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Body Weight and Age Analysis from Human Body Images

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ABSTRACT

In the past few decades, overweight and obesity are spreading widely like an epidemic. Generally, a person is considered overweight by body mass index (BMI). In addition to a body fat measurement, BMI is also a risk factor for many diseases, such as cardiovascular diseases, cancers and diabetes, etc. Therefore, BMI is important for personal health monitoring and medical research. Currently, BMI is measured in person with special devices. It is an urgent demand to explore conveniently preventive tools. This work investigates the feasibility of analyzing BMI from human visual appearances. Motivated by health science studies which have shown that anthropometric measures, such as waist-hip ratio, waist circumference, etc., are indicators for obesity, we analyze body weight from frontal view human body images. A framework is developed for body weight and age analysis and cloth measurement from body images, along with the computation methods of five anthropometric features for body weight characterization. Then, we study BMI estimation from the 3D data by measuring the correlation between the estimated body volume and BMIs, and develop an efficient BMI computation method which consists of body weight, height and age estimation and also cloth measurement from normally dressed people. We also intensively study BMI estimation from frontal view face images via two key aspects: facial representation extracting and BMI estimator learning. First, we investigate the visual BMI estimation problem from the aspect of the characteristics and performance of different facial representation extracting methods by three designed experiments. Then we study visual BMI estimation from facial images by a two-stage learning framework. BMI related facial features are learned in the first stage. To address the ambiguity of BMI labels, a label distribution based BMI estimator is proposed for the second stage. The experimental results show that this framework improves the performance step by step. Finally, to address the challenges caused by BMI data and labels, we integrate feature learning and estimator learning in one convolutional neural network (CNN). A label assignment matching scheme is proposed which successfully achieves an improvement in BMI estimation from body images.

Keywords: Social Networks, Dating, Job Hunting, Blogging, Digital Camera, BMI Estimation

I. INTRODUCTION

In modern lives, there are various social networks with different functions, such as image sharing, dating, job hunting, and blogging. With the popularity of digital camera, more and more people record their lives via photos or videos and post the records to social media. Photos from social networks contain lots of hard biometric and soft biometric information, such as pupil color, gender, height, weight, age, etc. Such biometric information can be utilized for individual identification. Among the soft biometric measures, body weight and fat are good indicators of health conditions.

Body mass index (BMI) is an important soft biometric measure that is related to people's daily lives. Given an individual's height and weight, BMI = (weight / (lb) / height (in2))*703. BMI is an important visual characteristic to describe a person. It is widely used for measuring the adiposity, especially for the overweight issue. In medical science, both BMI and body weight can be used to estimate the risk for some diseases, such as breast and endometrial cancers. Currently, computer vision has been a favored means for providing new techniques to automatically detect various diseases. Considering the inconvenience of measuring BMI with special devices, exploring an automatic BMI estimation method from visual images data could make it efficient to monitor the health conditions in a large-scale setting.

II. LITERATURE SURVEY

Min Jiang, GuodongGuo, “Body Weight Analysis from Human Body Images”.

Human body images encode plenty of useful biometric information, such as pupil color, gender, weight, etc. Among this information, body weight is a good indicator of health conditions. Motivated by the recent health science studies, this work investigates the feasibility of analyzing body weight from2-dimensional (2D) frontal view human body images. The widely used body mass index (BMI) is employed as a measure of body weight. To investigate the problems at different levels of difficulties, three feasibility problems, from easy to hard, are studied. More specifically, a framework is developed for analyzing body weight from human body images. Computation of five anthropometric features is proposed for body weight characterization. Correlation is analyzed between the extracted anthropometric features and the BMI values, which validates the usability of the selected features. A visual-body-to-BMI dataset is collected and cleaned to facilitate the study, which contains5900 images of 2950 subjects along with the labels corresponding gender, height, and weight. Some interesting results are obtained, demonstrating the feasibility of analyzing body weight from 2Dbody images. In addition, the proposed method outperforms two state-of-art facial images based weight analysis approaches in most cases.

João W. M. de Souza; Gabriel B. Holanda; Roberto F. Ivo; Shara S. A. Alves; Suane P. P. da Silva; Virgínia X. Nunes; Luiz LaPredicting body measures from 2D images using Convolutional Neural Networks.

Nutrition is a significant determinant of health, the resolution of many nutritional issues, initially requires an anthropometry examination. Body measures provide data for studying the relationship between diet, nutritional status, and health. Manual and automatic methods can perform body measurements. The manual method usually uses an anthropometric tape. However, the automatic process uses the equipment of Dual-energy X-ray absorptiometry (DXA). Our work presents a new approach to calculate body measures using 2D Camera Images, applying Digital Image Processing, Convolution Neural Networks, and Machine Learning techniques. The dataset used contains 38 exams, for each exam, has four digital images and the dimensions of body measurements, performed by a specialist. The methods used in this work for segmentation were

Dense Human Pose Estimation - CNN with the Bayesian, K-Nearest Neighbors, Support Vector Machine, Decision Threes, Adaptive Boosting, Random Forest, Multilayer Perceptron and Expectation-Maximization classifiers. The approach with Dense Human Pose Estimation and Expectation-Maximization reached the best results, with mean squared error (MSE) always bellow 4.606 ± 3.412 cm when compared with specialist measures.

III. Proposed System

The proposed weight estimation approach is based on the volume estimation. RGB-D videos are collected to facilitate this study. The condition for collecting the data is simple. Though the noise may be generated during the scanning and fusion process, the proposed weight estimation approach includes clustering and fitting stages to suppress such noise.

The significance of this study comes from several aspects. First, this work provides a non-contact way by using affordable devices for accessing BMI and body weight, age. It can be used as convenient self-monitoring tool or tele-medical equipment for users rather than asking them to find scales and metric tapes to measure their body weight and height. Second, this approach, as well as data acquisition, may give more opportunities in real applications. As the first step, we focus on BMI estimation from image data, which is a frequently used index parameter in reality. However, BMI estimation is not the only goal. Given the image data capture, more properties can be examined in addition to BMI. For instance, in smart health, one can assess the body volume, body shape etc. to get a more accurate estimation of a person's health condition; in E-commerce, one can assess the body image in whole for clothes selection with different fashions. Third, BMI and body weight and age are soft biometric traits that can be utilized as auxiliary information for recognition or tracking.

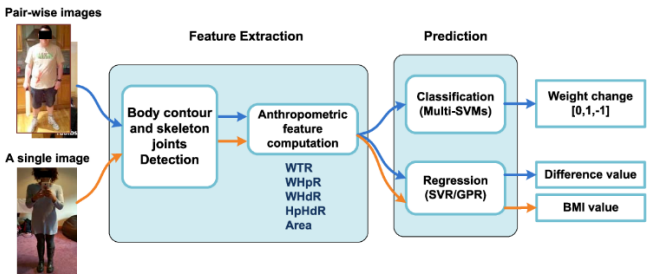

Fig.1: System Architecture

IV. ADVANTAGES OF PRPOSED SYSTEM

- The purpose of this work is to explore the feasibility of body weight and age analysis from the visual appearance of human body images.
- We develop some useful cues to characterize body weight/fat from human body images.
- A computational framework is developed for body weight and BMI analysis from 2D human body images, which can process either a single image.
- Successfully implement the test model based on training set as supervised learning approach.
- Execute the proposed system maximum accuracy.

V. CONCLUSION

In this work, we investigate the relation between body weight and visual body appearance and estimate the BMI values from body images. Our work proposes a new approach to predict body measurements using digital image processing, dense human pose estimation - CNN and machine learning techniques to perform segmentation and, finally, make measurements. Our contributions focus on predicting human body measures in images and create a new concept for body segmentation using outputs features of Dense Pose Estimation - CNN as the input of classifiers that perform body segmentation. The approach with Dense Human Pose Estimation and Expectation-Maximization reached the best results, with mean squared error (MSE) always bellow 4.606 +- 3.412 cm when compared with specialist measures. In future works, we intend to develop methods to calculate body fat percentage from images using CNNs

and integrate this method to mobile and web applications.

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