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BMI Prediction using Kinect and Data Mining Techniques for Healthcare System

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Abstract: *Body mass index (BMI) is a person's weight in kilograms divided by the square of height in meters. Body mass index is a measurement of obesity based on measured height and weight. Traditional method of calculating BMI is inconvenient and requires physical measuring of a person and particular instruments. A proposed healthcare system to predict BMI using Kinect and data mining techniques so that everybody can easily predict their BMI values using Facial images. Face detection and feature extraction component using haar cascade to detect useful face information. Framework by using facial images that uses machine learning algorithms for data mining namely, Data Preprocessing, Data Extraction, data evaluation and presentation to train models that would help predict obesity levels (Classification), Bodyweight, and fat percentage levels (Regression) using various parameters. System helps to advance the study aspect based on body weights and patients that are paralyzed or severely ill patient who unable to undergo basic measurement for emergency medical service.*

Keywords: BMI; data mining; face feature extraction

I. INTRODUCTION

People nowadays are more worried about their health than ever before. Obesity or being excessively thin appears to be a health problem. The BMI is one of the most extensively utilised health indicators (BMI). The BMI indicator assesses a person's weight in relation to their height squared. People may use their BMI to see if they are underweight, normal weight, overweight, or obese, as well as how far they are from the optimal weight for their height. An adult with a BMI of 25 to 29.9 is considered overweight; an adult with a BMI of 30 or more is regarded obese; a BMI of less than 18.5 is considered underweight; and a BMI of 18.5 to 24.9 is considered healthy. Being overweight has a variety of consequences, ranging from mental health difficulties to minor physical illnesses. Nonetheless, there is little evidence that there is a relationship between emotional well-being and obesity. Isolation, on the other hand, increases the likelihood of poor self-esteem, mood, and motivational challenges, eating disorders, and relationship communication issues, all of which have a direct or indirect impact on personal happiness. Type 2 diabetes, high blood pressure, heart and renal disease, asthma, back discomfort, and other physical medical issues are just a few examples. The BMI, which has been generally used for decades, requires people to make intentional estimates of their weights and heights. For people who are unable to walk or stand, however, it is uncomfortable to measure and compute.

The fundamental purpose of this project is to build a BMI prediction system that will allow individuals to effortlessly calculate their BMI by snapping a photo of their face anywhere, contributing to the establishment of a more convenient cloud-based healthcare system. To put it another way, we aim to create a system that uses face data to calculate BMIs. On the one hand, a person's face becomes smaller as it becomes rounder; on the other hand, a person's face becomes more appealing as it becomes narrower. This is the most common way for people to tell if a long-lost friend has gained or lost weight. On the other hand, a person's weight is proportional to their body. We have come to this conclusion as a result of our sensory perceptions. Need to find a link between face features and BMI as a result of these perceptions.

Here is a list of some of the work's challenges. The angle and distance at which image is taken can have a significant impact on the gathered facial characteristics. To gain significant facial traits, we must first select relevant images, such as the normal front face, and perform normalization. A range of other factors like gender, age and might be human DNA, will alter the relationship between face curves and BMIs. As a first step, we'd like to build a primitive BMI predictor in order to collect more information and then improve the system as more data becomes available. In this paper, we use

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data mining techniques to build a BMI prediction system. A face recognition component finds relevant face photographs, while a BMI predictor extracts facial traits and uses them to calculate one's BMI.

II. RELATED WORK

Few million individuals die every year as a result of being overweight, according to an article published in GBD 2017 Obesity Collaborators. Obesity rates in children and adults have climbed from 4% to 18% since 1975. Obesity is not just an issue in wealthy countries; it is also a problem in low income and developing countries, where the overall number of cases is 30 percent higher than in developed ones.

Manual experiments have been done to show the correlations between specific face features and BMIs in the fields of psychology and human intuition or perception. P.N. Tan, M. Steinbach, and V. Kumar proposed a new range-based technique based on a data mining density-based outlier detection algorithm. It necessitates the selection of K-nearest neighbours (KNN). The implementation of a Kinect based Steer by Wire system was reported by T. Leyvand, C. Meekhof, Y.-C. Wei, J. Sun, and B. Guo. It develops a revolutionary vehicle steering idea based on hand gestures. The core concept is to use Kinect to replace the steering and angle sensor to perform steering operations using gesture recognition. This research focuses on an advanced control design strategy that leverages gesture detection to perform steering operations.

III. BMI PREDICTION SYSTEM

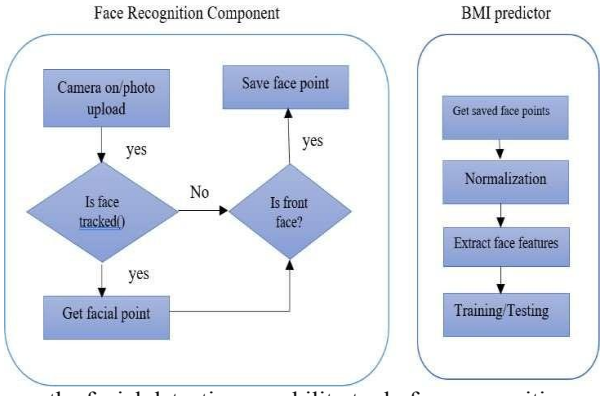

Fig. 1 The system uses the facial detection capability to do face recognition and BMI prediction.

3.1 Facial Recognition

The present methods can only provide a rough estimate of facial location and cannot provide precise information. To solve this problem, we employ Haar Cascade, an Object Detection Algorithm. Haar Cascade is an Object Detection Algorithm for recognizing faces in images or real-time video. In their study "Rapid Object Detection using a Boosted Cascade of Simple Features," Viola and Jones suggested edge or line detection features. A big number of photos with faces and a huge number of negative images with no faces are supplied to the algorithm to train on. On the OpenCV GitHub repository, you can find the model that was created as a result of this training.

3.2 BMI Prediction

The angle and distance at which photo is taken can have a big impact on the facial features that are captured. We must first identify useful photos, such as the normal front face and perform normalization such as rectification of the slanting face in order to get relevant facial features. The association between face curves and BMIs will be influenced by a variety of factors, including age, gender and might be human DNA. We want to start by developing a basic BMI prediction system so that we can collect more data. This BMI prediction model was built using the Keras Application Programming Interface (Keras API).

Keras is a neural network Application Programming Interface (API) written in Python that is closely tied to TensorFlow, a machine learning framework. This model offers a simple, user-friendly way of designing a neural network, which TensorFlow will then construct for the user. TensorFlow is a collection of open-source frameworks for creating and

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interacting with neural networks, such as those used in machine learning and deep learning. The algorithm used in this study is a Convolutional Neural Network (CNN), which is a Deep Learning system that can take an input image and assign relevance (learnable weights and biases) to various aspects/objects in the image, as well as distinguish between them.

IV. DATA MINING PHASES

The whole process of Data Mining comprises of three main phases:

4.1 Data Pre-processing

Data cleansing, integration, selection, and transformation are all performed. By putting raw data into a format that can be utilized to develop and train a machine learning model, data pre-processing enhances the quality of your data. The first step is to divide your data into train and test datasets. Because you don't want the test data to contaminate the training data, this is critical. The next step is to Standardize or Normalize your data if the model's technique is sensitive to unscaled data. In the third phase, you must partition the training and test data into target variables and predictor variables. Machine learning models:

- Supervised Regression.
- Supervised – Classification.
- Unsupervised.

4.2 Data Extraction

Accurate data mining is carried out. The process of removing a valuable resource from the soil, such as coal or diamonds, is referred to as "mining" in general. The practice of collecting relevant information from massive volumes of data or data warehouses is referred to as "data mining" in computer science. It's obvious that the term is puzzling in and of itself. Coal or diamond mining yields coal or diamond as a result of the extraction procedure. However, the extracted data is not data in the case of Data Mining!! Data mining, on the other hand, is the process of analyzing patterns and information gathered during the extraction process. In this context, data mining is called knowledge discovery.

4.3 Data Evaluation and Presentation

The method used to evaluate the data decides whether or not the information can be used to calculate risk. The distribution can still be determined even if the data is unsuitable for risk estimation. A distribution explains the likelihood or potential of any potential value. Data presentation is the act of graphically illustrating the relationship between two or more data sets so that an informed choice may be made based on them.

V. IMAGE NORMALIZATION

The term "normalization" refers to a process that alters the range of pixel intensity levels to make the image more familiar or normal to the eyes. When it comes to feature extraction and image segmentation, picture normalization is typically employed to improve contrast. To minimize noise in pictures, normalization is widely utilized (data). Image Normalization may be used to remove high-frequency noise and extremely low noise from an image, which is highly valuable. Our eyes get strained when we stare at a picture that perplexes our senses. Image normalization, on the other hand, can be beneficial. We place the image in a range of intensity values that are familiar to our senses, so we don't have to strain our eyes and can see what's going on in the image clearly. Our objective is to restore an image's contrast such that it is normal to our senses when it has low contrast for whatever reason.

VI. METHODOLOGY

The feature extraction component of the BMI prediction system is divided into two components. The system's first component is facial recognition, while the second component is BMI prediction system. The predicted responses for gathering facial characteristics associated to BMI values and conducting the prediction using information are displayed in Fig. 1. Face detection, data mining, and picture normalisation are all discussed.

In the first phase, we will not only detect the position of the face, but also collect facial contour information that will be useful in predicting BMI. We use Harr cascade frontal face to identify the front of the face in the system's facial

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recognition component, as shown in After that, the characteristics are extracted. Unlike previous researches in human perception, don't identify specific attributes in our study since we want to investigate how Body Mass Indexes and facial outlines correspond the information or data.

The system's first component is facial recognition, and the second component is the Body Mass Index prediction system. The prediction responses for gathering face characteristics linked to BMI values and completing prediction with data is displayed in Fig 1. As demonstrated in the use case diagram (Fig 2), the system extracts face features from a given image and predicts the BMI value, as well as providing weight-control advice to the user.

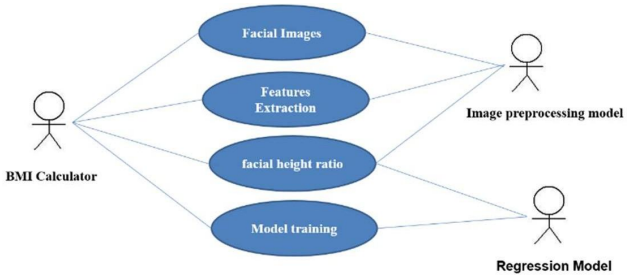

Fig.2 Use Case Diagram

VII. EXPERIMENTAL RESULT

- Generate & Load BMI & Face Detection Models: This module will load the CV2 library for face detection and the CNN model for BMI detection. The facial detection library assists us in detecting a human face from an uploaded image, which is subsequently fed into the CNN model to estimate BMI.
- Upload Image: We will use this module to upload an image to the application.
- Run the Face and BMI Detection Algorithm: This model extracts a face from an input picture and analyses facial characteristics to estimate BMI. Users will be given insurance quotes based on their estimated BMI.

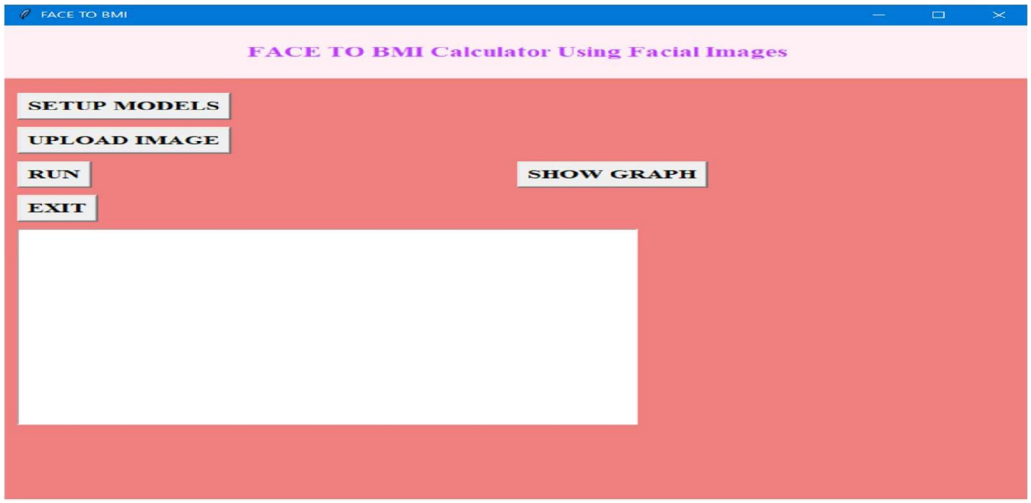

Fig.3 Main Interface

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Fig. 4 predicted BMI value and health status

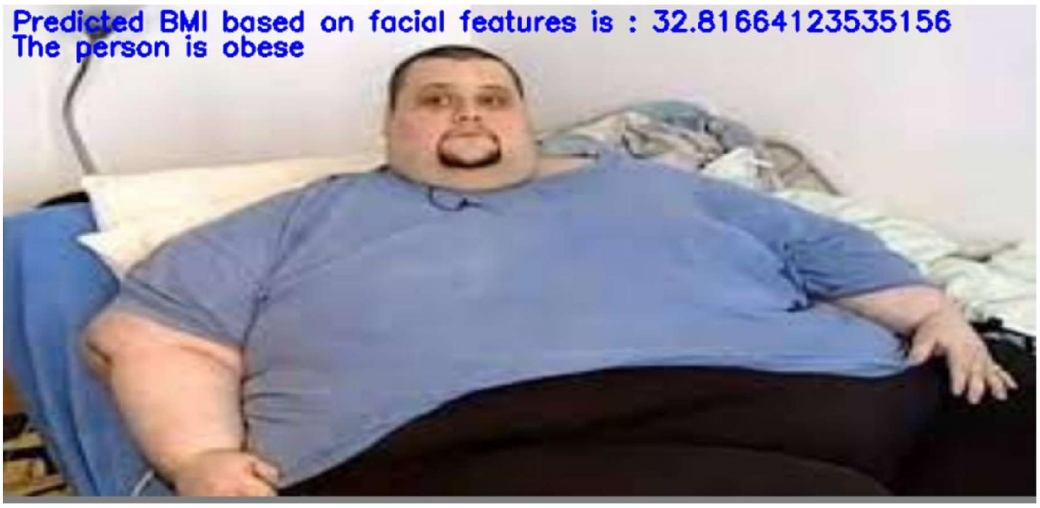

Fig. 4 predicted BMI value and health status

VIII. CONCLUSION

The System provides the BMI value Using data mining techniques. The software ensures that front-facing images are used and determines BMI. This study used data to assess any participants' BMI-related facial traits, as well as visualisation to guarantee that human judgements matched intuitions. This BMI values gives a understanding about the person's health based on the values person should take care of his health.

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