Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7401 - 7407
Received 16 February 2021; Accepted 08 March 2021.

Image Processing Based Classification of Energy Sources in Eatables Using Artificial Intelligence

Manjunathan A[1*], Lakshmi A[2], Ananthi S[3], Ramachandran A[4], Bhuvaneshwari C[5]

[1]Assistant Professor, K.Ramakrishnan College of Technology, Trichy, Tamilnadu, India

[2]Associate Professor, Kalasalingam Academy of Research and Education, Krishnankoil, Tamilnadu, India

[3]Assistant Professor, Sri Sairam Institute of Technology, Chennai, Tamilnadu, India

[4]Assistant Professor, PTR College of Engineering, Madurai, Tamilnadu, India

[5]Assistant Professor, K.Ramakrishnan College of Technology, Trichy, Tamilnadu, India

Abstract

In this paper eatables categorization of calories and micro nutrients, as well as the study has been the idea in depth of studies the intake habits and dietetic assessment are related to the multiplicity of applications. The healthy lifestyle is must for every individual in today's world along with giving utmost importance to what they consume as regulate to attain the similar. Our term paper focuses on creating software which offers the calorie and micro nutrients of the food image which the user is going to consume. The software will obtain images as input from the user in order to achieve this concept. The image will be detected with the aid of Faster Deep Learning algorithm from the food item. Using image processing and segmentation the image of food will be taken by this method, from the food image it calculates the nutrition and calorie content. The term paper gives a concise evaluates of these methods and proposes a capable way to compute and handle day by day food intake of patients and dietitians.

Keywords-Deep Learning Convolution, Calorie and Micronutrients Estimation, Image Processing

1. INTRODUCTION

In an individual's life health is one of the important aspects. If a person to stay in form and keep up a healthy diet, it takes some amount of effort. Unit of energy is obtained. People get energy from the food and drink they consume, for physical activity the energy is used, the calorie is the form of energy. For human proper health consumption of right amount calories is essential. For everyone based on their age, size and activity involved on that day consume various energy levels [1-3]. To survive the human body needs calories. If the consumption of calorie is too low or too high then the health problem will in the long run. The quantity of **c**alorie**s** in food tells us how a large amount of potential energy they contain. Calories is not only important, other than calories are taken from the substance also important. In our body the main essential nutrients are vitamin and minerals in order to perform various activities.

Nowadays it is very difficult for a person to track the calories consumed by them. The intake of calories plays a very vital role in one's healthy lifestyle. Previously, the users used to track their calories intake with the help of charts or timetable [4-6]. Otherwise, they used to maintain a strict diet where the food item which has to be consumed was fixed along with its quantity [7-9]. These methods are a bit tedious and difficult for the user to follow judiciously. We have come up with a project to help the user track the number of calories and identify the type of mineral and vitamin content which it takes in with the help of simple images of the food item [10]. Through the Deep Learning, Convolution Neural

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Network (CNN) the calories and micro nutrients are estimated. Food recognition and detection by intake of image. Food calorie and micro nutrients are measurement [11, 16, 17].

2. METHODOLOGY

An image processing-based approach to measure the calorie substance present in the food image. In the food category, we can take several food images as the input dataset. We are going to collected information set we collected jpg, png are collected set the images values. The process involved in our project is shown in fig.1.

Convolution neural network is a class belongs to deep learning technique. In today's scenario CNN is a leading technique in various computer vision tasks, mainly used in radiology. CNN consists of multiple layers such as Convolution layer, pooling layer, fully connected layer. Back propagation algorithms are designed for adaptive spatial hierarchy of features.

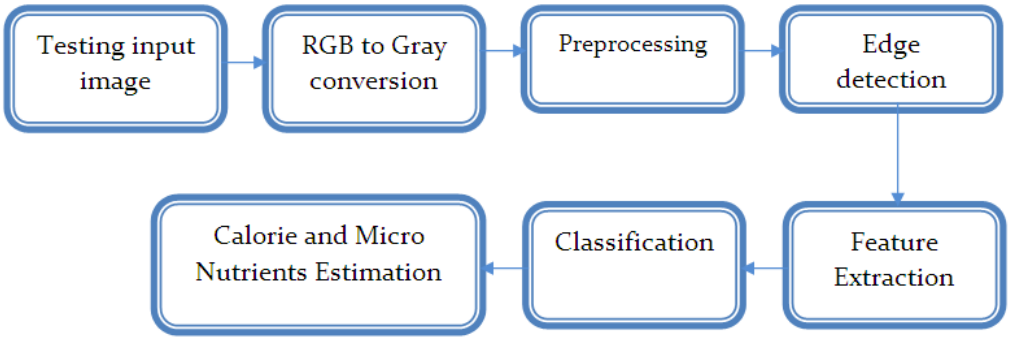

Fig.1 Block Diagram of Calorie and Micro Nutrients Estimation

3. RESULTS AND DISCUSSIONS

3.1 Data processing

Input food images shown in Fig.2 are in RGB format. The input image was converted into different channels i.e, Green band, Blue band and Red band separately. The input RGB image was further converted into grayscale using RGB to gray conversion process**.** Based on RGB image we need choose values after RGB we need to separate the color image from the RGB image. The entire image preprocessed and resized into the size [256,256].

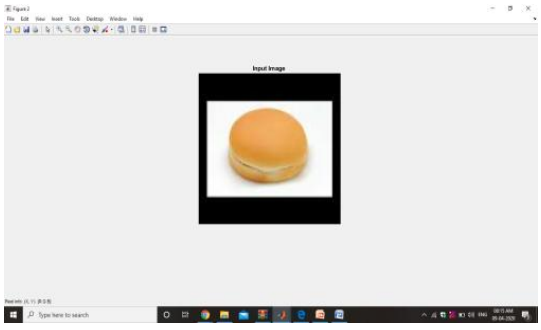

Fig.2 Input Image

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3.2 CNN layers training

Element of the kernel by element-wise is intended at each position of the tensor, in the corresponding Convolution layer. In CNN architecture a convolution layer is a basic component which is the combination of linear and non-linear operations are performs the characteristics extraction, i.e., the establishment function and convolution operation. For feature extraction it needs a particular type of linear operation which is convolution, array of numbers which are small, called as kernel. In the functional the input across it, Tensor which is called as array of numbers. The product between the input tensor and each position of the output tensor the output value is obtained by summed up, which is called as feature map. To form an arbitrary number of feature map, in multiple kernels this procedure is applied repeatedly, the different characteristics of the input tensor and different kernels can be represented as different feature extractors.

The convolution operation is defined by size and number of kernels as two key hectic parameters. Mostly we are using 3×3, and also in some cases we can use 5×5 or 7×7. Arbitrary is used to identify output feature maps depth. The convolution layer weight is depicted in Fig.3. The centre of each kernel is not allowed to overlap with outermost element of the input tensor, which describe the convolution operation, the breath and elevation of the feature map is reduced. Padding is a technique to add zeroes in the input tensor as a rows and column. Outer most elements are a center of S kernel through convolution operation and in plane dimension is kept same.

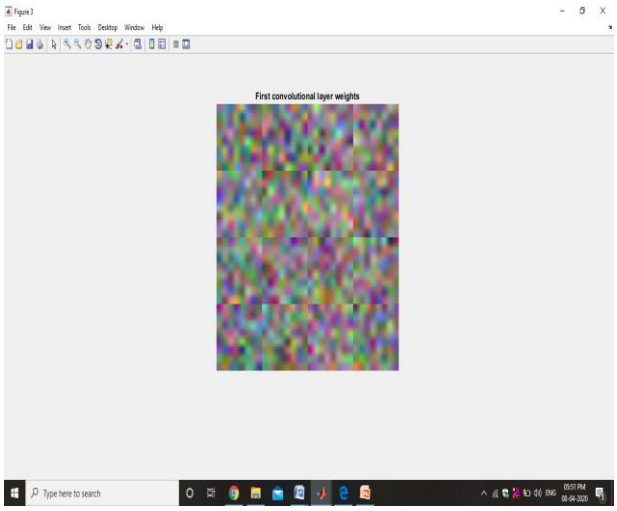

Fig.3 Convolutional Layer weights

3.3 Global Max pooling

Fig.4 shows the max pooling operation is the widely used pooling operation. The input feature maps which are extracts patches, in each patch outputs are the greatest value, and then all other the other values are rejected.

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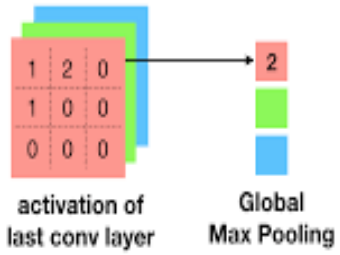

Fig.4 Global Max Pooling

3.4 Global average pooling

Global average pooling is another type of pooling operation. An extreme type of down sampling is performed by a global average pooling method shown in Fig.5, in that height and width of featured map is down sampled into 1x1 array, this is performed by averaging of all elements in each feature the map, where we can retain the depth of the featured maps. The fully connected layer operation is done on beforehand only once. The advantages of global average pooling are: (1) the number of learnable parameters is reducing (2) To accept the variable size of input the CNN is to be in enables condition.

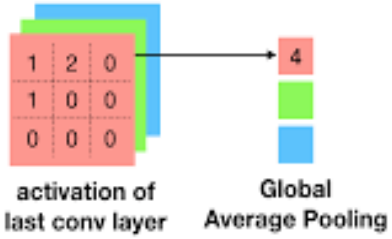

Fig.5 Global Average Pooling

3.5 Fully connected

The output characteristics are mapped by the typically compressed the pooling layer or final convolution layer i.e., changed into a array of numbers (or vector) one-dimensional (1D), the dense layer are said when one to more fully connected layers are associated. Each output by a learnable weight by each input is connected to it.

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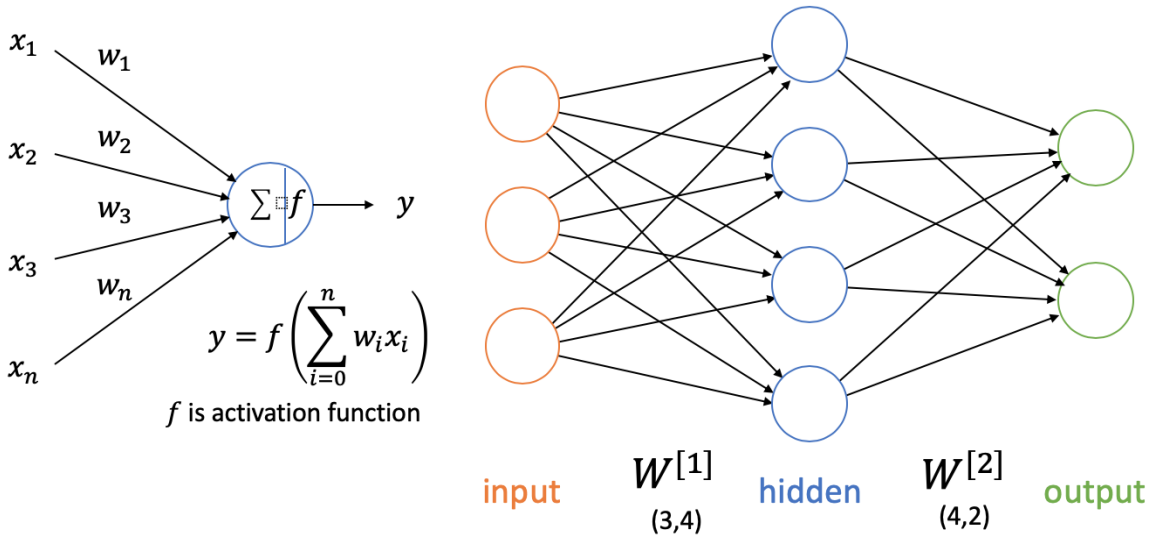

Fig.6 Layer Fully Connected

The features are extracted from convolution layer and then down sampled while creating a pooling layer. At the end of fully connected layer there will be same number of output node and the number of classes. The Non-linear functions, such as ReLU (Rectified Linear Unit), as described above are followed by the each fully connected layer shown in Fig.6.

3.5 Training network

Training network can be defined as the difference between output prediction and ground truth table on a training set. The difference can be reduced by determining the kernels in convolution layer and weight in fully connected layer. Back propagation algorithm is used as a training neural network in Fig.7. The gradient fall optimization algorithm and loss functions are play a vital role. Through forward propagation the particular kernel and its loss function weight can be calculated. Based on the loss value the kernel and its weight can be updated by optimization algorithm called gradient descent and back propagation with others.

```
10x1 Layer array with layers:

    1   ''   Image Input             120x120x3 images with 'zerocenter' normalization
    2   ''   Convolution             16 2x2 convolutions with stride [1  1] and padding [0  0]
    3   ''   ReLU                    ReLU
    4   ''   Max Pooling             2x2 max pooling with stride [2  2] and padding [0  0]
    5   ''   Convolution             16 5x5 convolutions with stride [1  1] and padding [0  0]
    6   ''   ReLU                    ReLU
    7   ''   Max Pooling             2x2 max pooling with stride [2  2] and padding [0  0]
    8   ''   Fully Connected         8 fully connected layer
    9   ''   Softmax                 softmax
   10   ''   Classification Output   crossentropyex
Training on single CPU.
Initializing image normalization.
|=========================================================================================|
|     Epoch     |   Iteration   | Time Elapsed |  Mini-batch  |  Mini-batch  | Base Learning|
|               |               |  (seconds)   |     Loss     |   Accuracy   |     Rate     |
|=========================================================================================|
|           1 |           1 |         1.18 |       2.0704 |       12.50% |     1.00e-04 |
|          20 |          20 |        21.13 |       0.4410 |      100.00% |     1.00e-04 |
|=========================================================================================|
```

Fig.7 Layers Training

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The calorie value and micro nutrients (vitamins and minerals) value of the food which was renowned also displayed in Fig.8. The combination of multiple feature channels provides corresponding information to get better recognition accuracy. The proposed system will certainly improve and facilitate the current calorie and micro nutrients measurement techniques. To closely controlling their daily food intake this system will helps the people.

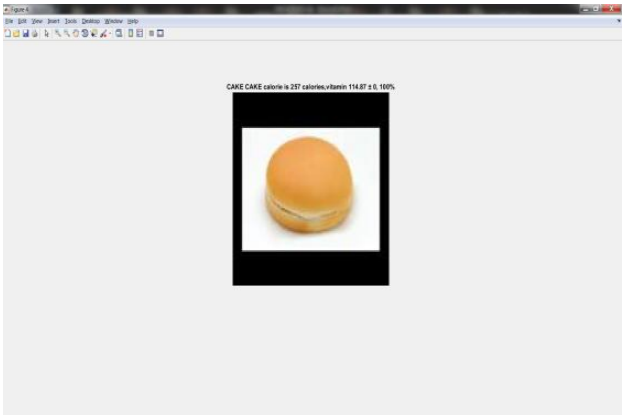

Fig.8 calorie value and Micro Nutrient Values are displayed

Calorie:265 , vitamins(Micro Nutrients):vitamin b1,b3,Minerals(Micro Nutrients):folic acid

4. CONCLUSION

In favor of the food object is carried out for measuring the calories and micro nutrition. For identifying the healthy food items by using image processing the food image is processed and helps to classify it. The input image contrast can be enhanced by histogram equalization technique. Then applying the HOG and LBP to extract the shape and texture-based features from the input image. The shape-based algorithm was also applied to extract the shape-based features. We have proposed a system to identify and recognize the food to help visually impaired people in their daily life. To identifies the calories and micro nutrients in the food image are done by this proposed system. By using Deep learning convolution, the food images are classified according to which classification.

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