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Vision Based Food Analysis System

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Abstract - *Part of people consume ill foods on purpose cause of variety of reasons, while others do it without thinking. Fatness, diabetes, and other lifelong illnesses are all linked to poor dietary attitude and dental diseases. Food picture revival & categorization could potentially replace the inaccurate personal nutritional evaluation, that relies heavily upon self-reporting.*

***Key Words*: ML, Food, Recipe, Nutrition, Food picture Recognition, Food Nutrition Analysis.**

1. INTRODUCTION

Food is vital to mankind's existence as well as the world wealth. Human's awareness has lately been drawn to food well-being & excellent nutritional enactment. Numerous studies over current age concluded as artificial intelligence and cv approaches could aid in the development of technique that can detect objects impulsively food and to estimate its nutrients. Often these systems exploit mobile applications for food recognition. Part of people consume ill foods on purpose cause of variety of reasons, while others do it without thinking. Fatness, diabetes, and other lifelong illnesses are all linked to poor dietary attitude and dental diseases. Food picture revival & categorization could potentially replace the inaccurate personal nutritional evaluation, that relies heavily upon self-reporting. Clearly, the true comparison of these systems necessitates the accessibility of appropriate repositories that accurately reflect the complexities of the food identification job.

2. PREVIOUS WORK

2.1 Food Calorie and Nutrition Analysis System based on Mask R-CNN

According to own-divulge of its fat individuals' provisions [1], around thirty-three percent of respondents miscalculate the quantity of food consumed. The authors in this paper tried to develop a system which will help in monitoring the calorie intake by a person and what nutritional value he is adding to his body.

Mask R-CNN [1] is an improved version of quicker R-CNN for instance segmentation. The convolutional backbone, the RPN, the RoIAlign layer, and the head make up its structure.

Mask R-CNN enhances the positional deviation of the frame selection object when compared to quicker R-CNN since it employs RoIAlign to unify the RoI size. As a result, the accuracy rate increases by at least 10% when a RoI enters the mask branch prediction mask [1].

Regarding [1], particular elements of the food picture are employed as the foundation for categorization in the image processing approach, and there is space for improvement in terms of accuracy. Color and texture are low-level particular characteristics in the deep learning-based technique. A deep neural network can learn abstract properties that can aid with food detection and recognition. As a result, this work employs Mask R-CNN to detect food pictures, a linear regression computation to estimate food weight, and a nutritional table to estimate food calories and nutrients [1].

The proposed system by M. -L. Chiang [1] picture rescaling, food identification and categorization, food amount detection, and food total energy consumed & nutrition report are the 4 key phases. You give the system a food image as input then it will resize the image size. The new image is then sent for recognition using Mask R-CNN. Once the item has been detected it will then detect the approx. weight and also the calorie and nutrition value.

The results of this system came out to be quite nice. They faced some challenges like with the weight prediction for which they needed the image to be taken from different angles. The different angle images help to have a correct ratio of how much food there can be. The dataset that they used had a total of 850 four hundred and twenty-eight testament pictures and four hundred and twenty-eight preparation images There were 4,118 & 1,978 food products examined and verified, individually, [1].

As in the 16 types, the mean precision measure of food identification were nighty-nine percent. 3,568 items were identified out of 3,680 foods tested, with 5 foods misidentified & hundred and twelve foods unable to be predicted [1].

2.2 Image-Based Estimation of Real Food Size for Accurate Food Calorie Estimation

Here the authors [2] have tried to create a system which will automatically find the calorie estimation of a food item provided to the system. For this purpose, T. Ege [2] and his colleagues have proposed two methods based on the three studies that they have reviewed. “DepthCalorieCam” which is a food calorie estimation system exploiting iPhone stereo

cameras. Rice grain based size estimation which uses rice grains the size of which are usually almost the same as a reference object [2]. For the work [2] presented they split the built dataset into 6 for the combination of 2 cameras and 3 amounts of water, and one for the evaluation and the rest is used for training [2].

2.3 Food Image Generation and Translation and Its Application to Augmented Reality

Here K. Yanai [3] has proposed a device which will change the visual of a food item. Basically the work that he has created will change the food image into any other different food item. The purpose is to change the experience of the user while having something. Suppose a consumer is having a basic steamed rice for dinner by using the authors [3] device it will change the visual and it will show you a different food item on the plate and the consumer will have a nicer experience even while having basic food. For this experience to be more realistic they brought in augmented reality which enhances the consumers overall experience.

For this technology to work they [3] have used GAN. Generative Adversarial Networks (GAN) has made it possible to generate realistic images with CNNs [3].

2.4 AIFood: A Large Scale Food Images Dataset for Ingredient Recognition

Here in this paper G. G. Lee [4] has developed a dataset for making the work easy for all the developers who are trying to create a food recognition model and are not provided with the proper dataset for the same.

The proposed work has 24 categories and 300,000+ food images from over the world. These categories not only have single items on the dish, it consists of multiple food items in one single dish with labeling of each item present. Also they [4] have created such a dataset which will not face the color cast problem which sometimes disturbs the food image recognition. To overcome this issue, they applied the Automatic White Balancing(AWB) algorithm. Also for too dark or too bright images, they added Contrast Limited Adaptive Histogram Equalization (CLAHE) algorithm to overcome the problem [4].

2.5 Grab, Pay and Eat: Semantic Food Detection for Smart Restaurants

The system proposed by Aguilar-Torres [5] focuses on monitoring food tray which will consist of many different food items at a time. This aspect of food tray analysis has several problems like multiple food placed on the same plate, different food served in the same dish, visual distortions and a few others [5].

For this work the authors [5] took two approaches, one is food segmentation and other is object detection. Food segmentation allows the model to determine where the food is in term of pixels and bounding boxes. And the other one allows to locate and recognize the food.

The dataset that has been selected is a dataset that has been collected in a self-service canteen. It has a total of 1027 images and 73 different categories. The recognition model had a 90% accuracy rate [5].

2.6 Identification of Food Waste through Object Recognition

According to the United Nations, roughly 1.3 billion tons of food is either lost or wasted worldwide every year [6]. The authors [6] in this project are working towards the mission of saving the food that is getting wasted.

A device was created for this project using IOT components like raspberry pi, camera module and some other stuffs. This device was created so that they can use this to take pictures and send the data to the backend instead of relying on mobile and then sending the data manually.

For the image recognition part, a machine learning model was created using convolutional neural network. Convolutional neural network was picked because it can pick out the segment of the image and compare that to the segments of training images [6].

TensorFlow was used inside a Jupyter Notebook for all data fitting, model tuning, and model training [6].

2.7 Zero Food Waste: Food wastage sustaining mobile application

The proposed system by M. D. C. J. Gunawardane [7] takes leftover food item images as input, then it recognizes the food items present and what all ingredients are included. Then it will provide the user with a recipe which he can use on the food that is left and create a new dish in itself.

The accuracy that they got for the image recognition was around 76%.

The main focus of this system is to work on how they can reuse the wasted food so that we can help the world in food wastage.

2.8 Mobile Application for Halal Food Ingredients Identification using Optical Character Recognition

The proposed system by M. Kartiwi [8] is system designed to particularly target the Muslim community. In the Muslim religion Islam there is a concept where they are allowed to eat only good food and drinks which are pure, clean, wholesome, nourishing and pleasing to the taste. In general, everything is halaal except what has been specifically forbidden [8]. The forbidden ingredients are known as haram.

The aim of this paper is to propose a mobile application which can be used by a Muslim to scan through a products ingredients using text recognition technique and identify whether a product is permissible to be consumed or not [8].

For the application purpose here waterfall and agile methodology is used. Once the user gives a input of the food description it will then compare it with the dataset present and tell whether it is permissible to consume or not.

2.9 Using Deep Learning for Food and Beverage Image Recognition

A deep learning architecture is created for food image and beverage recognition. This method is the modified version of AlexNet architecture. The way it was modified is that firstly they [9] increased the resolution of the image size from 256 * 256 pixels to 512 * 512 pixels.

The dataset used consisted of 225953 food and beverage images. After running the module, they got an accuracy of around 86.72% [9].

To make the model more accurate the authors [9] used a fake image of food items instead of providing the model with real time food images which helped to increase the accuracy to 92.18% [9].

2.10 Few-shot and Many-shot Fusion Learning in Mobile Visual Food Recognition

Deep convolutional neural networks (DCNNs) are currently the state-of-the-art technique in image recognition [10].

The proposed work is to develop a system that can recognize the food item when provided with only a few images for training. This path will help in making the model more accurate and fast recognition instead of providing the model with the large dataset.

What the large dataset is doing by training a large number of images the authors [10] are trying to do it with a small amount of images.

The results of the experiment came out to be pretty good as they [10] got an accuracy of around 72% even though they provided with a very small dataset.

3. CONCLUSIONS

In this paper, we have done a literature review of all the different papers that we have referred to develop our project of vision based food analysis system.

By reading through all this paper we have gained a lots of knowledge on how to proceed with our project, what kind of problems we might face and what can be the possible solutions to solve those problems. From the papers that we have referred we got to know that there are many different algorithms to execute our recognition module. Not only we got help for our project by referring the papers we also found out that how important of a topic this is to the world. This topic has opened a lot of thoughts on the food that we consume daily. This work helps in tracking what you are consuming on a daily basis, how much good it is for your body. Also what kind of food we should be consuming and the food wastage that we do without knowing how much it is affecting the world.

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