**Realtime Body Size Estimation using Machine Learning**

Submitted in fulfilment of the requirements for

Mini-Project Sem-VI

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**CERTIFICATE**

This is to certify that, the mini project entitled **“Realtime Body Size Estimation using Machine Learning ”** is the bonafide work of **Mr. Shriyash Narendra Karekar (33, Mr. Khan Imran Ali Mohammed Ali (36) ), Mr. Khan Aqueel Alam Sharif (129)** submitted to the University of Mumbai in fulfilment of the requirement for the mini project of Semester VI project work of Third Year Computer Engineering at Universal College of Engineering, Vasai, at the department of Computer Engineering, in the academic Year 2020-2021.

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**Abstract**

Online shopping platforms have been attracting many customers since they were introduced in the last decade of the 20th century. Using online shopping platforms, customers can purchase any merchandise anywhere and anytime without the need to physically go from store to store to find a product or wait in lines to check out. Despite their advantages in comparison with in store shopping, customers often have concerns when they shop for products that require measurements estimation such as furniture and clothes. Choosing the wrong clothing size, in particular, is a common issue experienced by many online shoppers. Therefore, in this research, we proposed a model that estimates human body measurements from human real-time pictures using Haar Cascade classifier and support vector machines.

***Keywords-* Estimate Body Measurements; Image Processing; Support Vector Machine; Brand Sizes; Clothing fit.**

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**List of Abbreviations**

**AR & VR – Augmented reality & Virtual Reality**

**ANN:** Artificial Neural Network

**K-NN:** k-Nearest Neighbour

**SVM:** Support Vector Machine

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**Chapter 1**

**Introduction**

In these modern times, we do prefer online shopping as it save our time rather than visiting store. But when it comes to buying clothes, we mostly prefer going in store. This is due to size issues that we face. Nowadays, even most of the brands usually have different standards of clothing sizes.

**Project Idea**

Users that shop for clothes online need to select the appropriate clothing size from available options. This is particularly a problem because different cloth brands define sizes differently. Many users struggle to estimate their size when they view a brand for the first time, while many other users have difficulties remembering their clothes size even after several purchases from a given brand. The effort for the user to find a measuring tape and manually perform measurements adds to the number of steps prior to finalizing a purchase, and at worst, can cause frustration such that the user abandons the purchase attempt. The problem is less severe at physical stores where a user can easily request a measurement to be performed (or perform self-measurement by requesting the store clerks for a measuring tape). Nevertheless, even at a store, measuring the body size and matching it against a particular brand’s definition of sizes adds to the number of steps needed to make a purchase decision and interrupts the purchase flow. Although augmented reality (AR) measurement apps exist, the user has to be aware of the existence of such apps, which may not be the case when a purchase decision is about to be made. Also, such apps require installation, configuration, and activation by the user, which adds to and the number of steps needed to finalize a purchase. Although the website of a brand can, in theory, request user permission and upon permission, activate an available AR app on the user’s device, doing so interrupts the purchase flow.

* 1. **Project Scope**

In our project, we are going to propose a model which it takes 2D images as input, process it and classify it into different sizes (X, XL, M, L …) and display it based on brand the user selects. So accordingly, datasets would be produced which includes detailed information about various constraints that determine the body features. For implementation we will be using computer vision more specifically Haar Cascade Classifier to detect the human body sizes. In this, detector will be designed such that one will identify the upper body, another will identify lower body and the last one will identify the full body. After detecting it will extract the features by segmenting each image into 40 parts to estimate shoulder width, waist circumference and all. It is then fed into SVM model for predicting size of clothes based on estimated measurements.

**Chapter 2**

**Review of Literature**

**2.1 Existing System**

The existing approaches for Human body size estimation are:

* Processing 3D images by capturing it through … which is common
* Extracting features from silhouettes using Multi-Dimensional Modeling
* Using AR & VR technologies with the help of body segmentation
* Virtual Garment try on which uses Naive Bayes based modeling
* Computer Vision to detect body parts

**2.2 Literature Survey**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PAPER NAME** | **YEAR OF**  **PUBLICATION** | **AUTHOR** | **PUBLICATION** | **PROPOSED**  **WORK** | **FINDINGS** |
| SEEING THROUGH THE APPEARANCE | 2015 | Wei-Yi Chang,  Yu-Chiang, Frank Wang | Research Center for Information Technology Innovation, Academia Sinica, Taipei, Taiwan | Estimates measurements of body from extracted features from silhouettes and image parsing using  Multi-view Body Shape Modeling with Measurement Constraints. | Scope is limited to silhouettes. Had Satisfactory Accuracy |
| GARMENT FIT EVALUATIONUSING MACHINE LEARNING TECHNOLOGY | 2018 | Kaixuan LIU,  Pascal Bruniaux,  Xianyi Zeng,  Xuyuan Tao | Elsevier B.V. | Fit evaluation is a virtual garment try on which uses Naive Bayes based model to evaluate garment fit. Its output was to show whether the cloth is fit or unfit. | Lack of data set at that time, defining only fit or unfit was way too simplified to give results and the digital pressure sensing was not effective with motion of body |
| FITME: BODY MEASUREMENT ESTIMATIONS USING MACHINE LEARNING METHOD | 2019 | Sahar Ashmawia Maram Alharbi Ameerah Almaghrabi  Areej Alhothali | Elsevier B.V | Estimates human body measurements from human real-time pictures using Haar Cascade classifier and support vector machines | The side images of body were not considered resulting into some impact on accuracy |
| Online Trial Room based on Human Body Shape  Detection | 2019 | D. M. Anisuzzaman  Md. Hosne Al Walid  A. F. M. Saifuddin Saif | International Journal of Image, Graphics and Signal Processing(IJIGSP) | A Web based application to estimate human body dimensions from 2D image using image processing techniques | Due to insufficient dataset, highest  Accuracy of proposed system was not achieved. |
| REALTIME CLOTHING SIZE ESTIMATION USING BODY SEGMENTATION | 2020 | John Mayes | Technical Disclosure Commons | Using AR to obtain the size measurement of body with the help of body segmentation | The model asks for height input from user and also the noisy background can alter the output |

**2.3 Analysis of Literature Survey**

Wei-Yi Chang and Yu-Chiang Frank Wang proposed a novel framework for body shape and measurement estimation, which only requires 2D clothing images as input data. The proposed algorithm can be viewed as constructing a parametric model, which recovers body shape images using information observed across different camera views. More specifically, their method focuses on reconstructing the body shape with both multi-view image and measurement guarantees. Different from prior approaches, this method does not require the coefficients for image reconstruction to be the same across camera views, while they introduce additional constraints on the observed measurements for improved estimation. In their work, they consider five different measurements which are popular used in online shopping websites such as two vertical measurements (i.e., overall height and inside leg length) and three horizontal measurements (chest width, waist width, and hip width) are considered. Quantitative and qualitative experiments on a 2D clothing image dataset supported the use of approach, which was shown to perform favorably against single-view or baseline approaches.

D. M. Anisuzzaman, Md. Hosne Al Walid, A. F. M. Saifuddin Saif have proposed a system for human body size estimation using image processing techniques, the proposed system has been introduced to recognize feature points, which has been used to calculate the cloth sizes .To implement the system they have pre-processed the image using Canny Edge Detection Operator to improve the image and suppress unwanted distortion. A light and plain background color has been used for data collection. Different types of algorithms have been used for noise removal. They have extracted some features by using Kollman’s distribution algorithm. In this proposed system, they have extracted five features, but due to inaccurate values they have used only two features for measuring the size of t-shirt and could not implement full body size.

Sahar Ashmawi et al. Proposed an approach that aims to improve and facilitate the experience of online shopping through estimate the human body measurements from 2D images by photographing the body using a smartphone camera. The experiment was conducted on a sample of volunteers who were photographed, manually measured, their real clothing size were reported to compare the result with the model predict size. For implementations, they used one of the computer vision pre-trained algorithms (Haar Cascade classifier) to detect the human body in images. The detectors are designed to identify three parts of the human body: one detector used to detect the upper body, another detector used to detect the lower part from the body, and the last detector used to detect the full body. After detecting the body major parts, they extracted features by segmenting each image into 40 parts and determine two points as focal points of each body part to estimate the shoulder width, bust circumference, waist circumference, and hip circumference. After that, they used several machine learning models that are trained on a dataset consists of measurements for predicting the size of clothes depending on the estimated measurements. Each model was trained to predicate size a piece of clothing. The results showed that most of the sizes that were predicated are some differences to the real extent of participants. They were unable to consider the side images which had a big toll on their model.

D. M. Anisuzzaman et.al proposed a model for the cloth size prediction and virtual try on, the pressure sensing technique was introduced by Donghua University, China. Factors affecting these models were the type of clothes and fabric properties and the garment pattern which seems affective. They designed two experiments and defined a database based on these experiments and fed it to the Model which uses Naïve-Bayes Algorithms. The software CLO 3D is applied to measure digital clothing pressures. Nine female subjects with representative body shapes are selected for performing real try-on and body dimension measurement. 72 pairs of straight pants, which cover most of pants’ sizes, are involved in the real try-on experiments for data collection.

John Mayes et al. proposed a model for the Real-time Estimation of measurement, This disclosure describes techniques that enable a user to measure body dimensions relevant to clothing size, e.g., chest, waist, inseam, etc., based on capturing images of the user. The techniques can be implemented using the camera and the browser of the user’s device, such that clothing-size measurement is frictionless integrated with the online shopping experience.

* 1. **3-Phase detail**

**Phase 1: Semester 6**

In this semester we have researched about the topics and had done literature survey with 5 papers from well-known publications. An application which takes datasets that has marked points across all the required measurements and which will train our model with those datasets. The model will classify the data accordingly and we will correct all the errors to get more accurate results. A User Interface Web Application will be made in which the camera module will be used in order to get live images. This application will be Cross Scripted and shall be used by all the devices. The app can capture pictures and feed the image to our trained model to give out results. Any absence of human figure will prompt an error like missing human figure or very noisy background. If the input values are valid, the result would be shown in Cloth-oriented sizes.

**Phase 2: Semester 7**

In this semester, we will use image processing and computer vision technology to handle noisy backgrounds. The Application would be able to give results in more complicated background. The Database for all the brand difference will be made to give results more specified to different size standards. The UI Web application will be improved adding more features such as studio background lightings. The body detection system will be using KNN algorithm for detection of different bodies to avoid multiple user input at once. The system will be trained with more datasets that would be the dataset to improve and increase the efficiency of the system. During this semester we will showcase our research work by participating in competitions like e-Yantra Ideas competition, Avishkar Mumbai University project competition and other Hackathons.

**Phase 3: Semester 8**

In this semester, our model will be able to perform calculations and give faster results regardless of movements of body. The Web App would be able to give try-on for modelled clothes in order to give best outfit look. The web app would be turned into smaller extensions for clothing brands or online stores websites to get desired results whilst shopping online. The Augmented Reality will show the user about best fit within the app. We will write research paper on the work done in this project and will try for publication.

**Chapter 3**

**Conclusion**

Hence, through the timeline we have did the literature survey and found out that we can use certain algorithms for training our model. For Computer vision, we will use HAAR CASCADE Classifier to calculate the characteristic points for size estimation. For classification of dataset in Machine Learning, we will use SVM to classify the sizes by calculation point based systems so that the outcome can be converted into smaller outputs by taking actual larger set of inputs. We also learned about the possibility of running our model in the web app using camera module. We have made a Google form to obtain our datasets. Some of the datasets are being obtained by http://www.kaggle.com . Our next step is to train our model to get more accurate results.

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