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IDENTIFICATION RANGE OF MOTION (ROM) HUMAN SHOULDER BASED ON SKELETON USING ARTIFICIAL NEURAL NETWORK AND FEATURE EXTRACTION

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ABSTRACT

Frozen Shoulder or Adhesive Capsulitis is a type of disease in the movement that occurs in the human body, especially disease or disorder that occurs in the shoulder area, the disease in the form of stiffness and pain, resulting in the limited movement of the shoulder even can't move at all. It can related with shoulder arm motion (active shoulder movement) it is necessary for a routine exercise so that the good process can be accomplished well where the results achieved must reach the circumcision scope of the joint in accordance with existing standards and produce active movement with normal movement. ROM value is the maximum number of motion performed on the three body parts sagittal, transverse and frontal. In this study identification is performed after the patient performs a routine exercise can produce normal movement and limited to the type of movement no object, hyperextension, adduction, extension, flexion and unidentified movement. Using a combination of moment invariant methods on the characteristic extraction process of the formed skeleton and using neural network method for identification process its yield an accuracy value of 97.8% for the identification with 299 times iteration. The feature extraction process uses video data by taking the right shoulder enabled action and following normal ROM. The result achieved in this study show optimal using a combination of invariant method and neural network.

Keywords: abduction, adduction, epoch, flexion, shoulder, hyperextension, moment invariant, Range of motion.

INTRODUCTION

The development of information and communication technologies, the process of capturing motion analysis the human body can be seen and identified using digital image processing. For example, the identification process in frozen shoulder patients or disease related to shoulder pain, resulting in limited movement and even can't be driven at all, and certainly associated with the motion of the shoulder cannot be moved together relate to the motion of the shoulder and arm (the shoulder's active movement). By the continuing process frozen shoulder patient, gradually the functional motion of frozen shoulder patient can be seen from the results of the exercises. The process of identification of the motion (Range of Motion) manually can be measured by instrument called goniometry. Goniometry is used to determine the exact position of joint the total amount of movement so that it can be seen functional ability of patients with frozen shoulder. Active movement of the joint can be done the patient during the physiotherapy process, so that the physiotherapist can see the normal movement and abnormal movements performed by a patient with the goniometry device manually can know of function on shoulders and around the arm, can be the diagnosis can know and evaluate existence of decrease or increase of scope motion of joints, the change of exercise inducted by patient, mentioned this manual process which can be done by physiotherapy, but with development knowledge computer technology especially image processing, provides a better contribution with the prototype designed. A Similar study has been done by (Jung, 2017) to create an application that can detect the

Range of Motion for the type flexion movement, neutral and extension. Further research can be developed using different methods for different types of movements. Research conducted by (Ming, 2014), created a smart application based application that can help patients with frozen shoulder using various types of virtual tutors to help patients consist of shoulder elbow exercise, a shoulder joints internal or external rotation, in the virtual tutor and real time interaction, the purpose of intelligent frozen shoulder rehabilitation. For further application development can use various types of other movement can help patients in healing. Similar research has been done by Arno, 2015 to create a visualization of the Range of Motion to diagnostic for patients with frozen shoulder. Visualization designed for visualization of the process of the range of motion of the right measurement range of motion with the right and the normal movement in the single subject. Process visualization can be done to known the standard Range of Motion the shoulder associated with shoulder ROM, Pathological ADL, assistive device ROM, Kinematic or dynamic device properties, with development can be done by doing the measurement using a different method to support the evaluation process and the determination of the standard movement based on normal ROM movements. In general the human body motion identification analysis using two techniques with a marker (marker) and without bookmarks (marker less), limitations of the marker less technique is a tool that must be mounted on the human body, so as inhibit movement and price of such equipment is quite expensive, whereas in engineering without markers (marker less), the body does not need to be paired tool, both pieces of this same technique in performing the analysis and identification of the motion, but the difference is in the process of developing the extraction of skeleton (Hustinawaty,2012). And the other research with the tracking process skeleton using grayscale depth, detection and extraction features of the skeleton with a Straight Leg Raise, extraction on the foot with a value of 94.54% accuracy (Tavipia,2017). Through previous research already done, so for this research we can develop a research related to the theme by using several different methods and approaches, and we get value of the best accuracy from the data and simulation.

II STUDY LITERATURE

a. Frozen shoulder

According to the book of soft tissue pain and disability by Rene C, frozen shoulder or adhesive capsulitis is a refer to pathological has been verified to be a process of the capsules with no accompanying lesions joints surfaces or short rotation of the cuff. This condition usually unilaterally, occurs between of 45 and 60, and is more frequent in females than males.

b. Range of Motion

Range of Motion is an undertaken to maintain or improve the level of perfection of or ability to perform the movements and normal joints, complete mass and muscle (potter & Perry, 2012). Range of Motion is description of how much movement at a joint. Rotation typical movement and this called the angular movement. ROM is the magnitude of a movement that occurs at a joint. Starting position to measurement all the ROM unless the position anatomically the rotation. Range of Motion became the basic technique to assess the scope of the motion of joints is useful as a guide in a course or exercises of therapeutic intervention. This technique allows the onset of contraction and stretching the muscles to move each of the joints are completely appropriates to a normal movement of either actively or passively. To maintain the value of the ROM in order to remain normal, each segment joints must be moved periodically on space motion. Range of Motion according to the types of movement can be classified into 3 groups, namely are dynamic Range of Motion, Range of Motion Static-active, and Static-Passive Range of Motion (Randall, 2000)

1. Dynamic(Kinetic) Range of Motion
   Range of Motion for dynamic or static the ability of the joints in the body movement
2. Range of Motion Static-Active is ability to maintain position on the movement with the help of the antagonistic muscle for example, raise your hand and keeping it high in the absence of support external.
3. Range of Motion Static-passive is the ability to maintain the movement with the help of weight, object or other tools, for example with chair for the exercise movement.

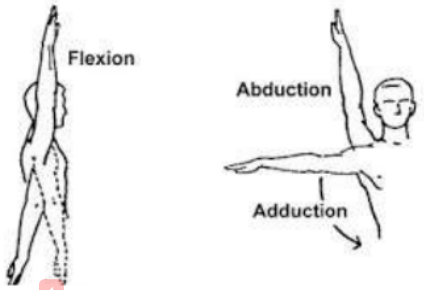


Figure 1 ROM (Range of Motion) samples

c. **Image Processing**

Image Processing is to acquire the image with the aim of obtain a digital image to determine the data neededand 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 processof 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 recogniton. (Linda G. Shapiro, 2001).

d. **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 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 on image stored and for example with moment invariant (Fauziah, 2017).

e. **Back Propagation Neural Network**

Identification process using Artificial Neural Network Back Propagation The training process uses the function activation of bipolar sigmoid on layer hidden and training functions L-Marquardt (Fausett, 1994) 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.

III RESEARCH AND METHODOLOGY

From the figure 2 is a flow about the methodology

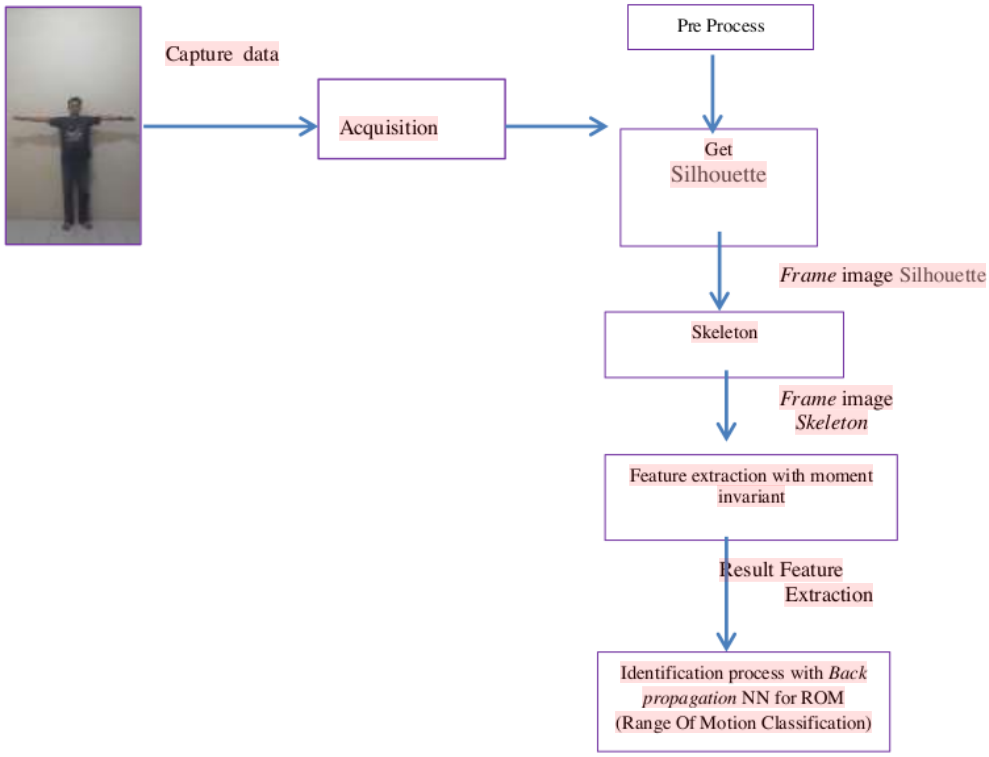


Figure 2 Research Methodology

Step by step from the figure 2:

- Preparing from the Human as actor who will give examples of movement With the Range of Motion
- Acquisition Using the Camera that has been prepared
- Conducting Video Frame Extraction process to Image
- Conducting the process of skeleton and do the process of extraction of Binary Image Characteristic using invariant moment
- Identification about the Range of Motion With the back propagation neural network

IV. RESULT AND DISCUSSION

1. Data Acquisition

In this research the data acquisition process is done using camera 8MP resolution smartphone. Data is a video that contains the movement of humans with various movement including hands for measurement Range of Motion.

2. Video Frame Extraction.

The next acquisition video is extracted into multiple frames. The total frame of extracted video totaled 1444 pieces. On each frame extraction results then performed image processing to detect the type hand

movement (Range of Motion). Table1 explain the result of frame extraction only a several frames for example.

Table1 Result of Frame extraction

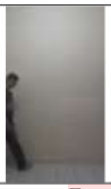
Frame 1	Frame 100	Frame 200
		
Frame 300	**Frame 400**	**Frame 500**
		

Table 1 is the result of frame extraction from the frame 1, frame 100, frame 200, frame 300 etc.

3. Image processing

Image processing is performed on each frame of extraction purpose to identify the type of human movement. Stages of image processing implemented among others are: image segmentation, feature extraction, and identification. Image segmentation done using background subtraction method to separate between foreground human with background (object other than human).

4. Identification

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 architecture The application for identification Range of Motion.

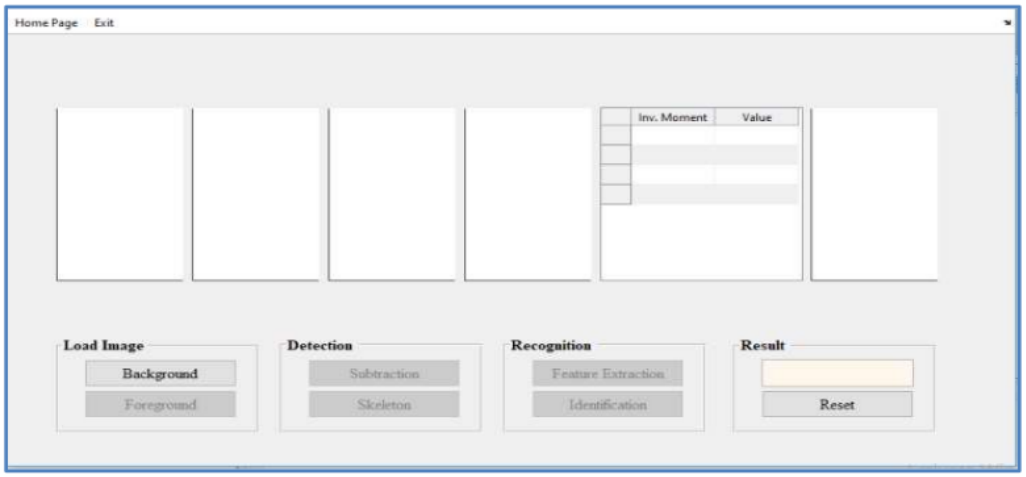


Figure 3 interface for the application ROM identification

From the figure 3 the application can be used for Range of Motion identification, the elements from the user interface from application are: load image (background and foreground), Detection (subtraction and get skeleton), Recognition (feature extraction and identification), and the results for get identification about the Range of Motion (no object, hyperextension, adduction, abduction, flexion and unidentified movement).For the load image in the figure 4

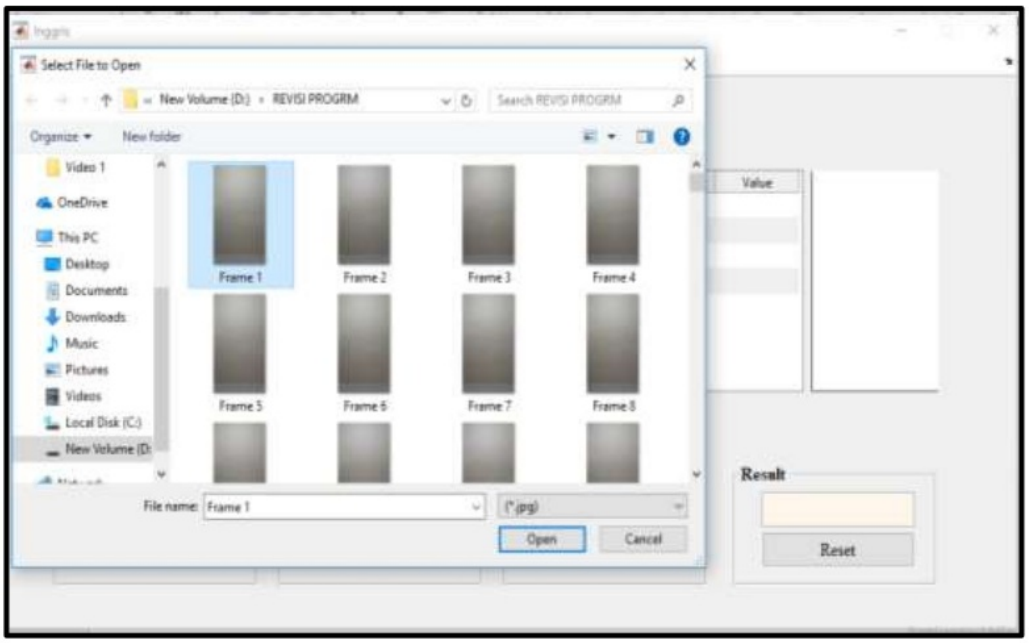


Figure 4 browse or select a background image and complete to User Interface

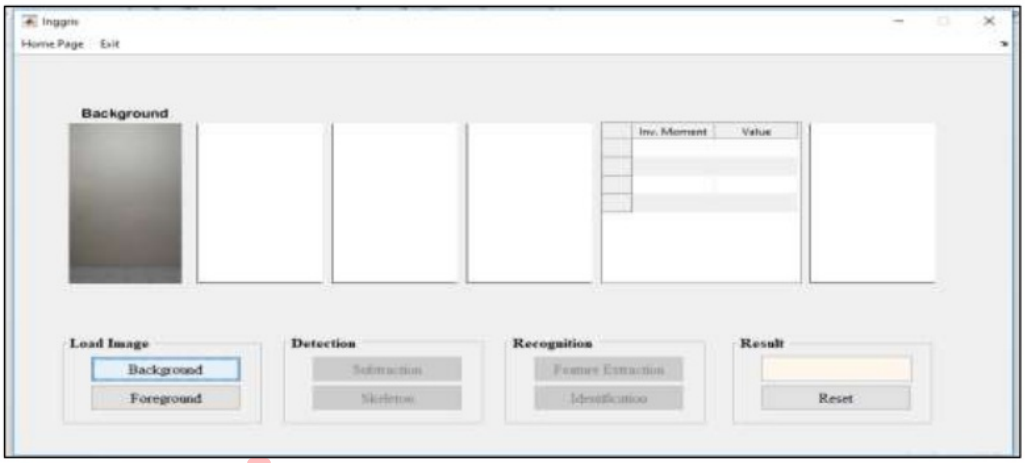


Figure 5 the result for User interface if we choose only one frame

The next step for user interface select background image, for example frame 247, look figure 9

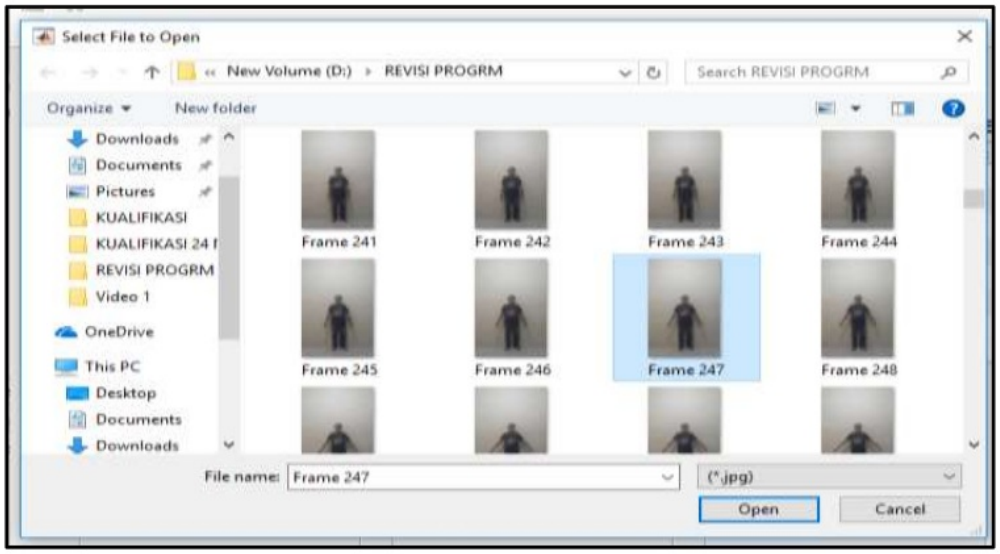


Figure 6 chose background frame image

The next step:

a. Detection Process (Subtraction and Skeleton)
b. Recognition (feature extraction and identification)
c. Result (for identification the Range of Motion: no object, hyperextension, adduction, flexion and unidentified movement).

From the figure 7-10 are the results:

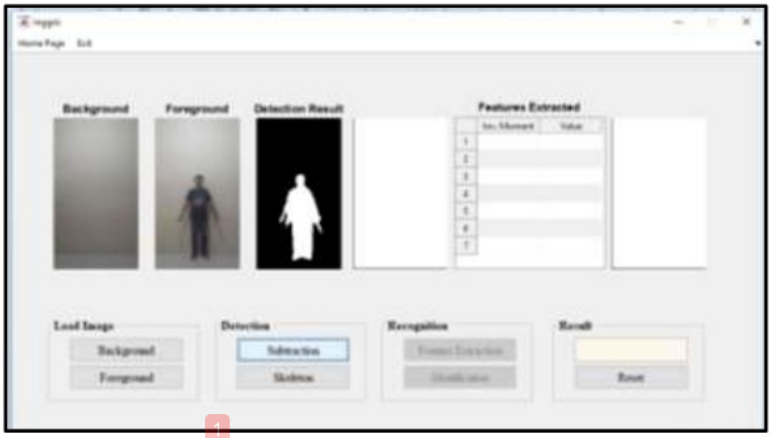


Figure 7 Detection Result (Subtraction)

Figure 8 Detection Result (Skeleton)

Figure 9 Recognition feature extraction with moment invariant

Figure 10 Identification process and the identification the Range of Motion

Conclusion

1. Background Substraction 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. Using a combination of moment invariant methods on the characteristic extraction process of the formed skeleton and using neural network method for identification process its yield an accuracy value of 97.8% for the identification results with 299 times iteration.
3. The feature extraction process uses video data by taking the right shoulder enabled action and following normal of ROM 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.

REFERENCES

1. Arno AH, (2015), Visualization od Shoulder Range of Motion for Clinical Diagnostic and Device Development, 978-4799-1808-9, IEEE Explorer
2. Fauziah, (2017), Identification of Hand Motion Using Background Subtraction Method and Extraction of Image Binary With Back propagation Neural Network on Skeleton Model, The Second International Conference on Computing and Applied Informatics (ICCAI), November 29th – 30th Medan North Sumatera, Indonesia.
3. Fausett L, (1994) Fundamentals of Neural Networks: Architectures, Algorithms, and Applications, Prentice-Hall Inc., USA, 1994.
4. Hustinawaty, (2012), Skeleton Prototype Software Detection and Feature Extraction of Non-intrusive On the gait of Man In Real Time, ISSN 1750-9823 (print), International Journal of Sports Science and Engineering, Vol. 07 (2013) No. 01, pp. 003-022.
5. Jung et all, (2017),Development and Evaluation of a Method to Measure Wrist Range of Motion on Paretic Hand Rehabilitation Device, (ICORR) QEII Centre, London, UK, July 17-20, 2017. PP. 1337-1342.
6. Linda G. Shapiro, Geogre C. Stockman, (2001), Computer Vision, Prentice Hall, 1 Jan 2001) 580 pages, The University of Washington, Seattle Washington, Department of Computer Science Michigan State University, East Lansing, MI.
7. Ming, (2014), intelligent Frozen Shoulder Rehabilitation, IEEE intelligent system, published by IEEE Computer society.
8. Potter & Perry, (2012), Fundamentals of Nursing, 8th Edition, Patricia Stockert Amy Hall, eBook ISBN: 9780323091916, eBook ISBN: 9780323293969, Published Date: 22nd March 2012, Pages1392.
9. Randal L. (2000), Physical Medicine and Rehabilitation, WB Sounder Company, Second Edition, The Curtis Center Independent Square West Philadelphia, Pennsylvania, 19106, 716 Pages.
10. Tavipia (2017), Measurement Straight Leg Raise for Low Back Pain Based Grayscale Depth", TELKOMNIKA, Vol.15, No.1, March 2017, pp. 471~477 ISSN: 1693-6930, accredited A by DIKTI, Decree No: 58/DIKTI/Kep/2013 DOI: 10.12928/TELKOMNIKA.v15i1.4291.

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