# "TO ESTIMATE HUMAN BODY MEASURMENTS FROM 2D IMAGES"

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**BACHELOR OF COMPUTER APPLICATION**
**IN**
**DATA ANALYTICS**

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**Abstract**

*Customers can purchase any products from any location and at any time using online shopping platforms, eliminating the need to physically travel from store to store or wait in lines to check out. Despite its advantages over in-store shopping, clients frequently express worries when purchasing things that require dimension assessment, such as furniture and clothing. Many internet consumers, in particular, have reported difficulty selecting the correct apparel size. As a result, in this study, we created a model that predicts human body measurements from real-time photos using the Haar Cascade classifier and support vector machines.*

## 1. Introduction

Online shopping platforms have attracted a large number of clients since their introduction in the last decade of the twentieth century. Customers can use online shopping platforms to buy any products from anywhere and at any time, eliminating the need to physically go from store to store or wait in queues to check out.
Despite its advantages over in-store buying, buyers frequently express worries while shopping for things that require dimension assessment, such as furniture and clothing. Many internet consumers frequently encounter the problem of selecting the incorrect garment size. As a result, in this study, we put forth a model that predicts human body measurements from human real-time images using the Haar Cascade classifier and support vector machines, allowing customers to search for any product in many stores and purchase online in a few steps rather than going to a retail store and standing in line to check out. Despite the numerous advantages of buying online, some customers may have difficulties since they are unable to judge the quality

of the product, which may result in obtaining a faulty, damaged, or delayed product. Clothes shoppers, in particular, face a variety of challenges. Clothes customers may choose in-store shopping over online purchasing for several reasons, including the inability to accurately estimate their proper clothing size, try on garments to check if they are suitable, and evaluate the quality of clothing materials. When it comes to finding the correct size, clients can either measure their body manually or choose a size that they are familiar with. Manual measurements are often taken using a measuring tape and include height, shoulder breadth, bust, waist, and hips. These measures, however, are not always exact or appropriate for all types of clothes. Customers may also need to measure more body areas if they are purchasing more specific clothing (e.g., suits or long-sleeved dresses). When a consumer wants to buy a dress or a jacket, he or she must first measure the bust, waist, and hips. To measure the waist, for example, the customer must securely and completely wrap the waist around the body. When measuring the thigh, the consumer must measure the greatest point. After measuring body components, the consumer may need to convert them and select the appropriate size.

Different dimensions, body parts measured, and clothing styles sometimes result in erroneous manual measures that take time. Several studies have looked into the idea of automatically predicting body dimensions from customer photographs. The majority of these methods rely on specialized instruments (such as an in-depth camera) to obtain 3D images of the human body. Despite the precision of measurements provided by 3D-based approaches, these methods are not appropriate for all users who want to estimate their sizes while shopping online. Only a few research used 2D photos to determine body measurements. Studies using 2D photos estimated certain fundamental measures of human bodies or classified the human body into specified classes. As a result, the goal of this study is to develop a smartphone system that allows users to evaluate their body dimensions and anticipate their body sizes by capturing a 2D picture of the body in one specific direction (e.g., front view). To construct a strong application and train the algorithm on real-world data, we initially carried out an experiment in which we photographed a number of people and measured their bodies. The suggested solution then uses computer vision and machine learning techniques to extract information from images in order to estimate body measures (such as waist and breast). After that, the approach employs a support vector machine (SVM) to predict the optimal size of the shoppers. Using such a method will assist online shoppers in precisely estimating their body measurements, hence improving the whole online purchasing experience

## 2. Problem Objective

We intend to create a smartphone system that allows users to estimate their body measures and anticipate their body sizes by taking a 2D photo of the body using a standard smartphone camera and making it user-friendly. Product size recommendations and fit prediction are crucial for improving customers' shopping experiences and lowering product return rates. We present an effective and efficient approach to automatically forecast clothes size for customers who buy items online.

## 3. Methodology

We used computer vision and machine learning approaches to estimate human body measurements and predict body size from 2D photos acquired with standard smartphones. To estimate human body measurements, the model 1) recognizes the human body in images, 2) extracts the body's features from the image, 3) finds the focal points in the human body, and 4) computes the body measurements by computing the difference between the focal points. To forecast the right clothing size of a specific individual, the models employ a support vector machine that has been trained on some body measurements and client body sizes.

This section explains the computer vision and machine learning approaches used in all ta research.

### 3.1 Body detection

Object detection is a computer science problem that is related to computer vision and image processing. The detection seeks to recognize a specific collection of an object's attributes in photos and videos. Most object detection systems employ a machine learning approach. The body detection model frequently begins by finding the properties of the desired object and then classifies the objects using a machine learning approach. The algorithm is also regarded as a good and robust method for object detection due to its ability to deliver a very high true positive rate with a very low false rate. The technique has been used successfully to detect human bodies in photos. To distinguish the actual body from the photos, we employ a pre-trained Haar-based detector that has three detectors: upper body detector, which detects the upper body, lower body detector,

which detects the lower part of the body, and whole-body detector, which detects the entire human body. When detecting the body based on the training data, these detectors may include part of the backgrounds.

### 3.2 Feature Extraction

Feature extraction is a critical step in image processing that leads to improved picture understanding and classification. The basic purpose of feature extraction in this study is to extract some interest spots (i.e., focal points) from the detected body in order to estimate the measures for each portion (shoulders, bust, waist, and hip). We investigated numerous ways for calculating human body part measurements before settling on this one. This study's methodology consists of two primary parts. The first phase involves vertically segmenting the input image to specify the interest points. The second step defines two places on the most left and most right sides of each body part. The selected locations should be on the segment line nearest to the most left and right sides of each body portion. To segment the body image, we divided it into 40 vertical lines based on interest points or proximity to them. To estimate the measurements of any area of the body, we must first extract two reference locations known as focus points. In the following sections, we will go over the methods utilized in this research to extract focal points and how they are used to estimate body measurements from photos that were accurately identified during the body detection step.

### 3.3 Extract the Focal Points

In this section, we will explain and demonstrate the method we used to extract the focal points after the segmentation stage. After segmenting the image into 40 pieces, we color every ten lines the same color to make it easier to count them. Following that, we manually select the nearest segment line to the interest points by examining all of the participants' images and identifying the closest line to the focal points of each body component. After agreeing on the lines, we calculate the average of the left and right focal points of all participants for each body region. For the shoulders, we found that all male participants' left focal points are between lines 11 and 16, and all right focal points are between lines 28 and 34. So, we used the average of these values to get the left and right focal points for the shoulder, respectively. The same procedure was used to identify the left and right focal areas for the bust, waist, and hips. For the bust, we can see that all left focal points fell between lines 14 and 17, whereas all right focal points fell between 27 and 32. For the waist, we discovered that all left focal points are between lines 13 and 17, while right focal points are between lines 27 and 32. Finally, for the hip, we saw that all of the left focal points are between lines 13 and 17, while all of the right focal points are between lines 28 and 31. We see that all of the female participants' shoulders have left focal points between lines 11 and 18, and right focal points between lines 29 and 37. The bust's left focal points fall between lines 12 and 19, while its right focal points fall between lines 28 and 35. We discovered that the waist's left focal points are all between lines 12 and 19, while the right focal points are between lines 28 and 34.. Finally, we see that the left focal points of the hip are between lines 11 and 18, while the right focal points are between lines 28 and 36. This method was accomplished manually, however it can be calculated automatically in future studies. The following section demonstrates how we used the focal points of each bodily part to estimate their measurements

### 3.4 Estimate the measurements

After determining the left and right focus points for each portion of the body, we must calculate the distance between these points using the difference between them. The upshot of this disparity is that the width of the region is represented in pixels, although the system deals with and operates in centimeters. As a result, we must convert the pixels into centimeters. To convert the width from pixel to cm, multiply the difference by 0.0264 using equation The values of the reference points (i.e., the fixed ratios for each body region) are those of a single participant chosen at random from both males and females. This value is then used to estimate the measurements for the entire group.

### 3.5 Predict the size

We should create machine learning models to forecast the appropriate size of shoppers by training and

evaluating them on a real-world dataset of participants' body dimensions and apparel sizes. In this phase, a supervised machine learning algorithm can be employed because the dataset contains features (e.g., body component measurements) and labels (e.g., conventional clothing sizes). We will try to construct SVM classifiers capable of predicting the shopper's clothing size. The Support Vector Machine (SVM) is a form of supervised machine learning classification method developed in the 1960s. It is one of the most robust and quick algorithms among the various classification methods, producing excellent results.

## 4. Dataset

Any machine learning-based system's performance is heavily influenced by its dataset. We need to construct a machine learning system trained on a dataset that consists of individuals' photographs and body measurements. the dataset: acquires training and testing. The training section will be used to train the model, while the testing section will be used to test and evaluate the model following the training stage. For this study, we require a dataset containing human body photos as well as basic measurements for each body. Shoulder width, bust circumference, waist circumference, hip circumference, and other measures wererequired to meet the goal of this study.

## 5. Conclusion

In this study, we suggested a strategy for improving and facilitating the online purchasing experience by estimating human body measures from 2D photos captured with a smartphone camera. The experiment was carried out on a sample of participants who were photographed, manually measured, and asked to report their true clothing size so that the results could be compared to the model's predicted size. To carry out the investigation, we used one of the pre-trained computer vision algorithms to detect the human body in photographs. The detectors are designed to recognize three portions of the human body: one detector to detect the upper body, another detector to detect the lower body, and the last detector to detect the entire body. After recognizing the body's primary components, we extract features by segmenting each image into 40 parts and selecting two points as focal points for each body part to estimate the measurements. Following that, we applied different machine learning models trained on a dataset of measurements to forecast the size of apparel based on the estimated measurements. Every model was trained to accurately predict the size of a piece of clothing. The data demonstrate that the majority of the sizes we predicted deviate little from the actual number of participants. In the future, we will work to boost the result of identifying the side photos, utilizing it to improve the estimating measures, and focusing on minimizing the error percentile.

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