ESTIMATING BODY MASS INDEX [BMI] THROUGH FACE RECOGNITION IMAGES

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ABSTRACT

Following the worrisome trend of obesity, self-diagnostic image-based solutions for healthy weight monitoring are garnering significant attention. These machine learning-based approaches for inferring Body Mass Index (BMI) from face photos are being developed as a solution for healthy weight monitoring and control. A person's weight status may have a significant impact on many aspects oftheir life, from mental health to lifespan to financial security. At the social level, "fat-shaming" and other types of"sizeism" are becoming more prevalent while rising obesity rates are associated with ever-increasing healthcare expenses. As a result, academics from diverse backgrounds are interested in examining obesity from several perspectives. Historically, individuals had to correctly self-report their body mass index (BMI) or see a doctor to have it tested. The typical way for calculating an individual's BMI is to take his or her weight and height. As a result, various instruments, such as a ruler and a scale, are necessary.

1.INTRODUCTION

In addition to a person's age and weight status, is a publicly available indication that has the potential to have a significant impact on a range of aspects of their life, including their health. As is obvious, having a higher BMI may have a detrimental impact on their health, increasing their chance ofdeveloping cardiovasculardisease and diabetes. When faced with obese patients, sizes has grown so common among health professionals that it has become a health hazard, as care providers fail to examine the many other factors that may be contributing to the patient's medical state.

Consequently, scholars from a wide range ofdisciplines are becoming more interested in studying obesity from a variety ofangles. Historically, a person's BMI has been calculated only after they have been measured. In this article, we provide a unique method for determining a person's body mass index (BMI) using face photographs. We really hope so. This system functions in a way that is like that of a human being. Therefore, measuring devices such as a ruler and a scale are required to be used. The following is how the body mass index (BMI) is computed based on an individual's height and weight:

$$\mathbf{BMI} = \begin{cases} \dfrac{weight(kg)}{height(m)^2} \\ or \\ \dfrac{weight(lb) \times 703}{height(in)^2} \end{cases}$$

2.LITERATURE SURVEY

There is a relationship between face characteristics and body mass index, according to psychological and human perception studies [16–18]. These findings provide the framework for estimating body mass index (BMI) from facial photographs.

Facial adiposity, or perceived face weight, maybe a predictor ofsubjective health and attractiveness, according to Coetzee et al. [16]. They took photographs of84 people who were ofCaucasian descent (43 females and 41 males). We took measurements ofeach participant's weight, height, and other crucial information, such as blood pressure, to determine their overall health.

The researchers then recruited four more groups ofpeopletopersonally review the face pictures. They discovered a connection between measured face adiposity and body mass index (BMI).

Coetzee et al. [17] looked at three different elements ofthe face: the width- to-height ratio, the perimeter-to-area ratio, and the breadth ofthe cheeks to the width ofthe jaw. They took photographs ofthe faces of95 Caucasians and 99 Africans. To construct each face picture manually, 179 feature points weredenotedonthe faceandthe aligned using computersoftware by employingthe interpupillarydistance.WecalculatedPearson'scorrelation coefficients to see how well two variables correlated. For men, all three oftheir facial traits were related to BMI, whereas for females, only the width-to- height ratio and the cheek-to-jaw ratio were shown to be associated with BMI.

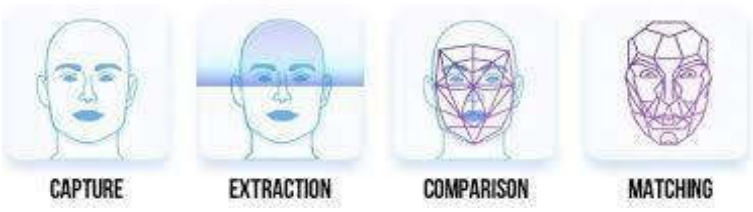
3. TECHNOLOGY

Face recognition is a technique of identification or verification of a person using their faces through an image or video. It captures, analyzes, and compares patterns based on the person's facial details. The face detection process is an essential step as it detects and locates human faces in images and videos. Identification means to compare your identity to all the identities present in the database.

The complete Face Recognition system can be divided into three categories:

1. Face Detection
2. Feature Extraction
3. Feature Matching

Basically, the output ofone method is taken as an input for the next method.



4.MODULES

Data Preprocessing

Data Collection and Augmentation The dataset consists of 20 images of Bollywood celebrities. The various images have been taken under different conditions so that we have enough variations. The image that has been taken is downloaded using google search engine results. Care has been taken care that all the images are latest. The label for each celebrity has been noted from the publicly available forums.

Traning Module

Convert to array, which forms the features (X) Map the labels (y: {BMI, height, and weight}) from meta-data Random sample from training dataset to build the generator formodel fitting features extract using Face Net.

Testing Module:

alignment: pre-process the training data by cropping the detected faces.Detect: when applying the model, detect the bounded faces from input picture and then apply the model for predictions. features extract using Face Net.estimatingbmi using kernel ridge machine learning algorithm.

Performance Evaluation Module:

In his module calculate Mean squared error: 0.00 Variance score: 0.13 Model

Performance Average Error: 0.0291 degrees. Accuracy = 94.60%. for both linear regression and Kernel Ridge machine learning algorithm.

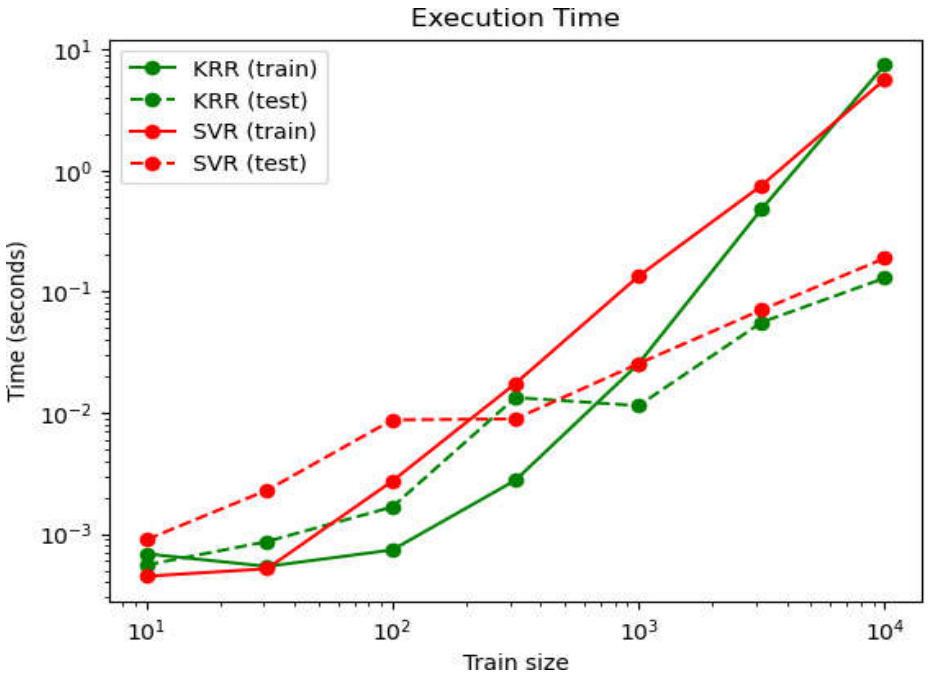
5. KERNEL RIDGE REGRESSION

Kernel ridge regression (KRR) combines Ridge regression and classificationwith the kernel trick. It thus learns a linear function in the space induced by the respective kernel and the data. For non-linear kernels, this corresponds to a non-linear function in the original space.

The form of the model learned by Kernel Ridge is identical to support vector regression (SVR).However, different loss functions are used: KRR uses squared error loss while support vector regression uses ϵ-insensitive loss, both combined with l2 regularization. In contrast to SVR, fitting Kernel Ridge can be done in closed-form and is typically faster for medium-sized datasets.

On the other hand, the learned model is non-sparse and thus slower than SVR, which learns a sparse model for ϵ>0, at prediction-time.

The next figure compares the time for fitting and prediction of Kernel Ridgeand SVR for different sizes of the training set. Fitting Kernel Ridge is faster than SVRfor medium-sized training sets, however, for larger training sets SVR scales better.



With regard to prediction time, SVR is faster than Kernel Ridge for all sizes of the training set because of the learned sparse solution. Note that the degree of sparsity and thus the prediction time depends on the parameters ϵ and C of the SVR; ϵ=0 would

correspond to a dense model.

6. RESULTS

```
predict_height_width_BMI(test_image,height_model,weight_model,bmi_model)
[49]  ✓ 0.5s                                                                Python
...  saved_img-final.jpg
C:\Users\hanum\AppData\Local\Programs\Python\Python37\lib\site-packages\ipykernel_launcher.py:3: DeprecationWarning:
np.asscalar(a) is deprecated since NumPy v1.16, use a.item() instead
  This is separate from the ipykernel package so we can avoid doing imports until
C:\Users\hanum\AppData\Local\Programs\Python\Python37\lib\site-packages\ipykernel_launcher.py:4: DeprecationWarning:
np.asscalar(a) is deprecated since NumPy v1.16, use a.item() instead
  after removing the cwd from sys.path.
C:\Users\hanum\AppData\Local\Programs\Python\Python37\lib\site-packages\ipykernel_launcher.py:5: DeprecationWarning:
np.asscalar(a) is deprecated since NumPy v1.16, use a.item() instead
  """
{'height': 1.8310455228754963,
 'weight': 59.081687629335875,
 'bmi': 23.05398257037411 7}
```

7. CONCLUSION

In this paper, we use a machine learning method to create a unique FaceTime system, which we present. When it comes to determining BMI, the performance of this technology is comparable to that ofpeople. We examine algorithmic concerns; although it is not 100 percent correct, it outperforms any other available models in terms of efficiency and effectiveness. Humanoid robots, military applications, and other fields may all benefit from our model's capabilities.

8. FUTURE ENHANCEMENT

In future research, we will apply our technique to social media profile photographs to estimate obesity trends at the population level. Preliminary findings indicate that geographical and demographic disparities in BMI are represented in considerable quantities of the profile image, according to the researchers.

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