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# Bespoke Measurement based on Convolutional Neural Network using OpenCV

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**ABSTRACT**

This paper introduces the smart measurement for assisting tailors. This project explores the pattern of scanning the accurate measurement of garment dimensions for bespoke tailoring purpose. Computer vision is used for measuring garments along with camera calibration technique using OpenCV and python through object detection. This reduces the manual work and can detect the corners of the garment image exactly, with increased efficiency and effectiveness. It is simple, robust and has fast processing speed. We seek in our project to provide an accurate measurement of garment dimensions for bespoke tailoring purpose.

**Key words :** Camera, Dataset, High Processing, Numpy, OpenCV, Python3, Yolo.

## 1. INTRODUCTION

Many of the techniques of Digital Image Processing (DIP) or digital picture processing was developed in 1960s at the Bell Laboratories and a few other research facilities with application to medical imaging, character recognition and photograph enhancement. The cost of processing was fairly high however with the computing equipment of that era. That got changed in 1970s when DIP proliferated as cheaper computers and dedicated hardware was available. Images then could be processed in real time for some dedicated problems such as television standards conversion.

A digital image is a representation of a two dimensional image as a finite set of digital values called picture elements or pixels. Pixel values typically represent gray levels, colors, heights, opacities etc.

DIP is used for computer algorithms to perform image processing on digital images. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that images.

Nowadays image processing is among rapidly growing technologies. It forms a core research area within engineering and computer science disciplines too.

## 2.IMPLEMENTATION

Image processing basically includes the following steps:

- Importing the images via image acquisition tools.
- Acquisition tools include digital cameras, webcams, images loaded from disc etc.
- Analyzing and manipulating the images.
- Image manipulation techniques make the image easier to process.
- These are also called pre-processing techniques. They include Noise reduction, Histogram, Equalization and Segmentation.
- Output in which the results can be altered on the report that is based on image analysis
- Manipulated images can be used to perform necessary process as per the need.

There are two types of methods used for image processing namely analog and digital.

### 2.1 Working Principle

Figure 1 gives a brief idea about the general processes and steps involved in DIP. In this an image has been captured by a camera and it is sent to a digital system to remove all other details and just focus on the water drops by zooming in such a way that the quality of the image remain the same.

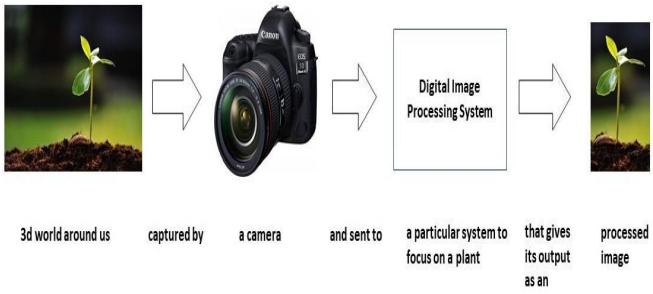


**Figure 1:**Digital Image Processing

### 2.2 Image Pre-Processing

In Image pre-processing, Image data is recorded by sensor on a satellite retain errors related to geometry and brightness values of the pixels. These errors are corrected using appropriate mathematical models which are either definite or statistical models.

### 2.3 Image Enhancement

Image enhancement is the modification of image by changing the pixel brightness value to improve its visual impact. Image enhancement involves a collection of techniques that are used to improve the visual appearance of an image or to convert the image to a form which is better suited for human or machine interpretation.

### 2.4 Image Segmentation

Image segmentation is the process that subdivides an image into its constituent parts or objects. The level to which this subdivision is carried out depends on the problem being solved i.e., the segmentation should stop when it is possible to manipulate multi- dimensional signals. It has a broad spectrum of applications. They include remote sensing data via satellite, medical image processing, radar, sonar and acoustic image processing and robotics.

## 3.BLOCK DIAGRAM

Figure 2 represents the visual model of the system, its components and their interactions.

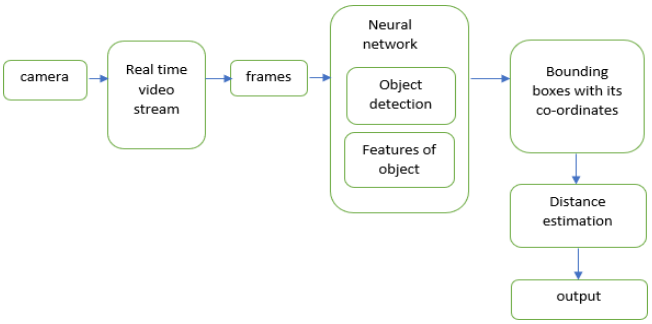


**Figure 2:** Visual model of the system

The input video is obtained using a camera and once the information is obtained object detection takes place where the parameter details are obtained using a pre-trained neural network. The captured information is used to classify an object and draw a bounding box.

X and Y coordinates are obtained and are used to determine the position and distance of the object in the real time video. All the processed information obtained is given as output in which they are made available to the user via monitor screen output with exact measurement of shirt and sleeve.

### 3.1 Neural Network

Open CV's Neural Network block is the major block of the entire program(figure 3). This consists of both DNN and CNN.

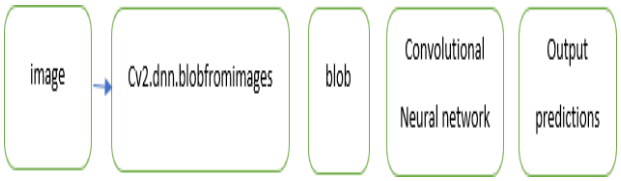


**Figure 3:**Deep Neural Network

Here the object detection takes place where the features of interest along with the parameter details are obtained by using the pre- trained Neural Network. The captured information is used to draw a bounding box.

X and Y coordinates are obtained to determine the position and distance so that the height and width of the object can be obtained. Object used here is shirt with two classes as shirt and sleeve.[3]

### 3.2 Deep Neural Network (DNN)

This figure is a general representation of the two types of Neural Networks used here are DNN and CNN[1].The cv2.dnn.blobfromimages is an in-built function provided by Open CV. Its new DNN module contains a function that can be used for pre-processing images and preparing them for classification via pre-trained deep learning models[7].

### 3.3 Distance Estimation

The distance d is estimated using, distance (mm**) = (**focal length * real height of the object * camera frame height in device) / (image height* sensor height) where focal length is in mm, real height of the object in mm, camera frame height in pixels, image height in pixels and sensor height in mm. Focal length is found to be 4mm for Logitech C270 from the specifications given[6].

### 3.4 Convolutional Neural Network (CNN)

CNN is a class of deep, feed-forward artificial neural networks that is being applied to analyze visual imagery. The networks normally used for pattern recognition are called feed forward because they have no feedback. They simply associate inputs with outputs [8].

Deep learning used by the network has been constantly improving in addition to the changes in the network structure, this highly complex pattern recognition can be achieved by using a network of neurons hence the name CNN [4]. They learn directly from image data, eliminating the need for manual feature extraction.

The use of CNN for deep learning has become increasing popular due to three important factors:

1.It eliminates the need for manual feature extraction – the features are learned directly by the CNN.
2.It produces state-of-the-art recognition result.
3.CNN can be retrained for new recognition tasks and allow for building on pre-existing networks. [5]

## 4. YOLO

YOLO - You Only Look Once It is an image classification software module. It is used to detect an object in an image from a data model. It uses features learned by deep CNN (Convolutional Neural Network) to detect object. It has 75 convolutional layers, skip connections and up-sampling layers. It has high accuracy and speed .[2]

## 5. PROPOSED METHOD

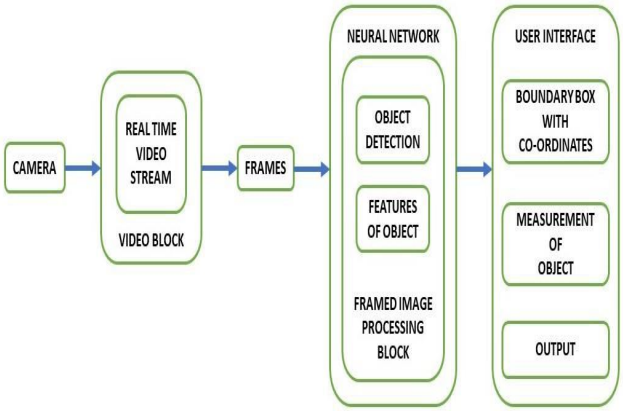


**Figure 4:** Block Diagram of Proposed System

### 5.1 Image Acquisition

The camera is the image acquisition device is used here. The input is obtained from the 'video block' that is capable of producing real time video streaming or a captured streaming**.**

### 5.2 Calculation Of Sensor Height

Sensor height is calculated experimentally using the Equation, D = (f × rh × fh) ÷ (oh × sh) Where D is the distance in mm, *f* is the focal length in mm, *rh* is real height of the object in mm, *fh* is camera frame height in pixels, *oh* is object height in pixels and *sh* is sensor height in mm.

### 5.3 Measurement Of Object

The distance is kept fixed for finding the real height of the object. The object to be identified is kept at a fixed distance of about 60 inches from the Logitech web camera.

By knowing the focal length, sensor height which is obtained from the camera specifications, image height, camera frame height in device and the distance, the real height of the object is thus calculated. [6]

## 6. RESULTS

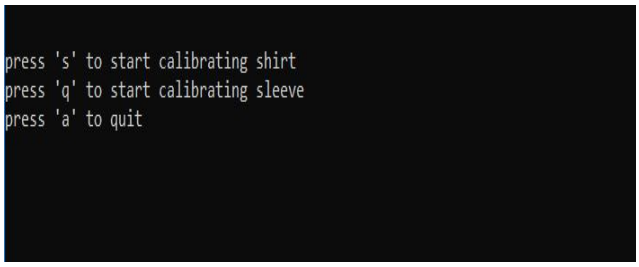


**Figure 5:** User Input step 1

### 6.1 User Input

Here the command prompt display the user navigation message to the user(figure 5). The user has to enter the respective key in order to initiate the calibration of the object.

### 6.2 Frontal Estimation

When the boundary box matches with the boundary of the object, the frames are processed. Each frame is processed and the values are stored in a list. Figure 6 is one of the processed frame.

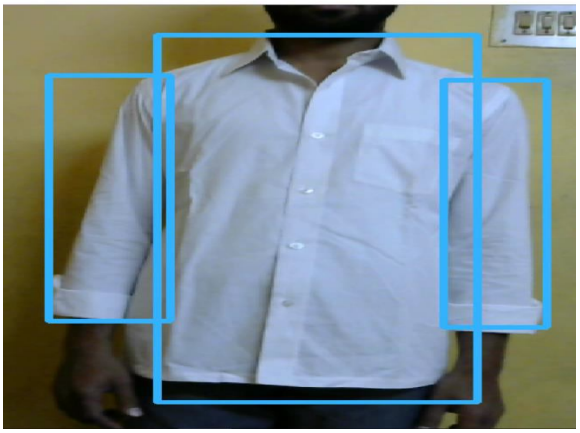

**Figure 6:** Frontal estimation of shirt and sleeve

### 6.3 Side Estimation

Figure 7 shows the side estimation of the object shirt and sleeve. These measurements could be used to identify the approximate circumference of the object to be estimated.

**Figure 7:** Side measurement of sleeve

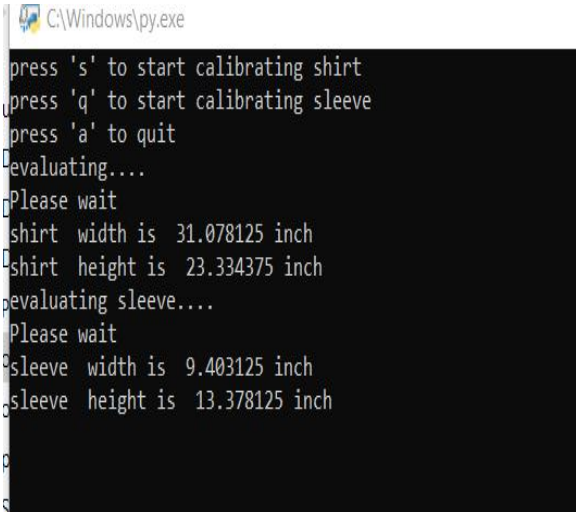


**Figure 8:** User Output screen

Figure 8 shows the output screen for the above images that show relevant information. Here the user enters that they want to calibrate the shirt first and then the sleeve. The information of the object height and width is displayed in inch after the processing time.

## 7. FUTURESCOPE

By further enhancement of the idea, this can customize complete attire for both men and women. It can be used in online shopping platforms to suggest garments from different brands of your size. Indian tailoring industry is about to change itself completely bespoke where measuring becomes easy and accurate.

## 8. CONCLUSION

Bespoke measurement is an efficient and accurate body measurement method where you can get your measurements without taking a picture where privacy wouldn't be a concern. Customers could get customized outfit without any need for further alterations. It can be used in online shopping platforms to suggest garments from different brands of your size. Less time consumption with high accuracy.

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