

Utilizing the CNN Algorithm to Identify Meals and Calculate Calories

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Abstract: *Food is one of the most important requirements of every living being on earth. The human beings require their food to be fresh, pure and of standard quality. The standards imposed and automation carried out in food processing industry takes care of food quality. Now a day, people across the universe are becoming more sensitive to their diet. Food recognition and calorie measurement project will describe the relationship between nutritional ingredients identification in food and inspecting calories through Machine Learning models to perform the data analysis, the experiments on real life dataset to show that our method improves the performance with efficient accuracy. Also, our System will recommend food for some different age groups. This work is able to identify the Nutrition that we may get effected by lacking of certain nutritional ingredients in our body and recommends the food that can benefit the rehabilitation of those Age groups. To achieve high accuracy and low time complexity, the proposed system implemented using CNN Machine Learning models.*

Keywords: Calculate Calories.

I. INTRODUCTION

The propose of food recognition system which are estimating calorie and identify food items. With the rapid development of our society, more attention has been paid to the quality of life, especially the food eat. Food recognition systems is a system which could identify the type of food in an image that is captured with a camera. This is an idea to help the users to keep track of their calorie intake. The user can automatically record their food and calorie intake with just a snap of its photo. adopt image recognition methods which are suitable for all suitable platforms. To recognize food items, a user draws bounding boxes around the food item, and then the system starts food item recognition within the indicated bounding boxes. To recognize them more accurately, segment each food item region, extract image features and finally classify it into one of the one hundred food categories with a convolution neural network. It can awake users if their food habits problems such as bad food trends and unhealthy food. It is useful for disease prevention. Collecting food recordings to keep an eye on the daily calorie intake and maintaining a set diet plan is not a super new concept. It was done even before the time when smart phones and high tech specialized dietary measurement tools were invented and became popular. Modern technologies entirely solved the issue and converted this tedious process into an exciting one by transforming the whole food recording process from writing everything down to the matter of clicking just a single picture of the food item on your smartphone or tablet and evaluating almost all of the possible nutritional information. This all has become possible with the advancement in machine learning and deep learning models. Now, taking phone out of the pocket and clicking a picture of the food to calculate the number of calories it contains sounds so simple and magical but in reality, this job requires high skills and lots of complicated calculations. The implementation results for the proposed system are provided in this paper.

II. RELATED WORK

[1]. Dieticians and healthcare conventions are concerned with the consumption of accurate quantity and right kind of food. There is no doubt that exercising also plays a vital role but what we are feeding our body plays a major role in obesity and many problems related to health like diabetes, stroke, and many cardio vascular diseases. Also, due to advancement in technology, today's generation can order food just with a click on their mobile devices. Thus, acceleration in obesity is evident. For the people who are concerned with this problem, keeping the records of the consumption of

nutrients manually is difficult. To combat this, a variety of health applications and Calorie measurement tools have emerged to reverse or shrink the effect of all the health-related troubles. Some of the applications also utilize state-of-the-art Machine Learning algorithms. In this paper, we will take a look at some of the methods used for food recognition and calorie measurements and also comparing their performance by putting them head-to-head on different scales.

[2]. The concept described in this study is motivated by increasing issues about the health consequences of excess weight. People all over the world seem to be more involved in fat loss, eating healthier, and reducing fatness. A method for calculating calories and nutrients in food items can be very useful. In this report, we suggest a nutrient and calorie calculation method for food that can help individuals and fitness trainers in assessing and reporting eating patterns. To lose weight and improve while still eating a healthy diet for typical persons, daily food consumption should be defined. The current paper studies say that obese people are in serious health conditions such as high blood pressure, cardiac arrest, cancer, cholesterol levels, thyroid, respiratory problems, diabetes, etc. The primary reason of overweight is the inequality between the energy consumed by the individuals and the amount of daily food intake. People have started to place a premium on their health and well-being with the aim to maintain themselves safe from injury. Various analyzers have now been set up to help people with their health problems by developing various services that help people remain well.

[3]. Personal services to recode people's food habits using mobile phones have become popular. Users can become aware of own diet, and evaluate nutrition by recording their taken meals. When recording meals, in putting the names of food items by texts or selecting food items by hierarchical links is the common way. To record several items of foods in every meal in such way is a quite troublesome task. Therefore, it is desired to make recording of food items easier and quickly. To this end, several methods to recognize food images have been proposed so far. However, all of these works assumed that one food image contained only one food item. They cannot handle an image which contains two or more food items such as a hamburger-and-french-fries image. In this paper, we propose a new method to recognize food images which contain two or more food items. In this paper, we call such images as "multiple-food images".

[4]. Accurate estimation of dietary caloric intake is important for assessing the effectiveness of weight loss interventions. Current methods for dietary assessment rely on self-report and manually recorded instruments. Though the 24-hour dietary recall is the gold standard for reporting, this method still experiences bias as the participant is required to estimate their dietary intake (short and long term). Assessment of dietary intake by the participant can result in underreporting and underestimating of food intake. In order to reduce participant bias and increase the accuracy of self-report, enhancements are needed to supplement the current dietary recalls. One of the potential solutions is a mobile cloud computing system, which is to employ mobile computing devices to capture the dietary information in natural living environments and to employ the computing capacity in the cloud to analyze the dietary information automatically for objective dietary assessment. Among the large selection of mobile cloud computing software for health, many have proposed to improve dietary estimates.

[5]. According to the World Health Organization, in the last years there has been a rapid increase of diseases related to excessive or wrong food intake, most notably obesity and derived issues such as diabetes, cardiovascular diseases, musculoskeletal disorders and some types of cancers. In particular, it is estimated that in 2014 about 39% of the world's adult population were overweight, including a 13% of obese people, whose number more than doubled between 1980 and 2014. Contrary to popular belief, the problem also affects many low- and middle-income countries, particularly in urban settings. Despite obesity being a complex disease involving many factors, from genetics to life styles, proper actions against it necessarily include a strict control over the daily food intake. Obese people should constantly take note of their daily meals, both for self-monitoring and to acquire useful statistics for dietitians. This justifies the large amount of food diary applications for mobile devices that have recently been developed. However, these apps typically require a manual annotation of the food intake, a tedious task that often discourages the potential users. To face this problem, many food recognition works have been recently proposed, whose aim is to automatically classify food (and possibly its amount) directly from smartphone-acquired pictures.

[6]. The advent of deep learning technologies has achieved successes in many visual perception tasks such as object and action recognition, image segmentation, visual question answering etc. Yet the object recognition performances are still unsatisfactory when it comes to label an image whose intra-category appearance might present more differences than it inters category counterparts. This is the case of food recognition where a particular food dish may be prepared in thousands of different ways, yet it is essentially the same food. Reaching the final objective of food diary applications.

The food recognition problem is characterized by large intra class variations. However, some dishes present a vertical structure which has been not considered so far. The food recognition and calories estimation problems would be highly beneficial to tackle the rapid increase of diseases related to excessive or wrong food intake.

[7]. Recognizing the category of the dominant object in an image is a task to which Convolutional Networks have been applied for many years. ConvNets have advanced the state of the art on large datasets such as the 1000-category ImageNet with 50 million labelled images. Many image datasets include images with a roughly-centered object that fills much of the image. Yet, objects of interest sometimes vary significantly in size and position within the image. This paper presents three ideas in solving these issues: The first idea in addressing this is to apply a ConvNet at multiple locations in the image, in a sliding window fashion, and over multiple. Even with this, however, many viewing windows may contain a perfectly identifiable portion of the object but not the entire object, nor even the center of the object. This leads to decent classification, but poor localization and detection. The second idea is to train the system to not only produce a distribution over categories for each window, but to also produce a prediction of the location and size of the bounding box containing the object relative to the window.

[8]. Obesity and overweight have traditionally been linked to intake of high calorie food and lifestyle. Obesity may be a medical condition during which excess body fat has accumulated to the extent that it's going to have an adverse effect on health. Obesity in childhood and adolescents is associated a number of complications like, psychological stress, cardiovascular disease, orthopaedic problems, etc. Obesity is usually preventable through a mixture of social changes and private choices. Changes to diet and exercising are the most treatments. Food is the key of human's body. So, a diet plan always needs to take into consideration the total number of calories to be consumed to maintain a fit and healthy life. But, in most cases, unfortunately people face difficulties in estimating and measuring the amount of food intake due to the mainly lack of nutritional information, which includes manual process of writing down this information, and other reasons. As such, it will be useful if there is a system to keep track and maintain the calorie intake. Hence accurate prediction of food calorie is equally important in such cases. In the last three years, object classification and detection capabilities have dramatically improved due to advances in deep learning and convolutional neural networks.

[9]. The need of accurate methods and tools to measure food and nutrient intake becomes imperative for epidemiological and clinical research linking diet and disease. We aim to develop an image analysis system to automatically identify and quantify foods and beverages consumed at an eating occasion from images of foods and beverages acquired using a mobile device. Classifying foods in an image poses unique challenges because of the large visual similarity between food classes such as a brownie and a chocolate cake. In addition, foods are non-rigid objects that can deform in many ways, and consequently there is also a large variation within classes such as scrambled eggs and boiled eggs. Appearance variations may also arise from changes in illumination and viewpoint. There have been recent efforts to address the challenges in food identification. In a method of food identification is described by exploiting the spatial relationship between different ingredients and learning the statistics of pairwise local features.

[10]. Measuring daily food consumption for obese patients is one of the challenges in obesity management. In this project, a computer vision-based system to estimate energy intake based on food pictures taken. Emerging food classification methods play an important role in nowadays food recognition applications. For this purpose, a new recognition algorithm for food is presented, considering its shape, color, size, and texture characteristics. Using various combinations of these features, a better classification will be achieved. Food calorie and nutrition measurement system that can help dietitians to measure and manage daily food intake. The prevalence of obesity is getting increased dramatically. Obesity is one of the most leading factors for numerous diseases, such as heart disease, hyper-tension and diabetes. There is a strong correlation between obesity and positive energy balance, which is the difference ingested energy from expended energy. Energy Intake is being considered as one of the primary reasons for gaining weight. Energy intake can be defined as the calorie equivalent of the consumed amount. The main cause of obesity is the imbalance between the amount of food intake and energy consumed by the individuals. Therefore, to lose weight in a healthy way, as well as to maintain a healthy weight for normal people, the daily food intake must be measured.

III. ALGORITHMS

Deep learning has been very widely used especially in projects with huge datasets because of its Powerful learning ability along with the luxury of automatic extraction of new features from raw data. Additionally, the deep Learning algorithm

CNNs proved to be very successfully pattern recognition image processing and in reducing the number of parameters by using spatial relationships without compromising on the model quality. Cioccaetal came up with a new food dataset consisting of 1,027 canteen trays filled with food items divided into 73 food classes. They used CNN for image recognition and attain an accuracy rate of 79%. Along with that, they successfully build a pipeline that takes an image containing numerous food items presented in a tray as input, finds the region of interest which then finally outputs a list of identified food items.

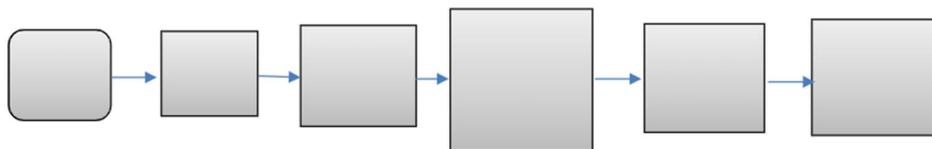
Segmentation algorithms were also developed for ensuring that the quality of the food images is adequate .The system consisted of three main components:

- Frontend Component(where water shed segmentation algorithm was used)
- Backend Component(where CNN based algorithms were used)
- Communication Component(CC).The experiment was conducted on UEC-256, UEC-100, and Food-101 datasets which obtained an accuracy of (63-87)%, (76-94)%, and (77-94)% respectively.

Moreover, volume estimation can be performed only for the solid food items and that too is an error- Prone process. L Jiang et al took two datasets: UEC-FOOD100 and UEC-FOOD256 for training and testing their deep learning model for recognizing food items and implementing nutritional analysis using the Region Proposal Network (RPN) which is a part of the Faster R-CNN model. The project executes in a three-step process which incorporates detecting regions of interest ,applying feature maps over them and then identifying the components of each picture .In the end ,a dietary assessment report is generated based on the existing data and the researchers saw incredible results from the food recognition deep learning model.

IV. ARCHITECTURE

In proposed system, we can identify the Nutrition information that may get effected due to lack of ingredients thus we recommend Calories according to the body's intake on type of food consumption. We propose a model which detects a given food image and displays the amount of calories in it. Further, it also displays a statistic analysis of the number of calories consumed by user. There have been several number of models proposed for detection of food images, measuring the amount of calories present in food items and analysing the calorie intake of a person by determining their daily dietary information as well. Several methods and algorithms have been implemented in the related works for calculating the same. The model, when trained convolutionally, generates the natural image samples which gives the better broad statistical structure of the natural images as compared with previously existing parametric generative methods.



Dataset Preprocessing Splitting Applying Performance Food & Model ML Algorithms Evaluation Recommendation Selection

V. RESULT ANALYSIS

The system will be fed with the image by the user. The image will then be preprocessed to remove the noises present in them. After preprocessing the image that is fed to the system will be of same contrast. Later the CNN algorithm will be applied which will provide the name of food in the image along with its total calorie and nutritional information. After the information about the food is obtained the user can further have a health diet analysis then the system will provide the details about the lacking nutrients in the diet. Our system will provide the data about the recommended intake of each nutrient that the user should follow in order to have a healthy diet.

VI. CONCLUSION

The major problem of people today is that they are in need to identify and classify their food according to the nutrients composition so that they may have a clear understanding of their diet and make necessary decisions to improve their

health. Today over 30% of the total population of the world is obese and overweight. This system will provide solution to these problems by providing correct amount of the calorie and the nutrients present in the diet. Also, the system will provide proper health diet analysis using this information, also the lacking nutrients in the diet. The information about the nutrients that the user should intake to overcome his/her imbalance in the diet will also be provided. Due to this the fraction of the people suffering from obesity will also be reduced. Thus the paper is designed to aid dieticians for the treatment of obese or overweight people, although normal people can also benefit from our system by controlling more closely their daily eating without worrying about overeating and weight gain This is simple and easy to use. Hence this system is very important in the field of biomedical, the actual program is clear and easy to understand.

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