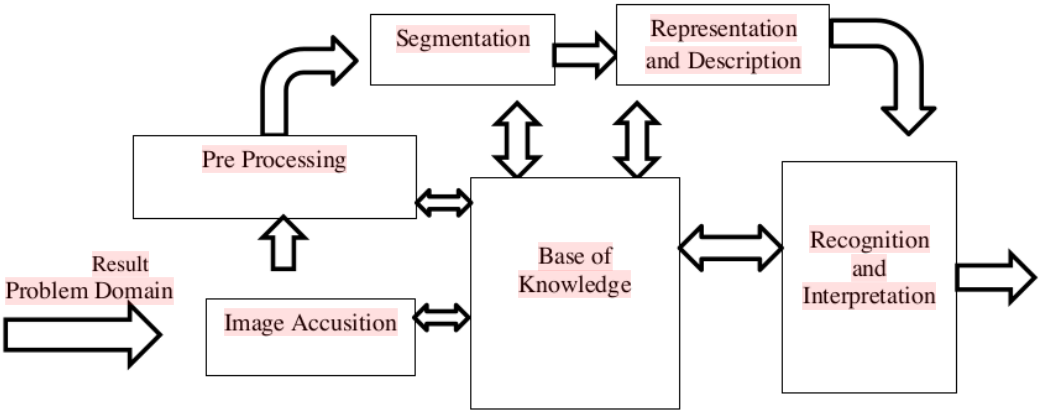


Figure 1. Stage of Image Processing [3]

Figure 1. are the stage of image processing, the initial stage is to acquire the image with the aim of obtaining a digital image to determine the data needed and choose the method of recording digital image at this stage steps taken to take the object to be taken pictures, and also to the preparation of tools, actors to imaging, the result of image acqusition is strongly influenced by the ability of the sensor to perform the process of digitizing the signal access. Preprocessing is related to image quality improvement, noise remove process, image transformation, determined the image to be observed. Segmentation is a stage that aim to partition the image into sub section that have important information such a sparating objects and backgrounds. Representation and description by representating a region with a list of coordinate points in a close curve and performing image description by performing feature selection and feature extraction. Recognition and Interpretation provide labeling objects whose information for the interpretation to giving meaning to groups of recognition objects. The last stage useful for based knowlegde to guide the operation of each process module and the performa the process of controlling the interaction to template matching or pattern recognition.

2.4. Background Subtraction

Background subtraction method is on of the methods used to perform the sparation process of one object with another object by doing background image reduction process. Background subtraction known as foreground detection is one of the techniques in digital image processing and computer vision to perform the process of detec or retrieve the foreground of the appropriate background based on human object, text and other object movements [3]. In general background subtraction method is used to perform the process of moving object detection of an image or object on the video based on the difference between the reference background with the frame produced from the video.

2.5. Artificial Neural Network

Artificial Neural Network is one system process information that has information identical with biological nerves. Artificial Neural Networks are used as pattern recognition, signal processing and forecasting [6].

2.6. Feature Extraction

The feature extraction process in image processing is used to perform the recognition process and the classification processing of objects in the image, or video used by using feature extraction can be known to exsiting classes and search for significant feature areas on an image or video object and rely on the intrinsic elements used to perform the identification process of the characteristics can form the best representation of and object to distinguish one object from another object, the feature extraction of form is used to match an image or object exists within in the region used, the process of feature extraction involves the computation of a number of feature characteristic values of an object shape independent of size or orientation. Feature extraction can be calculated for each object that can be identified on each image and on image stored.

2.7. Skeletonization

There are saveral ways used to form skeleton. Skeleton is a unique form of an object, which the order of an object. One way to get skeleton is the trough thinning. Thinning is a morfological operation is use to minimizing the geometric size of an object with the end result of a skeleton. Skeleton using an image to express the topology and characteristic model a grass field [16].

2.8. Previous Research

Table 1. Previous Research

NO	Reserchers	Method	Result	Feature Work
1.	Syed Sohaib Ali, Zafar M.F, Moeen Tayyab, 2009	"Neural Network"	Detection people in video with five part and good performa for classification and the correct classification rate 85%, the results show better speed of and accuracy	From the system can be tracking, detec and recognize from side view and identification for human action
2.	Huimin Qian, Yaobin Mao, 2010	" SVM Decission Tree "	Identification of movement in walking, running, stand to sit, stand to squat, fall .	Extraction is still on the foot, not in the hands, head and the others body, and for identification of human action (hand, head and the others)
3.	Alessio Ferone, Lucia Maddalena, 2014	"Neural Background Subtraction"	Moving object detection with Zoom Cameras and solve the problem with background subtraction and good result	From the result limited comparasion of average precision, still moving object, in the system can be crate for human action and identification
4.	Graciela Ramirez-Alonso and Mario I. Chacon - Murguia, 2014	"Background Subtraction Model"	The Algorithm good parameters from the result combine background subtraction and Self Organized Map Neural Network the result good threshold	Implementation in the system for dynamic background subtraction, in the system good for identification of human action

5.	Nasrullah Ratu BSL, Deby Faisol Akbar, 2014	"Background Subtraction and Kalman Filter "	Generate process of tracking and identification of objects by combining the method background subtraction and Kalman Filter Method and managed to track the object	Not seen the accuracy of the filter results obtained only limited to the process of tracking object only and the identification value is also not seen, for the future in the system good for identification human action
6.	Lyra Vega Ugi, Bambang Hidayat, Suryo Adhi Wibowo, 2015.	"Variabel Modul Graph"	The system is made with the purpose of performing the process of identification and detection through a person walking gesture without having to pay attention to the individual by using the classification method and the result obtained with an average accuracy of 86.67%	The process of taking video is strongly influenced by the intensity of light so that affect the process of identification of objects used, can be created for identification of human action(hand, hand and the others)
7.	Zhang Di Ban Xiajuan and Wu Di, Hao Wang, 2016	"Spherical Coordinate and Angular Velocity (SCAV) Feature"	From the result good classification for action can be represented as spatial temporal, and the high accuracy 92.45%	From the system can be tracking, detect and recognize from side view and identification for human action(hand, head and the others)
8	Archita Tah, Sudipta Roy, Prasenjit Das and Anirban Mitra, 2017	"Background Subtraction and Kalman Filter"	In the result good method and for background subtraction increase the computer vison, the result good similarity 93.1%	From the result limited feature extraction and multimodal feature, Extraction can be create for identification of human action

3. Proposed Method

Stages performed in this study include:

1. Preparing from the human as actor who will give examples of movement hands: hands down, hands to the side and hands up.
2. Conducting Process Preparation H/W and Tools consisting of:
   Hardware processor Core i5, with 16 GB memory and 500 GB harddisk capacity,
   Nvdia Geforce 820 monitor 14.0 ", with windows OS 8.64 bit.
3. The other device used is Camera support smartphone 8MP resolution, Video acquisition using the camera that has been prepared.
4. Conducting video frame extraction process to image.
5. Perform background subtraction process on object component to obtain a binary image
6. Conducting the process of skeleton and do the process of extraction of binary image characteristics using invariant moment.

7. Perform the process of identification of hand movements using artificial back propagation. The steps of the research undertaken and determine the renewal or contribution of proposed research

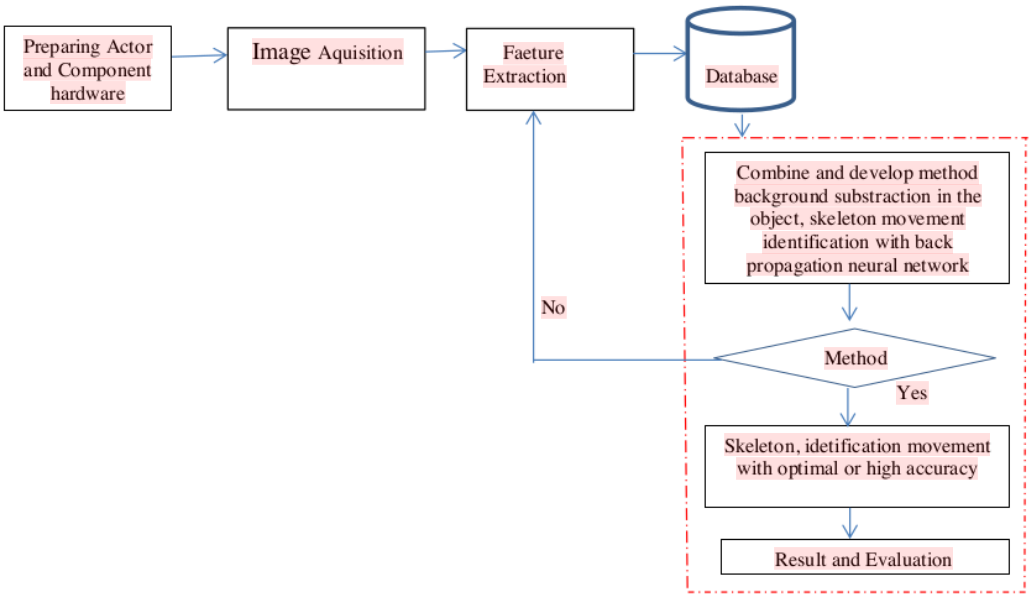


Figure 2. Research Methodology

3.1. Data Acquisition

In this research the data acquisition process is done using camera 8 Mega Pixel resolution smartphone. Data is a video that contains the movement of humans with various movement including hands down, hands to side and hands up. The video specification of the acquisition results are shown in table 2 below

Table 2. Video specifications of acquisition

No	Specifications	Description
1	Name	Video
2	Format	Mp4
3	Duration	48 seconds
4	Frame Rate	30 times/sec

3.2. Video Frame Extraction

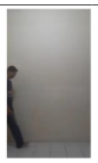
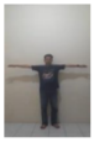
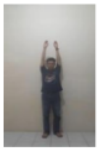
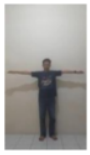
The next acquisition video is extracted into multiple frames. In this study, the total frame of extracted video totaled 1444 pieces. In each frame extraction results are then performed image processing to detect the type hand movement. The following is a coding for extracting video frames:

```
vid = ('Video 1.mp4');

Vid width = vid Width;
Vid height = vid. E Height
Move ('c data zero (vid height, vid Width,3,'uint8'),...
   'colormap',[]);

k = 1
while has Frame(vid)
   move (k).c data = read Frame(vid);
```

Table 3. Some Extraction represents the result of frame extraction

Frame 1	Frame 100	Frame 200
		
Frame 300	**Frame 400**	**Frame 500**
		

3.3. Image Processing

Image processing is performed on each frame of extraction result in order to identify the type of human movement. Stages of image processing implemented include: image segmentation, feature extraction, and identification

3.3.1. Image segmentation

In this research, image segmentation is done using background subtraction method to separate between foreground / human and background / object other than human.
The steps of image segmentation are as follows:

1. Define the frame containing the background (background frame) and the frame you want detect (current frame).
2. Convert the image color space that was originally in the RGB color space (red, green, blue to grayscale against both frames. The equation used to convert RGB image to grayscale image is Grayscale = 0.2989 * R + 0.5870 * G + 0.1140 * B. [1] (Rafael C Gonzalez, Richard E Woods, 2002).
3. Perform a subtraction operation (subtraction) between the grayscale current frame images with the image grayscale background frame.
4. Convert grayscale image of subtracted result into binary image through thresholding operation.

   The binary image that the thresholding result is defined as: $g(x,y) = \begin{cases} 1 \text{ if } f(x,y) \geq T \\ 0 \text{ if } f(x,y) < T \end{cases}$ [2]

   Where g (x, y) is the binary image of the threshold result, f (x, y) is the grayscale image, and T is the threshold value [11].
5. Perform morphological operations on binary imagery in the form of filling holes and opening area for eliminating noise and perfecting segmentation results

6. Skeletonize the binary image of the segmentation result.
Coding to do image segmentation is:

```
% Read the background frame image
Background =in read ('Frame 1.jpg');
Background = in rotate(Background,90);
Background = in resize(Background,.1);

% Read the current frame image
Foreground = in read ('Frame 600.jpg');
Foreground = in rotate (Foreground,90i
Foreground = in resize (Foreground,

% Convert image to grayscale
Background_ gray = rgb2gray(Background);
Current Frame _gray = rgb2gray(Foreground);

% Grayscale image reduction
Subtraction = (double (Background _gray)-double (Current Frame_ ))
Min S = min (Subtraction (:));
Max _S = max (Subtraction (:));
Subtraction = ((Subtraction-Min _S)/(Max _S-Min _S))*255;
Subtraction = uint8(Subtraction);
```

The display of image segmentation process shown in Table 4

Table 4. Display Image Segmentation Process

No	Image Processing	*Current Frame*	*Background Frame*	**3. Process Subtraction** (current Frame with Background Frame)
1	**Read Image**			
2	**Convert RGB to GrayScale**			 **4.Convert Binary Image with Tresholding)**
5	**Motphology aperation** *filling holes* and *area opening* for good segmentation process			 **6.Skeleton**

3.3.2. Feature Extraction

After the object in the image separated with background then performed the feature extraction step. Extracted traits are used to distinguish the type of movement between one object to another object. In this study feature extraction is done through morphological analysis (form) based on seven invariant moment values. The values are extracted from each image to distinguish the 4 output classes: class no object, hand-down class, hand-to-side class, and hands-up class. The calculation of the invariant moment value is based on the set of moments of a function f (x, y) of two variables defined as follows:

$$m_{pq} = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x^p y^q f(x,y)dxdy \quad pq= 1,2,3,\ldots \qquad [3]$$

The two-dimensional moment with the order (p + q) of a digital image of size M x N is defined as:

$$m_{pq} = \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} x^p y^q f(x,y) \qquad [4]$$

where p = 0.1,2, ... and q = 0.1,2, ... are integers. Furthermore, the central moments of the order (p + q) are calculated on the basis of the equation

$$\mu_{pq} = \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} (x - \bar{x})^p (Y - \bar{Y})^q f(x, y) \qquad [5]$$

for p and q is 0.1,2, ..., where:

$$\bar{X} = \frac{m_{10}}{m_{00}} \text{ dan } \bar{Y} = \frac{m_{01}}{m_{00}} \qquad [6]$$

Then normalized central moments, denoted by hpq, are defined as follows.

$$\eta = \frac{\mu_{pq}}{\mu_{00}^{\gamma}} \qquad \gamma = \frac{p+q}{2} + 1 \qquad [7]$$

For p + q = 2, 3, 4, etc

So the seven invariant moments can be derived from the second and third moments through the following equation

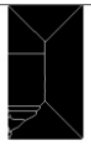
$$M1 = \eta_{20} + \eta_{02}$$
$$M_2 = (\eta_{20} + \eta_{02})^2 + 4\eta_{11}^2$$
$$M_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$
$$M_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$
$$M_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$
$$M_6 = (\eta_{20} - \eta_{02})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$
$$M_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{12} - \eta_{30})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] \qquad [8]$$

M1 - M7: Invariant Moment 1-7 (Hu, M. K, 1961)

The seven values of the moment do not change with respect to translation, scale change, reflection, and rotation. The extracted moment invariant is then used as input in the identification algorithm. Image processing is performed on each frame of extraction purpose to identify the type of human movement. Stages image processing implemented among others are: image segmentation, feature

extraction, and identification. Image segmentation are done using background subtraction method to separate between foreground human with background (object other than human).

Table 5. Extraction Results

No	Real Class	Image Skeltonization	Moment Invariant M1	M2	M3	M4	M5	M6	M7
1	No Object		7.9632	26.1607	58.718	52.7462	3307.9726	260.9713	1381.9107
12	Hand-down class		6.7129	41.4148	21.5833	21.6338	317.9023	138.2061	-5.2105
3	Hand-to-side class		3.7781	0.8647	61.9913	10.2550	157.1118	9.3815	-7.2060
4	Hands up class		9.1374	78.5791	86.8490	77.9693	5872.0859	690.9475	50.6525

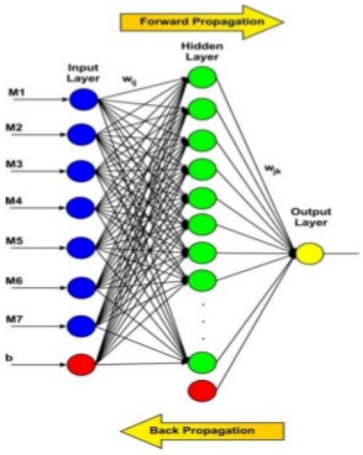


Figure 3. Artificial propagation neural network architecture

3.3.3. Identification process

The artificial neural network used consists of three layers that include one input layer, one hidden layer, and one output layer. The identification process is performed to identify the type of human movement based on the input value in the form of seven invariant moment values previously extracted. The identification process is done using a back propagation neural network algorithm with an architecture like that shown in Figure 3 below: Figure 3 Identification process using Artificial Neural Network Back Propagation The training process uses the function activation of bipolar sigmoid on layer hidden and training functions Levenberg-Marquardt. In this process the seven invariant moment values are propagated progress through the initial weights had previously been initialized. Propagation the input value is made the neuron contained on the layer hidden. After arriving at the layer hidden, the total value by received by each neuron is processed use the activation function. So obtained the value of neurons in the layer hidden

The value of the neuron then again flipped towards layer output to obtain values output. The output value is compared with the target value. If the resulting error is smaller than target error that has been previously set, then the propagation process will be Stop. But if on the contrary, is done back propagation process by updating weight value. The back propagation neural network algorithm is used as follows:

Algorithm 1. Training

Step 1: Initialize, initialize all the weights on the hidden layers and output layers, and define the activation functions used at each layer and the rate of learning. Initialize weights use random numbers within range in a small range.

Step 2: Activation, activate network by applying input and expected ouput

a. Calculating the output obtained from neurons in hidden layers.

b. Calculating the output obtained from neurons in the output layers

Step 3: The weights are updated when the error is receded in Artificial Neural Network the returned error corresponds to the output signal.

a. Calculates the gradient of errors for neurons in the output layer, calculating weight correction. Updating weights on output layer neurons:

b. Counting gradient errors for neurons in hidden layers: calculating weight correction, updating weights on hidden layer neurons

Step 4: Iterate, raise one for the iteration p, goback to step 2 and repeat the process until the error criteria is reached. The artificial neural network training process is done by varying the number of neuron in the hiden layers, the result obtained are shown in Table 6

Table 6. Result Tarining with Back Propagation Nueral Network

Neural totals			epoch	accuracy (%)
Input Layer	Hidden Layer	Output Layer		
7	10	1	718	97.5745
7	20	1	1000	97.8517
7	30	1	963	98.4061
7	40	1	730	98.3368
7	50	1	623	98.3368
7	60	1	661	98.4061
7	70	1	374	98.2675
7	80	1	302	98.4754
7	90	1	323	98.2675
7	100	1	258	98.5447
7	110	1	274	98.2675
7	120	1	255	98.2675

7	130	1	236	98.1289
7	140	1	254	98.1289
7	150	1	201	98.2675

In Table 6 it appears that the architecture that provides the highest accuracy is the architecture with the number of neurons 100 on the hidden layer. The architecture is used to propagate the input value to the output value of the system implementation process into the user interface.

1. Main Program

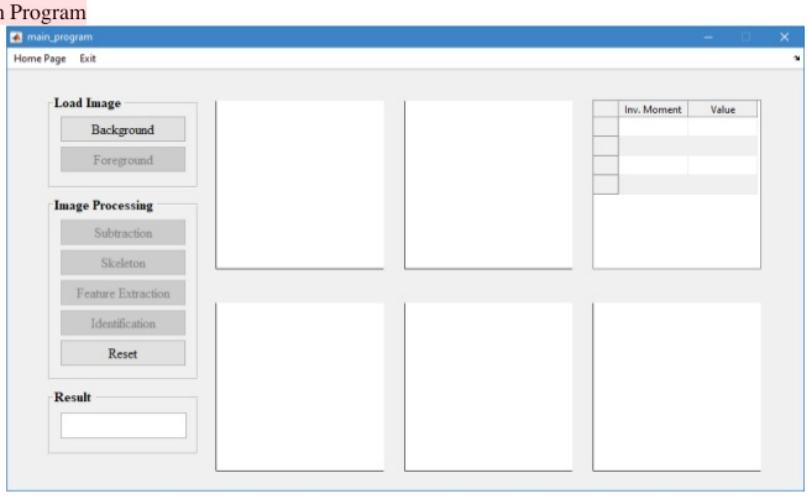


Figure 4. User Interface Main Program

2. Identification of images using back propagation neural network algorithm (down hand class and side-to-side hand movements).

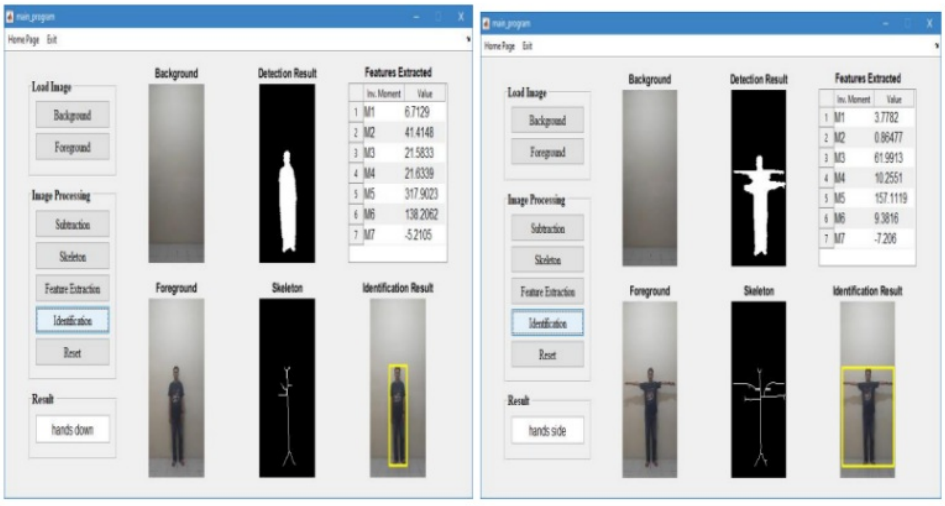


Figure 5. User interface down hand class

Figure 6. User interface site to side hand movement

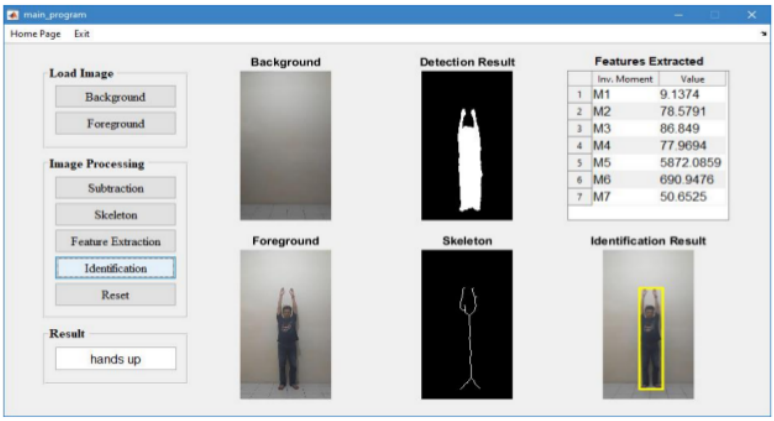


Figure 7. user interface hands up movement

4. Conclusions

1. Background subtraction method in this research is used to separate between foreground (human) with background (object other than human), and succeed are done by producing good skeleton.
2. Video frame extracted amounted to 1444 pieces. Each frame the extraction results, then performed image processing to detect the type of hand movement, with the process identification using back propagation neural network using 7 pieces invariant moment value input to produce an accuracy of 98.5557% for the process of identification of hand movements based on 4 pieces of class, one class no object, hand-down class, hand-to-side class and hands-up class.
3. Further development can be tested with various movements, and types of videos with various formats, so it can be compared the results and can be recommended the result with high identification and accuracy value and better, and for future work can be done with other action for identification.

References

[1] Ferone A and Maddalena L 2014 Neural Background Subtraction for Pan-Tilt-Zoom Cameras *IEEE Transactions on Systems, Man, and Cybernetics: Systems* **44** pp 571-579.

[2] Tah A, Roy S, Das P and Mitra A 2017 Moving Object Detection and Segmentation using Background Subtraction by Kalman Filter *Indian J. of Science and Tech*. **10**

[3] Ramirez-Alonso G and Chacon-Murguia M I 2014 Segmentation of Dynamic Objects in Video Sequences Fusing the Strengths of a Background Subtraction Model, Optical Flow and Matting Algorithms *Conf.: 2014 IEEE Southwest Symp. on Image Analysis and Interpretation (SSIAI)* pp 33-36.

[4] Hu, M. K 1961 Pattern Recognition by Method of Moments *IRE Transactions of Information Theory* **49** pp 179-187.

[5] Qian H, Mau Y, Wang H and Wang Z 2010 On Video-Based Human Action Classification By SVM Decission Tree *Intelligent Control and Automation (WCICA), 2010 8th World Congress on Jinan, China,7-9 July 2010*.

[6] Fausett L 1994 *Fundamentals of Neural Networks, Architectures, Algorithms, and Applications* (USA: Prentice-Hall).

[7] Shapiro L G, Stockman G C 2001 Computer Vision (University of Washington, USA: Prentice Hall).

[8] Ugi L V, Hidayat B, Wibowo S A 2015 Individu Identification System Running Video-Based Processing Using the Variable Module Graph Method *e-Proceeding of Engineering* **2** p 331.
[9] Talib M R, Shafique A, Hanif M K and Sarwar M U 2017 Gait Identification using Neural Network *(IJACSA) Int. J. of Advanced Computer Science and Applications* **8.**
[10] BSL N R and Akbar D F 2014 *Object Tracking Based Background Subtraction and Kalman Filter* [Thesis] yudistira.lecture.ub.ac.id/files/2014/01/paper-pcd-object-tracking.pdf
[11] Gonzalez R C, Woods R E 2002 *Digital Image Processing* (New Jersey: Prentice Hall).
[13] Szeliski R 2011 *Computer Vision Algorithms and Applications* (London: Springer).
[14] Aviv R 2011 Algorithms for Testing Connectivity – Implementation on Binary Images (Israel: Tel-Aviv University).
[15] Bouwmans T, Porikli F, Höferlin B and Vacavant 2014 *A Background Modeling and Foreground Detection for Video Surveillance* (Chapman and Hall/CRC).
[16] Chen Y, Drechsler K and Zhao W and Laura C O 2011 A Thinning-based Liver Vessel Skeleton Method *Int. Conf. on Internet Computing and Information Services,IEEE, Computer Society* pp 152-155.
[17] Zang D, Ban X, Wu D and Wang H 2016 3D-LSR: A New Model For Skeletal Representation and Segmentation *IEEE Int.Conf. on Internet of things (I things) and IEEE Green Comp. and Comm. (Green Com) and IEEE Cyber, Physical and Social Computing (CPS Com) and IEEE Smart Data(Smart Data) IEEE Computer Society* pp 80-86.
[18] Zhu Z 2008 *Computer Vision Research Progress* (UK: Nova Science Publishers).

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