IMAGE BASED AUTOMATIC DRESS MANAGEMENT

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering.

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APPROVAL

This Project titled "**Image Based Automatic Dress Measurement**", submitted by Tamanna Alam, ID: 172-15-9626, and Jannatul Ferdous, ID: 172-15-9737, and Md. Ariful Islam, ID: 172-15-9615 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on September 2021.

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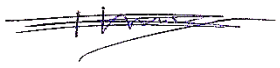

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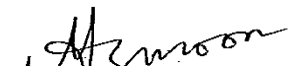

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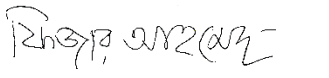

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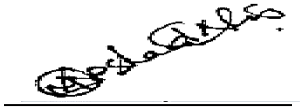

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We hereby declare that, this project has been done by us under the supervision of **Warda Ruheen Bristi, Lecturer, Department of CSE,** Daffodil International University. We additionally pronounce that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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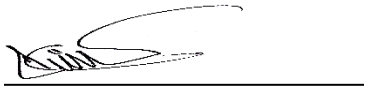

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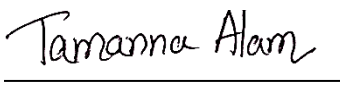

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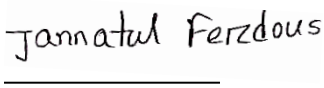

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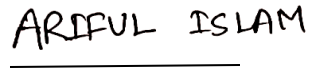

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Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

This report writes on image-based project name “Image Based Automatic Dress Measurement System”. In this project we developed body measurement without any direct contact of anyone and only by using his/her full body image, we can measure the measurements that a tailor measure for making a dress. This project will helpful for especially female who feels uncomfortable for measuring their body in front of tailor. This process of measurement is very easy and also time consuming. It takes only 7-8 sec whereas the manual measurement had taken 3-5 minutes for subjects. The images of the body were captured using any camera then that image was fed to computer, then by uploading the picture in this project we will get the accurate measurement of shoulders, arms, chest, leg, waist and wrist sizes to make a dress. We develop this project by using machine learning and computer vision technology. The anthropometric data of the body covered by luminance color ribbons, it can quickly measure by the system.

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CHAPTER 1

Introduction

For a human, clothing or dress has two purposes. One is to cover the body and another is to beautify the appearance. As clothes are covers most parts of our body, it is consciously or unconsciously a big matter for our physical or emotional feelings. So, a perfect size of cloth or dress is very important for a human. Body shape may differ significantly so form all this point of views we have made this project that is automatic dress measurement system.

1.1 Image Based Automatic Dress Measurement System

Measuring the body of human is a significant activity, which has long been performed to describe subject for a variety of very different tasks. Automatically body measurement can do in many methods, we have done this with image processing-based systems. The measurements such as the circumferences of hip, shoulders, arms, chest, waist and wrist are important matrix for making a dress perfectly. And the aim of our project is to measures these sizes as a tailor do.

The classical terminology and methods of body measurement for the clothing field were first published by the join clothing council. Body measurement were divided into four groups. Stature, segment length, body breadth and circumference.

Due to the still increasing importance of the visual information, the field of computer vision having growth in research and also publication. The refreshed deep techniques are playing a major role in the success of computer vision techniques. Using machine learning and computer vision we have done this project. This is a very simple project. Only one image is enough for this to measure the full body shape.

1.2 Project Motivation

All over the country, there are many male tailors but female tailor is very rare, for this sometimes female feels uncomfortable to measure their dress in front of male tailors. Also, in this pandemic situation of covid-19, it's much risky to measure our body in front of a tailor and also for lockdown tailors may close all day long. And a tailor took much time to measurement, so we have focused all these problems. This project can solve all these problems only by clicking one image.

1.3 Project Objective

This project is running with various objectives. The most important objective is given below:

1. To solve female dress measurement problem
2. To measure body automatically only by using one photo
3. To measure body measurement appropriately within a few seconds
4. To reduce risk in this pandemic covid-19 situation
5. To save time and money also
6. To understand easily we use the easiest method.

1.4 Expected Outcome

After completing our project, we will able to measure our dress measurement by using only our one full body picture and our height. This system will be time consuming and also easy. Female will feel comfortable by using this system. The measurement of body that a tailor measure for making a dress as size of arms, chest, leg, waist and wrist will be measure automatically. Another important outcome is we will use CPU device for this system that's why we don't need any internet connection. Tailors can also use this system to measure the dress measurements.

1.5 Project Management and Finance

Project management gives an overview about the project such as how we design, implement and outcome of the project whereas project finance gives financial structure of project. For implementing our project, we need some machine learning tools, as it is a image based project, so we need computer vision for this project implementation. And also, as it is a software-based project, the tools of machine learning that we will use is totally free and available to get them easily, so there we don't need any financial structure for the project.

1.6 Project Layout

Here, we will give a whole overview about our project report. In our project report, there are five chapter these are Introduction, Background, Methodology, Experimental Result and Discussion, Conclusion and Future Scope.

Chapter 1: Introduction

In this session we talk about the project that why we choose this project, why this project is important, what are the expected outcome of our [project and some management things of our project and also the rational of the study to do our project.

Chapter 2: Background

In this section we have discussed about the background related works, scope of problems and challenges that we faced.

Chapter 3: Methodology

Here, we have discussed the theorical topics those are related with the project, as machine learning, computer vision, the workflow and implementation requirements.

Chapter 4: Experimental Result and Discussion

In this topic we provide the experimental results, performance evaluation and discussion of the final result. Some extensional pictures are presents in this chapter to make realize the project.

Chapter 5: Conclusion and Future Scope

In this last chapter we talk about the summery of the project and conclusion and our future work on this project. The chapter will close by appearing the limitations of our works that can be the long run scope of others who need to work on this project.

1.7 Rationale of the Study

It is no doubt that there are many works on body measurement system and these approaches or processes are being used in many automated systems as well as computer vision. To develop more automated application or make much more efficient of machine learning approaches in, there has no alternative to work with this, this made us to be interested to work with this project.

In this pandemic situation it's quite dangerous to go to tailor's shop to make a dress in front of tailor, also female feels uncomfortable sometimes because in our country female tailors are rare. So, it's important to do the same things from another way. Though there have many ways but most of them are much difficult as that are expensive or difficult to use the system or took much time to measurement or don't user friendly. So, we took challenge to overcome all these problems through this project.

Chapter 2
Background

2.1 Introduction

In this section, we will discuss about the related works, research, summary and challenges about this project. In related works session we will discuss other projects that are related to this work also some research papers that are written on this type of works, their methods and accuracy which are related to our work. Our project summary vs their project summary and also, we will talk about some challenges that we face to make this project and also the accuracy and how we thought to increase the time and accuracy level, also why this project is better than that project or apps.

2.2 Related Works

In May, 2002 three authors were published a research paper that was shape matching and object recognition using shape context, though it was not fully related to our work but there was something that was a little relate to our work. This research work was not shaping a human body, it only shaped any alphabet or any abstract's shape. Then In January, 2009 an author wrote a paper on development of Human Body Measurement size system for clothing. In this paper is very much similar to our project. In this paper there needed human's age, weight and height. There it took .96 minutes and it processed on Adobe Photoshop and Microsoft Excel for the image measurements. In January, 2011 three authors were work on a paper, it was Image-based dress-up system. In this paper they present virtual dress-up system according to user input model and garment image. This paper as like to measure a body so that we can saw ourself on one dress before buying the dress. How the dress will fit our body this paper is based on this. In 2012, there was also a publication about human body measurement system in clothing using Image processing. This project is for a device that is made Iran to measure body size and Improved garment fitness. Using camera clicked photo from three angles then the data

are converted into three anthropometric sizer using image processing procedure. In July, 2013 in 35th Annual International Conference a journal was published in Japan that was Anthropometric Body Measurements Based on multi-view stereo Image Reconstruction. In this publication's circumferences of some body parts length, it's ratio and also body mass index. It's for evaluation obesity and fitness. Basically, it was on the health or fitness of human. But it also helps us in our project. In 2018, West Virginia University published a paper that was a machine learning approaches to human body shape analysis with a vision – Driven approach and a Soft-Biometric viewpoint, a medical science viewpoint it was made. It can calculate the mass of body, body fat percentage and also body surface area, this research paper also helps us in our project. In 2018, there was also an Article on Image Processing Techniques for augmentation 3D modeling. It usually on 3D image. And recently November, 2020 an article found on Image-Based waist to hip. Ratio determinant this article is similar to our project but this paper only determined the waist to hip ratio of body not the full body ratio.

So basically, these all papers help us to successfully make our project.

2.3 Research Summary

Human body measurements bring a lot of information about individual physical shape, status, size and body composition. There are a lot of procedure for talking body parts measurements. Profound learning might be a method for completing machine learning.

Due to increasing the importance of visual information, computer vision has growing in research and publication. Machine learning is another field that can boost the computer vision technique. Deep learning playing a major role in the success of computer vision technique. So, we have chosen this technique to fulfill our desire project. This project is simply body measurement system project that will measure our cloth size as a tailor measure. Basically, this project made with machine learning and computer vision thought to detect the body from the image, we use a pre-trained Har-based detector which used for detecting the body parts. We have to click a picture of our whole body then to insert the photo into the program file and have to insert code and also have to input their accurate height of the person and then using the picture of image processing the

measurements of full body or tailor's clothes measurement will show there. Here in this process the program will detect the body in the picture, then feature extraction will do, in this part it will lead to better understanding and classify the image. Then the program will extract the focal points of the body. Then estimate of measurement will done. And finally, it will predict the size of the objects as measurement to make dresses. We will provide more details about the computer vision and machine learning techniques that used in every research in chapter 3. The collaboration process is based on projective transformation by matrix, it can describe as linear transformation on homogenous – 3 vectors.

$$\begin{bmatrix} x'1 \\ x'2 \\ x'3 \end{bmatrix} = \begin{bmatrix} h11 & h12 & h13 \\ h21 & h22 & h23 \\ h31 & h32 & h33 \end{bmatrix} * \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}$$

Or, in short,

$$x' = Hx$$

In this system there is also another 2D vector matrix for detecting body parts as required.

2.4 Challenges

The main challenges of this work are to collect the right dataset dealing with all the dataset was too tough. To collect the accurate dataset, we used some method. We needed a lot patience to detect the problems and measure the measurements accurately. There was a problem to measure the measurements very accurately. From different positions the measurements came out different. It was a challenge to overcome/solve this problem. Also, if the height was not accurate then it fails to get the correct measurements. So there thing was a challenge for us to overcome.

Chapter 3
Methodology

3.1 Introduction

In this area we will attend the theriacal part of our project. To estimate human body measurements and get body sizes from 2D images that taken from any camera or smartphone. We use computer vision and machine learning to predict and get human body measurements. The model will do some method.

I. Detect human body from image
II. Extracts the features of the body from image
III. Determines the focal points in the human body
IV. Calculate the measurements by computing difference between the points.

In this section, we provide more details about the computer vision and machine learning techniques used in research.

3.2 Research Subject and Instrumentation

Inquire about subject can be called as research area that was reviewed and studied for clearing concepts. This is not only the implementation of this project but also for design model, implementation of project, process data and training the model. Then also instrumentation that is which technology and method we used. In this project, we used windows platform, python language with many packages like NumPy, Pandas, Open cv-python, Pillow, SciPy, Tensor board, Torch, Torch vision, Pycoco tools, Onnx, Scikit-leart, matplotlib etc. We used CPU device here. Using these all things this project will be done. As we are using CPU device here so for running this project fulfil, we don’t need any internet connection.

3.3 Workflow

This project has few stages of workflow as body detection feature extraction, extract the focal points, estimate the measurements, finally predict the size of the body.

3.3.1 Body detection

Human body detection or object detection in general a computer research problem related to computer vision and image processing. The main aim of detection is to identify a specific features or part of any object in image and videos. Using machine learning approach most of the object detection system used. To determining the features of an object we use machine learning to detect the body and the use the classification techniques to classify the objects. Haar-Cascade is a machine learning approaches to specifying the features of an object. For real-time object detection Haar-Cascade classifier is a machine learning based approach. Haar-Cascade is very fast and more accurate than other components. So, we have chosen this classifier over another object detection algorithm. There also have some algorithm to detect object those most popular are Rowley Baluja-Kanade detector, but Haar-Cascade classifier classification process is based on feature values rather than pixels that makes the algorithm 15 times faster than Rowley Baluja-Kanade detector and 600 times faster than Schnciderman-Kanade detector. The algorithm also considered as good and robust method for object detection because it provides very low false rate. The algorithm has been successfully applied to human body detection in image.

To detect the human body from the image, we use a pre-trained detector that provides three detectors. These are upper body detector, lower body detector and full body detector. In upper body detector it’s detecting the upper body part, in lower body detector it’s detecting the lower body part and then in full body detector it used detecting the whole human body. There will be image with a random background, from that image the detector will detect only human body. This detector has some limitations that it can’t detect body from side body, it only detects body from front and back side.

Some detector has some problems that some detector can't detect wearing light color dress but here all color will be okay. After doing some experiments on these detectors, we found out to enhance and improve the detection results by converting the input image to colorful scale. It can detect 96% model detects on front body image and 21% of side body image. So, in this research, we ignore the side body type. We will only consider the front image.

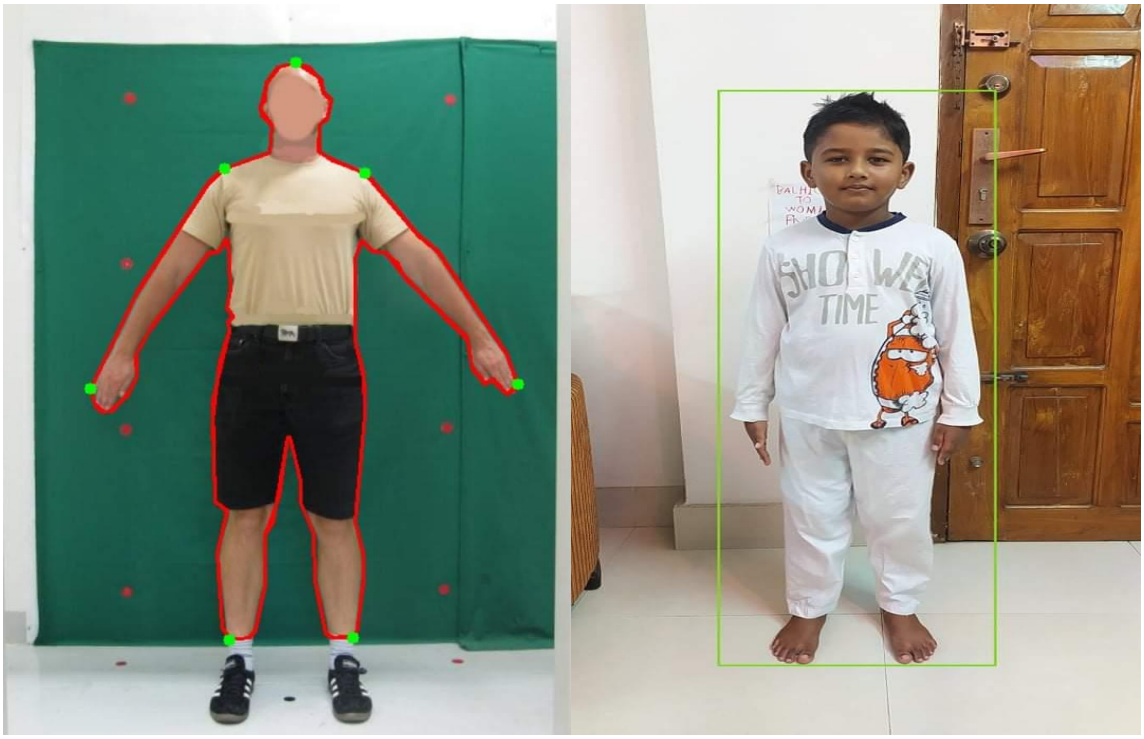

Figure 3.1: Body detection shape

3.3.2 Feature Extraction

Feature extraction is an essential stage that leads classifying image in image processing. The main goal of this feature extraction is to extract some focal points from body of image to estimate the measurements for each part that have to measure for our measurement as shoulders, bust, waist, hip, leg sizes.

We have tried to calculate the measurements in some other methods finally we have chosen this method to measure the body part. In this method we have two major steps. The first step segments the input image, vertically into parts the specific points. Then in the second step specifies the two points from the most left and most right side of each body part. We have significant the image into 18 dots and some vertical lines. We know that to estimate the measurements foe any part we need at least two focal points as example most left side and most right side. We will discuss further about this type of measurement in the next section that how we have measurement all these from the body image and how we get the accurate classified in body detection stage.

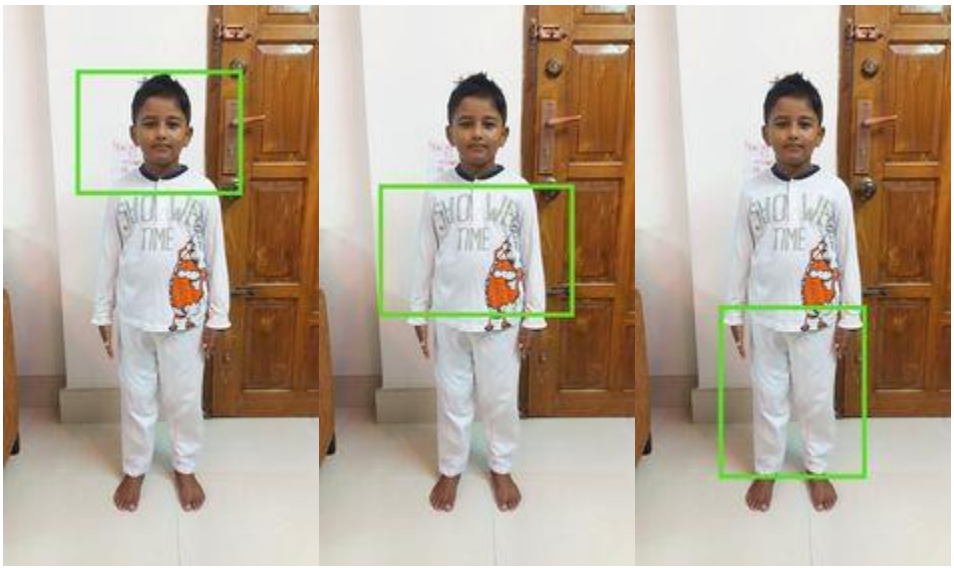

Figure 3.2: Feature extraction dataset

3.3.3 Extract the Focal Points

In this section, we will discuss about the method that we used to extract the focal points after the segmentation stage. After segmentation the image into 18 dots, it has colored every line with the same color to facilitate counting them. Then we have selected the nearest segment line in the interest points by observing all lines in pictures and select the nearest segment line to the interest points by the observing lines. We select the mean point of the left and right points for each body points, the shoulder point is forming the most left point to the rightest point. We consider the average of those values as left focal point and right focal point for the shoulder. As these all the measurements measures of bust, waist, hip measured with this same process. For the bust, we observe the focal points between 5 to 9 and the waist from 6 to 8 points. And finally for the hip, all the left focal points fall between 8 and 10 and all the right are between 14 to 16.

For the female body measurements of shoulders that, we observe left focal points fall between 5 to 7 and 12 to 14 falls from right focal points. Then for the bust fall between 6 to 8 from left focal points and from 14 to 16 right focal points. As this the waist size is also calculated from one point to another. This process will be done automatically and will give us the accurate measurements in future works. This section will shower us that how we will use these focal points manually in this work.

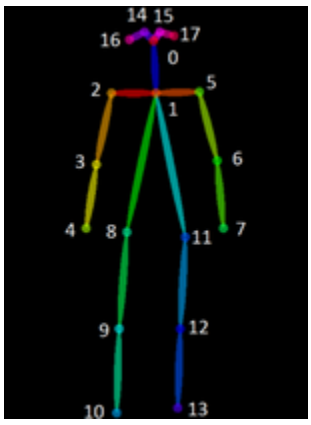

Figure 3.3: Extraction of the total focal points

3.3.4 Body Segmentation

In this section, we will discuss about how the segment of body measurements will work and how will measure the accurate measurements. In provides section, we discussed about how the segments of length estimation done. We can easily describe this process by one mathematical term.

$$\boldsymbol{E(a,b,r) = \sum_{i}\{(xi - a)^2 + (yi - b)^2 - (r)^2\}}$$

Here, (a,b) is estimated.

Circle center, (xi, yi) are circle position and are circle radius. These terms can obtain the original factor position of center of rotational in joint. Though this process of segmentation is for 3D model. With the difference of larger input enhancements, the next is to search for five most distal points of the subject. We have developed an algorithm for scanning and extracting the segments that explain as follows, it will describe as center axis. After desired length that extracted and continue the process for next segments. This process is as following and in this picture this system arranged.

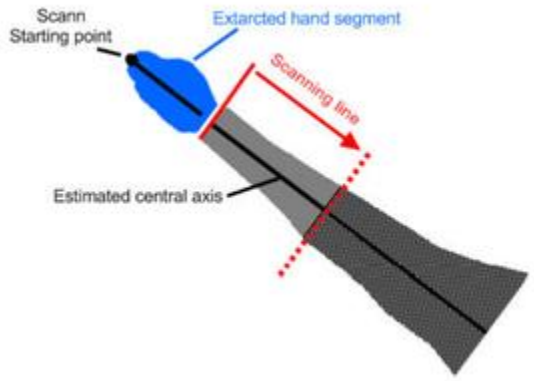

Figure 3.4: Segment scanning procedure

3.3.5 Estimate the Measurement

After specifying the left and right focal points for all the parts of the body, we need to find the distance between those points by finding the difference between them. The result of those difference is as the width of the area by pixel unit but the system will work in cm. So, we have to convert the result from pixel to cm. We know that, 1 pixel is equal to 0.0264 cm. So, we have to multiply the result to 0.0264. We obtain the results that we got after converting the difference represent the width of the area inside the body image by cm and we want to use this value to estimate the real measurements of the body. To estimate the real measurement of body area knowing the distance between focal points inside the image to the distance between the real focal point inside the image to distance between real focal point and body and the camera. So, we fixed the ratio between the width of focal point inside the image (cm) and the real (cm) the ratio between the width of the shoulders inside the image and in real and as same way as the ratio between the real of waist or bust or hip and the camera-based measurements. The values of the reference point are the values of a single particular selected randomly from the male and female. Here are some equations that are based on the all measurements.

1 pixel = 0.264 cm

Estimate Shoulder = 11.862 * width (cm)

Estimate Bust = 29.03 * width (cm)

Estimate waist = 26.01 * width (cm)

Estimate Hip = 31.15 * width (cm)

Estimate Wrist = 6.03 * width (cm)

These measurements are for male only.

For the female body measurements these are different. For female we given in below.

Estimate Shoulder = 13.63 * width (cm)

Estimate Bust = 36.18 * width (cm)

Estimate Waist = 14.66 * width (cm)

Estimate Hip = 39.05 * width (cm)

Estimate Wrist = 8.32 * width (cm)

3.3.6 Predict the Size

In this paper, we discuss about the project, we build a machine learning models to predict the size of dresses that are suitable by training and testing the models on real-world dataset of the body measurements of participants along with their clothing size. Machine learning method was used in this phase as the dataset contains features as body part measurements. Here we implemented SVM classifiers that can predict the clothes size. SVM or support vector machine is a type of supervised machine learning classification algorithm that was introduced in 1960s. SVM is one of the most used and fast algorithms that give best results among other classification method. We built SVM model to predict the standard sizes. For all cloth category as upper pieces, lower pieces, full pieces and also one versus all multiclass classification approach. Finally, the output of the model will represent as the size of the clothes according to the measurements.

The work flow of our model:

In the whole process there it is,

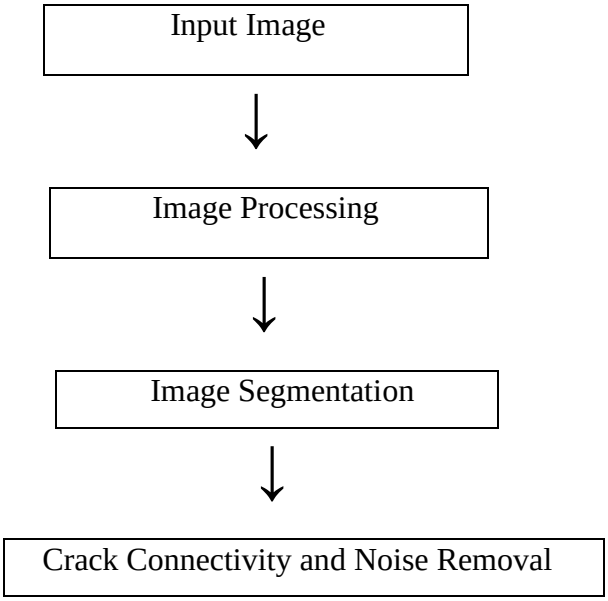

Figure 3.5.1: Workflow of our approach

And the process that used towards the model:

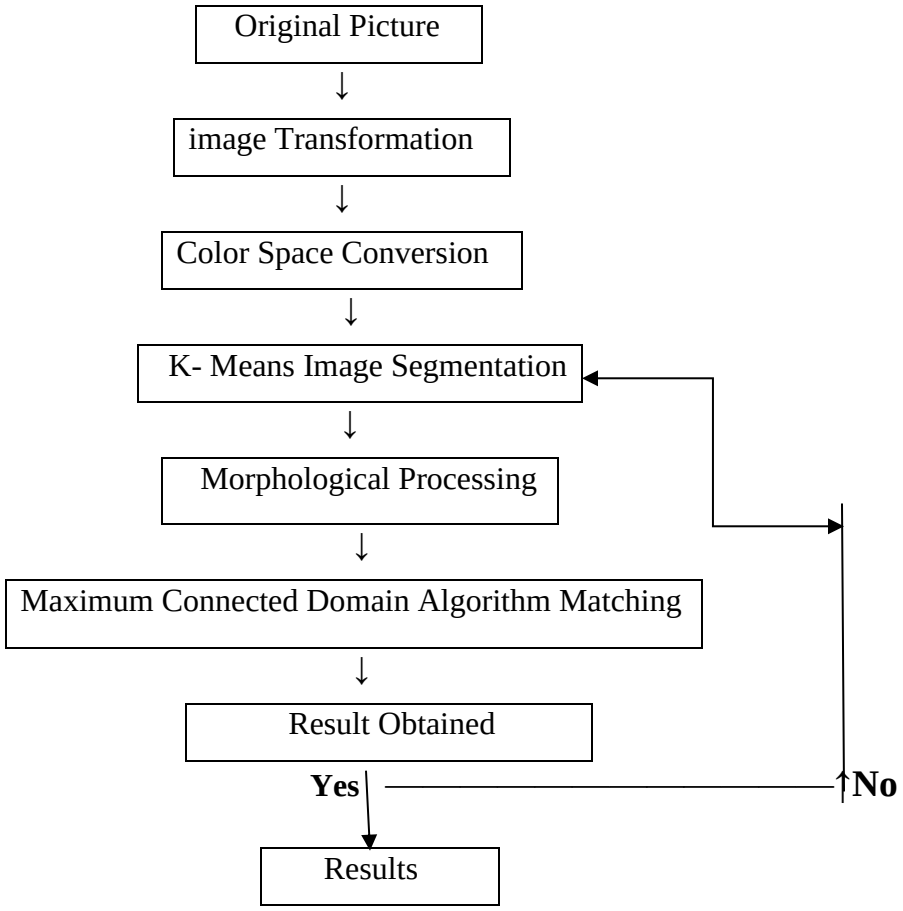

Figure 3.5.2: Workflow of our approach

3.4 Data Collection Procedure

Dataset plays a vital role in the performance of any machine-learning based system. To build a system that a tailor measure to make a dress to estimate their body measurements from an image that taken by any camera or phone, we need to develop a machine learning algorithm of dataset that consists individual image with everyone body measurements. The measurements that we needed to achieve the goal of this project is to measure shoulders width, bust width, waist circumference, hip also some other measurements. From some previous dataset we have found there some missing data. So, we build our own dataset. According to scientific research procedure we collected our dataset the

subjects of data collection was divided as gender, age, camera etc. There were 22 participants, 15 was female and 7 was male. From that 5 was under 15 years and others were between 15 to 45 years. And the images that clicked by some different camera phone.

We took the measurements of the participants by using a measuring tape of measure their shoulders, bust, waist, wrist and hip etc. as the unit of centimeter. There were random pictures that was clicked from different distance and also with different background to make it user friendly. As smartphone is now-a-days very available to use so we have chosen this device for clicking pictures.

Figure 3.6: Image of some sample clicked

3.5 Data Processing

Data processing system has two parts. The training part and the testing part. The training part will be used to train the model and then testing part will be used to test and evaluate the model after testing part. In this project session, we will take human body images and also basic measurements as dataset. Then the pre-processing stage will come, the victory of any research depends on the pre-processed information. The more effectively information will be more correct. In one word, it is the starting challenge for such kind of inquire about basic work.

3.5.1 Data Augmentation

Data augmentation is a common method in deep learning that used to reduce the effect of overfitting. This idea is to expand an existing data set that only available so that learning algorithm should be effective. Usually, to train deep learning database we need a big set of data, data augmentation can be employed. Data collection is based on two procedure one is from manual data collection and another is already existing data set. We have found that in existing data case only limited data set is available so for expend the size of dataset data augmentation is important. We choose some strategies as,

- Rotate left 30 degrees
- Mirror – It is the most popular augmentation to increase dataset
- Salt and pepper
- Shear: to do shear augmentation we use,

$$A = \begin{bmatrix} 1 & 5 \\ 0 & 1 \end{bmatrix}$$

3.5.2 Data Preparation

All the pictures that capture by camera are same sizes photo and jpg or jpeg type photo. All the pictures of our dataset have diverse statures and widths. There are two types of data or picture collection. One is from digital camera and another is from smartphone camera. This is because the quality of difference that differ two kinds of pictures. There we have used some branded phone. One is Xiomi note 8 that's resolution is 1440*1440-pixel, windows phone that was 750 pixels, Huawei note 7i that was 750*1334 pixel, Xiomi note 9 pro and Xiomi note 7 pro that was also high-resolution picture was 1440*2960 pixel then in the digital camera this resolution is much high that was 128-megapixel camera. We have collected some image from one person that was edit by coloring properties of a body.

3.6 Proposed Methodology

The methodology of our project has some steps that is important to connect with the project and understand this procedure. In this process here are two parts.

1. Acquisition
2. Processing

3.6.1 Acquisition

In this section, this is the front part of our work. The first doing work is preparation and scanning.

In these two parts here are also some works to do. Body mark and postures will be done firstly then ISO standard is important for this procedure. Also, from this ISO standards form it measure body measurements.

Then in scanning procedure, it can progress 2D data and 3D scan process. In 2D data it processes RGB image and in 3D scan procedure there have point cloud and depth map. As according to this procedure, the diagram should be,

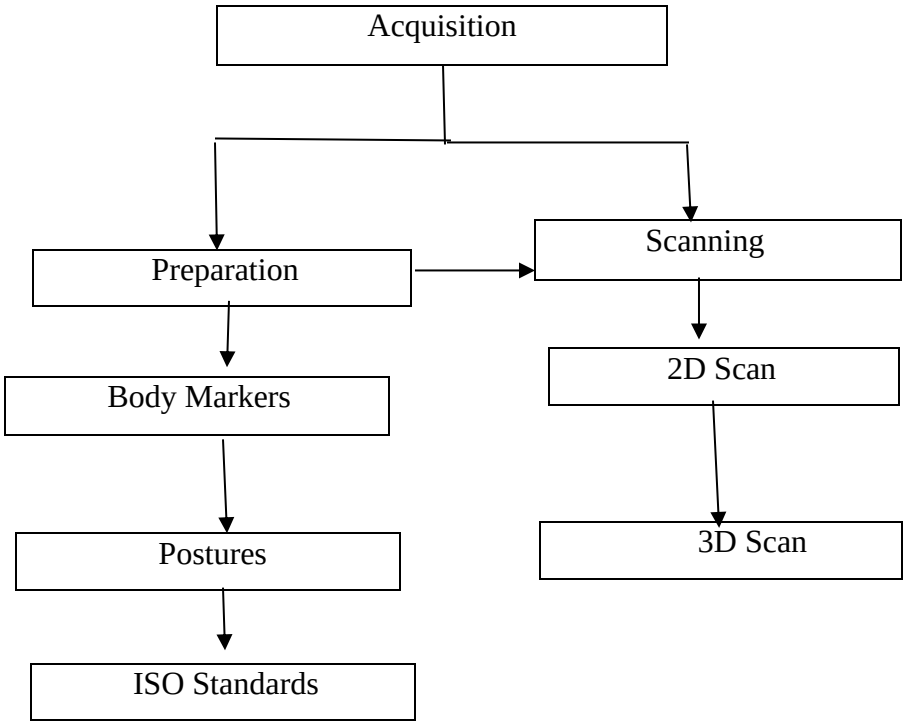

Figure 3.7: Acquisition procedure diagram

3.6.2 Processing

In this section, there are also some procedures. Those are feature extraction, model fitting and measurement extraction. After the previous part of work acquisition part, preparation then scanning then the important part of processing is feature extraction.

In extraction two important part are executed that are key point and silhouettes. Key point is that is pointed to the image as for measure the body sizes. These key points are important for measurements. And silhouettes are the size of the body. These two's work is sometimes similar to all the work of main part. In the model fitting part, their work done in two steps these are mesh fitting then statistical models.

This step is the revision step of this model. This is the four steps of this methodology. The final procedure of this model and as well this part is measurement extraction. In this session the measurement part done and the final result come out.

In total the final model of this methodology come with this following model.

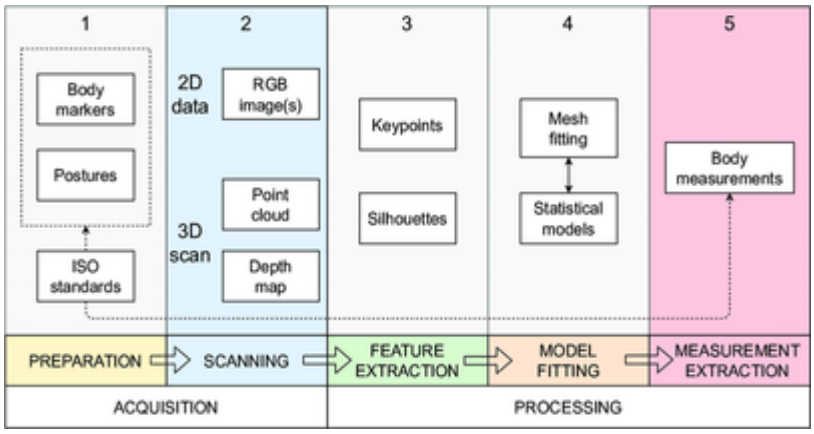

Figure 3.8: Proposed methodology of our model

3.6.3 Sikhs Features

Sikhs or scale invariant Heat Kernel Signature is an important feature of our model. Basically, it will give connection between time intervals and sampled frequencies, these two are the main parameter of this model. This time intervals usually determine the spatial frequencies analyzed. The second one as the parameter usually determines the sampled frequencies from the LBO eigen decomposition. This epical, we use a relatively small number of frequencies that are from 2 to 20, with a step of 0.2 first 20 components from LBO.

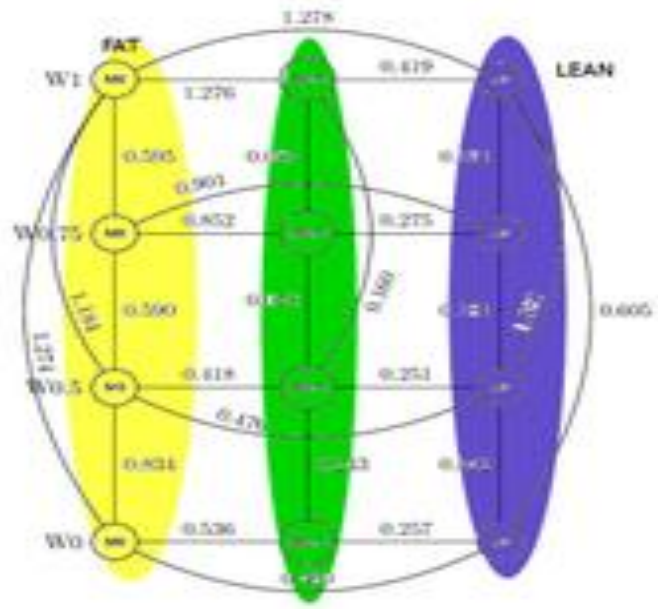

Figure 3.9: Categorized of subjects in virtual body dataset

In the image, here yellow is for fat, green is for average and blue is for lean.

3.7 Training the Model

For all the experiments, we have split the sample whose ratio was 70/30 between training and testing. For the experiments with the sample height, we used 240/106 shapes for class and respectively for train and testing. For those experiments, we used 800 and 554 substantial number. We decided to use SVM from liblinear library to keep the training time low. Here, we have used about 75% dataset to train the model and 25% dataset used to test and valid the dataset. In this model, we also used the Homogeneous Kernel map to take advantage to additive kernels.

3.8 Implementation Requirements

by the proper analyzing on all the methods and statistical and theoretical concepts, the requirements or tools that we need for this project are:

Hardware/Software requirements

- Operating system (windows 8 or above)

- Hard Disk (minimum 500 GB)
- Also, about 100mb free space
- RAM (minimum 4 GB)

Developing tools

- Python environment
- PyCharm

Chapter 4

Experimental Results and Discussion

4.1 Introduction

In this chapter, we will discuss about the development process of the project, how the experimental results of the project came from and some discussion about the process. We have done this or prepare this of the demonstrate isolated into few steps as dataset collection, information planning, information increase, information resizes and finally the proposed of this project. The experiments that we tried to do for the future project and the outcome that comes from the experiments is important for a better project thought. This chapter will present these things detailly.

4.2 Performance Evaluation

In this section the scale of measurement that is accurate is held in the previous section or manual section that a complete measure can give us. We measured the user's satisfaction with our system by using image or open cv technique. In this technique we can say,

$$\text{Standard Error} = \frac{SD}{\sqrt{n}}$$

Here, SD = The standard deviation of the distribution.

n = The sample size.

The standard error for the manual measurements is 0.0541 and while that of the image-based measurements is 0.0514. these are standard mean error.

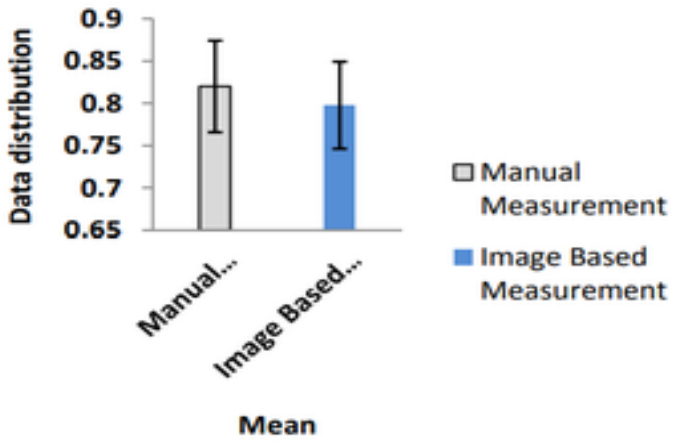

Figure 4.1: Companion of manual and image-based measurements bar chart

The percentage accuracy:

$$\frac{Mean\ of\ image-based\ measurements}{Mean\ of\ manual\ measurements} * 100$$

$$= \frac{0.7977}{0.8199} * 100$$

$$= 97.3\%$$

The same work that was done before in previous researches, it was often that some measurements show the best results. In this table we have shown only 15 users among 40 users that measures some measurements. Here some bar chart of the previous and our new model measurements.

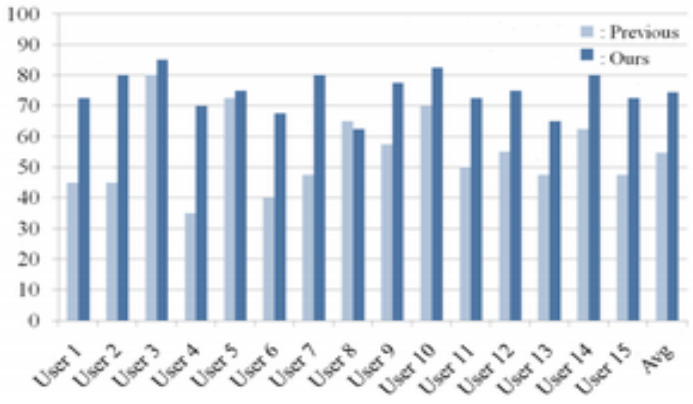

Figure 4.2: Analysis of average 15 users compared with previous 3D based method with ours.

4.3 Results Discussion

Here, we will present the result of the prediction size using the estimated measurements. Also, by applying our method to variety of input image and see the final result of our system. We predicted the measurements for different pieces as upper part, lower part and full piece and we have compared the sizes with the true size of our clothes.

From 4.2 performance evaluation, we have gotten the accuracy that manual system. This result came from some data that was measured from picture and from manual.

From an image that's height was 125 cm. Here, the different of two types of measurements are,

Body parts	Image-based measurements	Manual measurements
Arms	35 cm	38 cm
Chest	58 cm	52 cm
Leg	92 cm	102 cm
Waist	124 cm	108 cm
Wrist	10 cm	12 cm

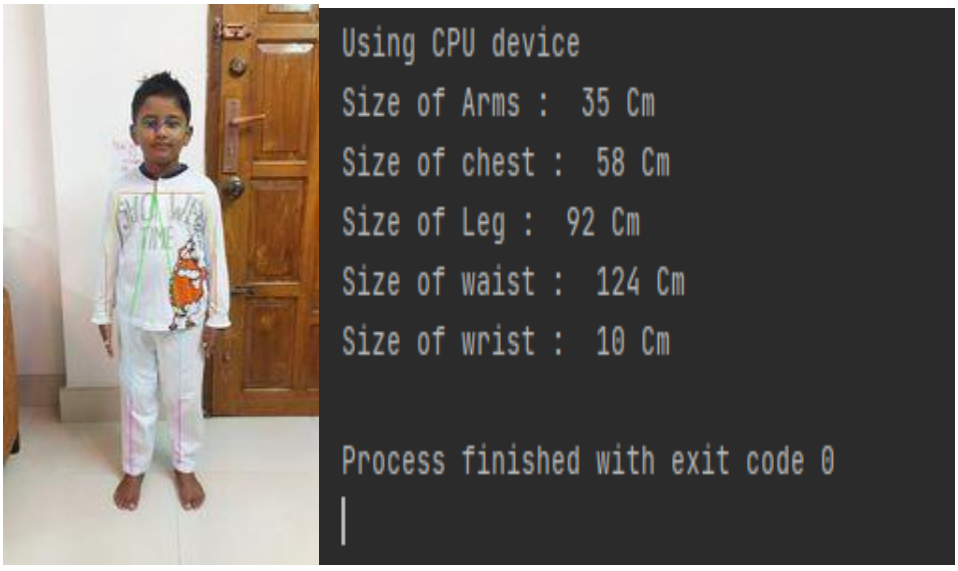

Figure 4.3: Output skeleton and final result of our system

These are the difference with two types. And from these data we got these measurements and got 97.3% accuracy. As this is a machine and a robot can’t do always the accurate results. So, it is okay to get this percentage accuracy.

Chapter 5

Conclusion and Future Works

5.1 Summary of the Study

There is a lot of research work on this topic. Basically, first of all we are proposed a model for this project. We proposed an approach that aims to make a system that is a measurement system of human body. We have trailed many pictures and find out expected result which accuracy is much better about 97.3%. we used an algorithm which was SVM (Support Vector Machines) this algorithm usually used for machine learning. Body measurement system is needed for especially women and also for today's digital work. Now-a-days there are many systems on this topic but this project that we have done is much user friendly and easy to use also its accuracy is much high. To implement the study, we used computer visions pre-trained algorithm to detect the human body in image. After detecting the body, we extract features by segmented the image into some parts and then determined the focal points of the body image. Then we had estimated the parts as arms, chest, leg, waist and wrist. From the result we get much accuracy of measurements.

5.2 conclusion

In this project, we have solved some problems that we have faced before as feeling uncomfortable in front of tailors also the manual system needs much time therefore in this system, we need only few seconds to measure the accurate measurements. We took help to make this project from many previous research papers and some machine learnings projects. Here, we present virtual pose dataset with 2D body image from multiple subjects under post deformation. The outcome that has accomplished is really encouraging. This system will consume time and also other problems that are important in present situation. This method will be sought after and will create in the future with some other works that some failure happens here in this project. We tried to help people

to make their life easier through this project. We applied our knowledge and ideas to create and successfully complete this project.

5.3 Future Works

As we all know technology is a smart way to get any kind of information that we needed in this technological world. Day by day people's requirement through technology is getting increased. And by helping with technology these desires are being fulfilled. That's why we develop this system in demands of tomorrow's world.

In future we want to develop this project with some extra features. We want to make this as a web application and then want to add some options of size with clothes, then people will easily understand, how the dress will look like if we use these measurements to make ant dresses, also from 97.3%. we will try to increase the accuracy to at least 99% as, machine can't give us the actual result that a people can do but we can make the machine to give us much accurate result. So, these are our future challenges for this system.

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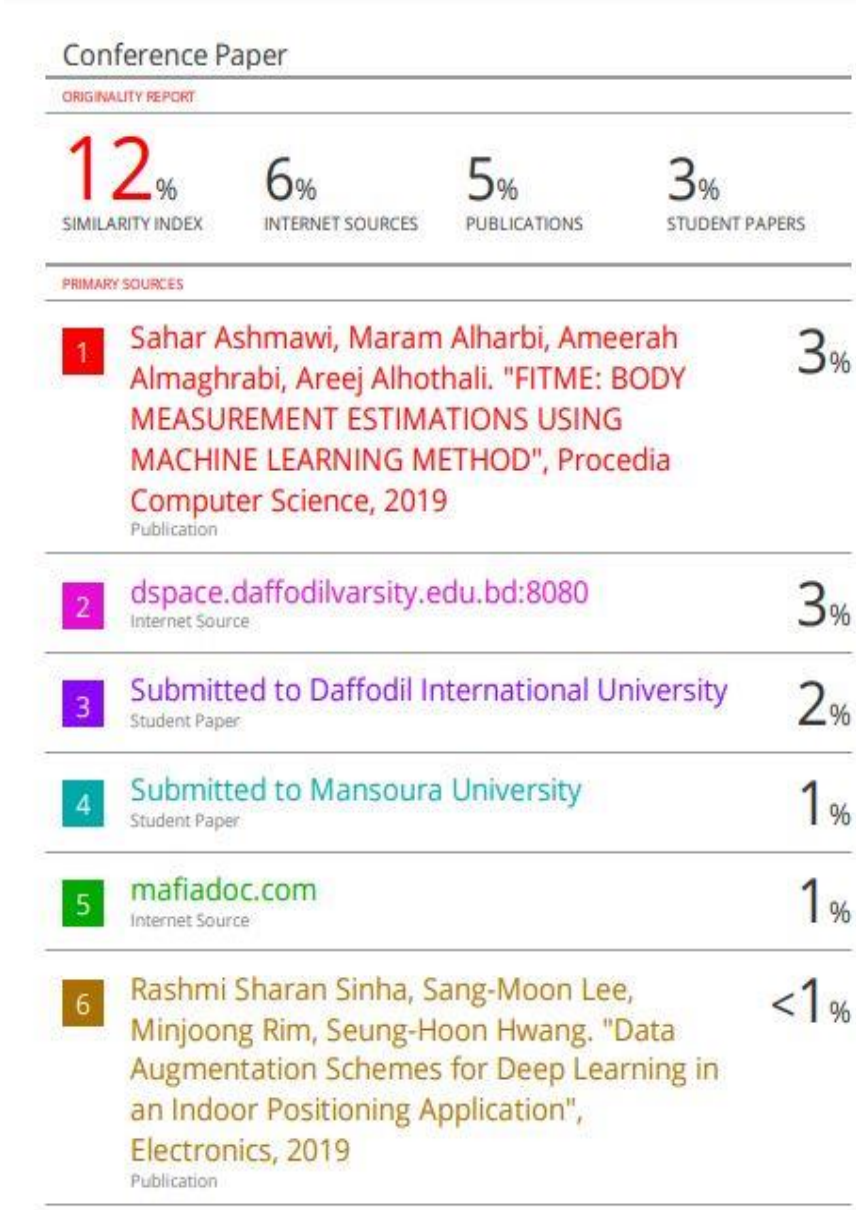

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