Food Calorie Estimation Using Convolutional Neural Network

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Abstract:
The modern world healthy body depends on the number of calories consumed, hence monitoring calorie intake is necessary to maintain good health. At the point when your Body Mass Index is somewhere in between from 25 to 29. It implies that you are conveying overabundance weight. Assuming your BMI is more than 30, it implies you have obesity. To get in shape or keep up the solid weight individuals needs to monitor the calorie they take. The existing system calorie estimation is to be happened manually. The proposed model is to provide unique solution for measuring calorie by using deep learning algorithm. The food calorie calculation is very important in medical field. Because this food calorie is provide good health condition. This measurement is taken from food image in different objects that is fruits and vegetables. This measurement is taken with the help of neural network. The tensor flow is one of the best methods to classify the machine learning method. This method is implementing to calculate the food calorie with the help of Convolutional Neural Network. The input of this calculated model is taken an image of food. The food calorie value is calculated the proposed CNN model with the help of food object detection. The primary parameter of the result is taken by volume error estimation and secondary parameter is calorie error estimation. The volume error estimation is gradually reduced by 20%. That indicates the proposed CNN model is providing higher accuracy level compare to existing model.

Index Terms: Convolutional Neural Network; Deep Learning; Food Classification; Food Detection; Pattern Recognition; Tensor flow;

1. INTRODUCTION

Food is the key of human's body. Nowadays more and more people care about the dietary intake since unhealthy diet leads to numerous diseases. A diet plan always needs to take into consideration the total number of calories to be consumed to maintain a fit and healthy life. Weight is an ailment and means you have an excess of muscle to fat ratio. Assuming your BMI is more than 30, it implies you have obesity [1]. Weight can have different reasons. One of these reasons is burning-through a lot calorie. Devouring an excessive number of calories implies that measure of calories that you are taking is greater than measure of calories you consume. The body stores the abundance calorie as muscle to fat ratio [2].

To get in shape or keep up the solid weight individuals needs to monitor the calorie they take. Yet, this interaction can be troublesome and tiring. Since individuals will in general dodge troublesome and tiring things, they regularly don't follow the amount they eat and this may prompt stoutness. Among these examinations, two fundamental variables of the precision change are object location calculation, volume and calorie assessment strategy. For instance, Support Vector Machine (SVM) is utilized for object discovery and characterization [3]. For volume and calorie, the assessment reference point is the thing that has the effect. Utilizing diverse reference points impacts the reasonableness of the application. Reason for this investigation is to make this following simpler. For this, we concoct a Machine Learning Base methodology [4].

Fig 1 Example Figure

With just two pictures (one is from the side and one is from the highest point) of the food and a solitary coin, individuals will actually want to know the calorie of the food that they are eating. In this investigation we discover and characterize the food and make an expectation about the volume of the food. At last, we figure the calorie of the food dependent on the volume that models have anticipated [5]. Nonetheless, we found that assessing the calories straightforwardly was giving us much precise outcomes. 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, a system to record and measure the number of calories consumed in a meal is of a great help. 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 networks [6]. Harnessing this technology to accurately classify and detect food objects is significantly essential for a healthy and fit life. But to always refer to the nutritional content in each food item is an extremely tedious task [7]. In this project, we use a deep learning-based fruit image recognition algorithm to improve the accuracy of dietary assessment and analyze each of the network architecture.

2. LITERATURE SURVEY

Effect of high calorie diet on intestinal flora in LPS-induced pneumonia rats:

Intestinal flora plays an important role in inflammatory response to systemic or local organs of its host. High calorie diet has been shown to aggravate the condition of pneumonia and delay recovery, especially in children. However, the underlying mechanisms remain unclear. This study placed SPF rats in a conventional environment, high calorie diet or LPS atomization was performed respectively or combined. Analysis of high-throughput sequencing of intestinal content combined with animal weight, organ index, serum inflammatory factors indicators and bioinformatics found that after pulmonary infection combined with a high-calorie diet, rats showed significant changes such as weight loss and increased lung weight index, and their lung and intestinal tissues showed more obvious inflammatory changes. And its gut flora structure suggests, the abundance of Leuconostocaceae in significantly reduced; abundance of Staphylococcus, Planococcaceae, Staphylococcus, Staphylococcaceae, Bacillales, Gemellales and Aerococcus significant increased. The study showed that high calorie diet and LPS atomization synergistically promoted pneumonia process in rat pups, which is related to changes in structure of intestinal flora. It is worth noting that pneumonia rats fed by convention diet also causing intestinal flora imbalance.

Real-world application of machine learning and deep learning:

The world today is running on the latest computer technologies and one of those is machine learning. The real life example that most of us know is speech recognition. Google Assistant is the common example for this Speech recognition. This google assistant is not only limited till `Ok Google', but it responds to all your questions in a smart way. It can manage all your calls or can book appointments. Imagine you fell down while de-boarding a bus. So, Next time you take care so that you don't fall that is something that your brain has interpreted from your past experience. This is what exactly deep learning is, it imitates human brain works. Deep learning is sub-branch of machine learning. It is able to build all new things based on its previous experiences. Many of us have heard about driverless cars and medical diagnosis. Recently google has developed a new technology where all your cardiovascular events can be predicted by eye scan so, that doctors can get a clear view of what is inside the body of a patient. These all are developed using machine learning. It has a capability to change the human world into a complete robotic world. Anyways, it also has its own disadvantages. This article discusses about those, Scope of machine learning, its Market potential, financial growth and Current applications of machine learning.

Cyber Secure Man-in-the-Middle Attack Intrusion Detection Using Machine Learning Algorithms:

The main objective of this chapter is to enhance security system in network communication by using machine learning algorithm. Cyber security network attack issues and possible machine learning solutions are also elaborated. The basic network communication component and working principle are also addressed. Cyber security and data analytics are two

major pillars in modern technology. Data attackers try to attack network data in the name of man-in-the-middle attack. Machine learning algorithm is providing numerous solutions for this cyber-attack. Application of machine learning algorithm is also discussed in this chapter. The proposed method is to solve man-in-the-middle attack problem by using reinforcement machine learning algorithm. The reinforcement learning is to create virtual agent that should predict cyber-attack based on previous history. This proposed solution is to avoid future cyber middle man attack in network transmission.

Smelling our appetite? The influence of food odors on congruent appetite, food preferences and intake:
We are surrounded by sensory food cues, such as odors, that may trigger (un)conscious decisions and even lead to (over)eating, it is therefore crucial to better understand the effect of food odors on behavioral responses. Food odor exposure has been shown to enhance appetite for food products with similar properties: sensory-specific appetite. This suggests that based on previous encounters with foods, we have learned to detect the nutritional content of foods, through our sense of smell. We investigated the influence of aware exposure of macronutrient-related odors on various measures of eating behavior, in a cross-over intervention study. Thirty two normal-weight healthy and unrestrained Dutch females took part in five test sessions. On each test session, they were exposed to one of five conditions (active smelling of clearly noticeable odors representing food high in carbohydrates, protein, and fat, low in calories, and a no-odor condition for 3-min) and assessed on specific appetite, food preferences and intake. Odor exposure increased congruent appetite after protein-related odor exposure. Similarly, protein-related odor exposure influenced the liking for protein foods and the preference ranking for savory products. However, food intake was not affected by smelling congruent food odors. Together this indicates that exposure to (aware) food odors may mostly influence appetite, but does not impact subsequent food intake. Moreover, appetite seems to be triggered by taste qualities rather than macronutrient information of the food, as signaled by olfactory cues. Future studies should investigate the role of awareness in more detail, to fully understand how odors might be used to steer people towards healthier food choices.

Deep learning in multi-object detection and tracking: state of the art:
Object detection and tracking is one of the most important and challenging branches in computer vision, and have been widely applied in various fields, such as health-care monitoring, autonomous driving, anomaly detection, and so on. With the rapid development of deep learning (DL) networks and GPU's computing power, the performance of object detectors and trackers has been greatly improved. To understand the main development status of object detection and tracking pipeline thoroughly, in this survey, we have critically analyzed the existing DL network-based methods of object detection and tracking and described various benchmark datasets. This includes the recent development in granulated DL models. Primarily, we have provided a comprehensive overview of a variety of both generic object detection and specific object detection models. We have enlisted various comparative results for obtaining the best detector, tracker, and their combination. Moreover, we have listed the traditional and new applications of object detection and tracking showing its developmental trends. Finally, challenging issues, including the relevance of granular computing, in the said domain are elaborated as a future scope of research, together with some concerns. An extensive bibliography is also provided.

3. METHODOLOGY

In previous study with just two pictures (one is from the side and one is from the highest point) of the food and a solitary coin, individuals will actually want to know the calorie of the food that they are eating. In this investigation we discover and characterize the food and make an expectation about the volume of the food. At last, we figure the calorie of the food dependent on the volume that models have anticipated [5]. Nonetheless, we found that assessing the calories straightforwardly was giving us much precise outcomes. 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, a system to record and measure the number of calories consumed in a meal is of a great help. Hence accurate prediction of food calorie is equally important in such cases.
The drawback of this study is manual process of writing down this information, and other reasons.
unfortunately people face difficulties in estimating and measuring the amount of food intake due to the mainly lack of nutritional information.
In the last three years, object classification and detection capabilities have dramatically improved due to advances in deep learning and convolutional networks. Harnessing this technology to accurately classify and detect food objects is significantly essential for a healthy and fit life. But to always refer to the nutritional content in each food item is an extremely tedious task. In this project, we use a deep learning-based fruit image recognition algorithm to improve the accuracy of dietary assessment and analyze each of the network architecture.
The benefits of this system is the food calorie value is calculated the proposed CNN model with the help of food object detection. The volume error estimation is gradually reduced by 20%. That indicates the proposed CNN model is providing higher accuracy level compare to existing model.

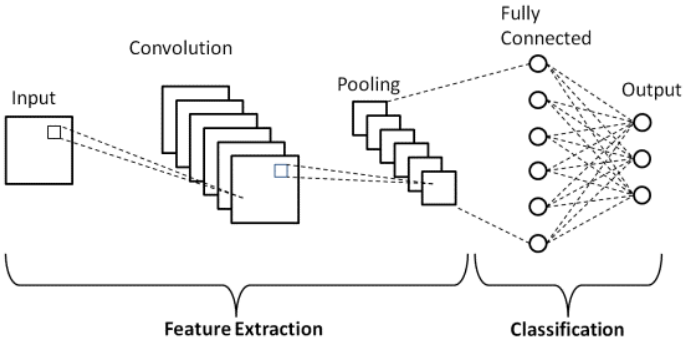

Fig 2 Proposed Architecture

Modules:

To carry out the aforementioned project, we created the modules listed below.

- Data exploration: using this module we will load data into system
- Processing: Using the module we will read data for processing
- Splitting data into train & test: using this module data will be divided into train & test
- Model generation: Model Building- CNN, SVM, KNN, Random Forest, MobileNetv2, Inceptionv3 and DenseNet. Algorithms accuracy calculated
- User signup & login: Using this module will get registration and login
- User input: Using this module will give input for prediction
- Prediction: final predicted displayed

4. IMPLEMENTATION

Algorithms:

CNN: A CNN is a kind of network architecture for deep learning algorithms and is specifically used for image recognition and tasks that involve the processing of pixel data. There are other types of neural networks in deep learning, but for identifying and recognizing objects, CNNs are the network architecture of choice.

SVM: Support Vector Machine(SVM) is a supervised machine learning algorithm used for both classification and regression. Though we say regression problems as well its best suited for classification. The objective of SVM algorithm is to find a hyperplane in an N-dimensional space that distinctly classifies the data points

KNN: The k-nearest neighbors algorithm, also known as KNN or k-NN, is a non-parametric, supervised learning classifier, which uses proximity to make classifications or predictions about the grouping of an individual data point.

Random Forest: A Random Forest Algorithm is a supervised machine learning algorithm that is extremely popular and is used for Classification and Regression problems in Machine Learning. We know that a forest comprises numerous trees, and the more trees more it will be robust.

MobileNetv2: MobileNetV2 is a classification model developed by Google. It provides real-time classification capabilities under computing constraints in devices like smartphones. This implementation leverages transfer learning from ImageNet to your dataset.

Inceptionv3: The Inception V3 is a deep learning model based on Convolutional Neural Networks, which is used for image classification. The inception V3 is a superior version of the basic model Inception V1 which was introduced as GoogLeNet in 2014. As the name suggests it was developed by a team at Google.

DenseNet: DenseNet was developed specifically to improve the declined accuracy caused by the vanishing gradient in high-level neural networks. In simpler terms, due to the longer path between the input layer and the output layer, the information vanishes before reaching its destination.

5. EXPERIMENTAL RESULTS

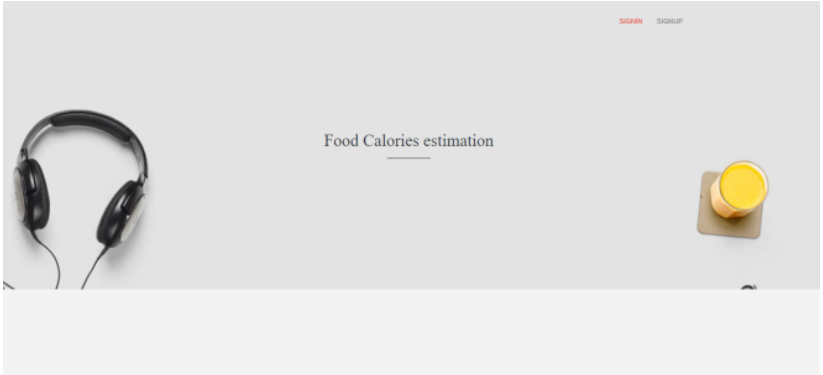

Fig 3 Home Page

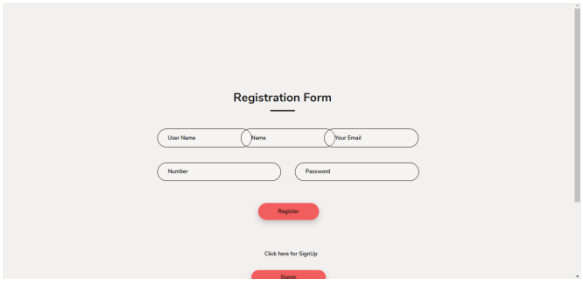

Fig 4 Registration Page

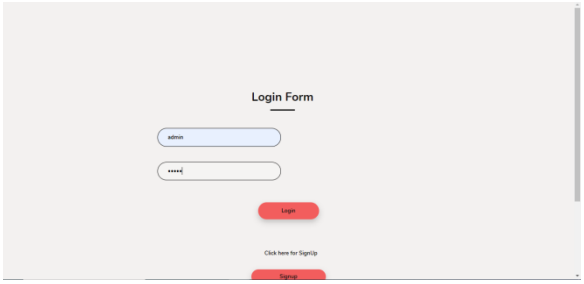

Fig 5 Login Page

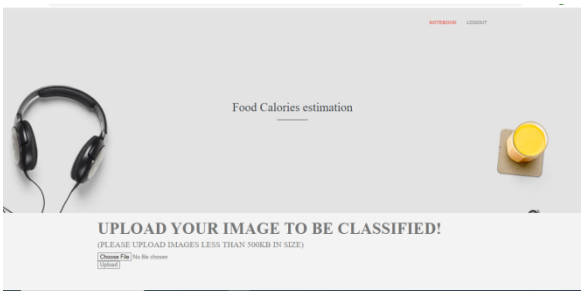

Fig 6 Main page

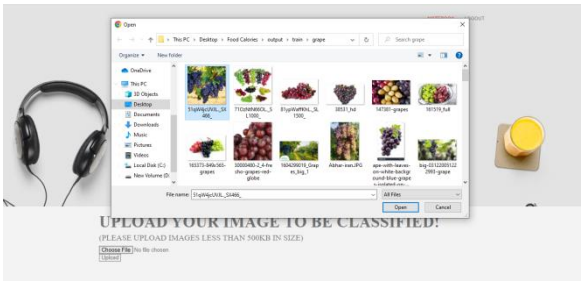

Fig 7 Upload Image

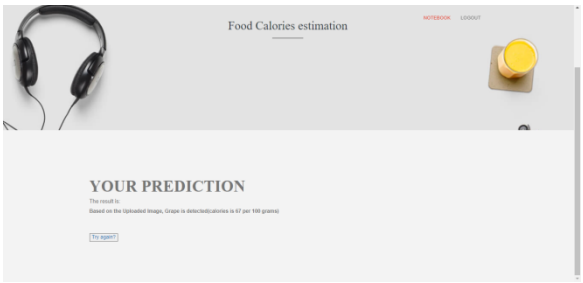

Fig 8 Prediction result

6. CONCLUSION

This proposed method is to create food recognition and detection while using several algorithms. Those algorithms are CNN, Random forest, SVM to get better accuracy and we obtained it. We have used a food image dataset which is publicly available. CNN was used for the image recognition. Also we trained the models using information from dataset. Also accuracy has further improved through optimization, hyper parameter tuning. We have written a function which determines calories based on the fruit detected by taking in consideration the average calorie value of that fruit. We will finish up our work contrasting our outcomes and the benchmark work regarding volume assessment since the outcomes

for calorie assessments are not partaken in the paper. In the event that we utilize 30% for testing Random Forest model is the most ideal model for our concern with the mean mistake of 13.12 though KNN has a mean blunder of 21.06. We can see the correlation between benchmark results and both of our models. As we can see both of our models beats the benchmark work. Since volumes determined with math equations in our standard work, some natural product that are near amazing shape like lemon has higher precision than our models, anyway this is simply restricted to food sources with ellipsoid shapes. At the point when we look at our volume assessment techniques, we can find that irregular woods model is marginally outflanking the KNN model. The motivation behind why the K Nearest Neighbors technique is however great as the Random Forest strategy seems to be that the informational index and the quantity of highlights that we use is little and in this manner the model doesn't experience the ill effects of revile of dimensionality. Since our informational collection is moderately little we can grow our informational index which will diminish the mistake considerably more as a future work. Additionally eliminating the imbalanced conveyance in our informational index will diminish the blunder too.

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