Nutrition Analysis Using Image Classification

By Deep Learning & Convolution Neural Network

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1. INTRODUCTION

In the current age, people are more conscious about their food and diet to avoid either upcoming or existing diseases .In order to properly assess dietary intake, accurate estimation of calorie value of food or fruit is of paramount importance .Due to the advances in various technologies used in smart phones, their computational power has also increased .They are capable of processing real-time multi-media information with their computational power. Since the present smart phones can handle the high-quality images too, research on food classification is focused on developing real-time applications which capture images and train the machine learning models instantly.

It helps to take prevention to avoid diseases such as diabetes, blood pressure and so on .In order to properly assess dietary intake, accurate estimation of calorie value of fruit is of paramount importance.

A majority of the people are overeating and not being active enough. Given how busy and stressed people are today, it's effortless to forget to keep track of the food that they eat. This only increases the importance of proper classification of fruit.

1.1 Overview

Deep-learning-based techniques and methods are becoming popular in Nutrition analysis studies, as their performance is superior in image analysis fields, such as object detection, image classification .Here effort has been made to classify the images of fruit for further diet monitoring applications using convolution neural networks (CNNs). Since the CNNs are capable of handling a large amount of data and can estimate the features automatically, they have been utilised for the

task of fruit classification. The standard Fruits dataset has been selected as the working database for this approach. More deep-learning-based methods that are utilized for fruit classification, and prediction and by using the algorithm of a Flask model has been implemented and tested. Among all the deep learning methods and techniques, CNNs perform better for image segmentation, classification, and prediction.

1.2 Purpose

Our aim from the project is to make use of Tensorflow, keras libraries from python to extract the libraries for Deep learning for the Nutrition analysis.

Secondly, to learn how to hyper tune the parameters applications using convolution neural networks (CNNs) algorithm.

And in the end, to predict the fruits image classification and get the calorie value of that fruits using Deep learning algorithms and withdrawing the conclusions.

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2. LITERATURE SURVEY

The task of the fruit detection system images were segmented initially to form the feature vector with size, shape, texture, color (normalized RGB), and other context-based features. With this motivation, a minimized feature vector with the Gabor filter responses (texture), pixel intensity, and color components however, the performance is good for fruit replicas, and a less efficient performance is observed with real images. The size of images and their variations in capturing could be the reason for the performance degradation with this, the better performance is found with less number of classes, although the images of each class are more. Images contain some common visual patterns that are useful in recognizing the category of fruit. This process reduces the complexity raised by the direct image matching techniques.

2.1 Proposed Solution

Deep Learning (convolution neural networks (CNNs)):

Deep Convolutional Neural Networks have been used for fruit recognition recently which uses a combination of baseline feature extraction and neural network fine-tuning. Convolutional Neural Networks along with a Maximum Pooling layer.

Fine tuning is done for Activation Map generation, which includes adding a convolutional layer with stride, and setting a SoftMax layer. Additionally, via threshold, bounding boxes are generated. The present work is to combine above methodologies to gether , that creates a fruit classification system that predicts the class of fruit the image is in, and also gives the calorie value based on the fruit weight or count given by the user. This concept has a high scope in the

health sector, as people want to keep track of what and how much they eat and simplifying the process into this form of implementation increases usage and awareness of health-related factors.

2.2Nutrition plus

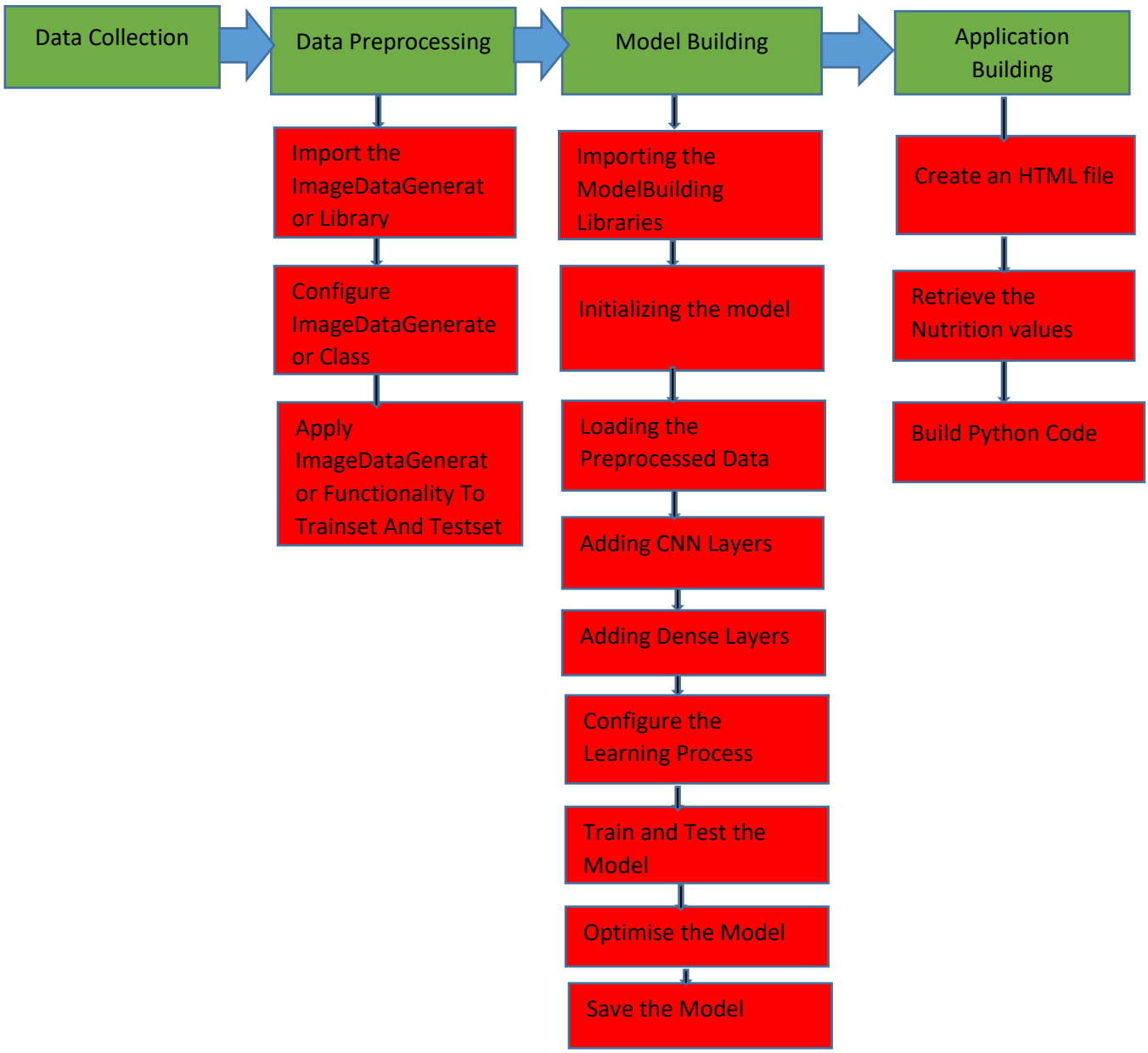
Nutrition Plus is an application where the user can search for the fruit items based on the nutrition values such as carbohydrates, protein, fat, iron, calcium and vitamin. The user can also search by fruit items and find the particular fruit's nutrient composition. It gives the healthcare information about the diseases and provides the diet plans. They didn't use any technologies for the classification of fruit images.

3. THEORETICAL ANALYSIS

It is important to detect species as early as possible. Manual detection of a species cell is a tiresome task and involves human error, and hence computer-aided mechanisms are applied to obtain better results as compared with manual detection systems. In **deep learning**, this is generally done by extracting features through a convolutional neural network (**CNN**) and then classifying using a fully connected network.

We have trained a convolutional neural network and obtained a prediction accuracy of up to 90%. CNN is a modified variety of deep neural net which depends upon the correlation of neighbouring pixels. It uses randomly defined patches for input at the start, and modifies them in the training process. Once training is done, the network uses these modified patches to predict and validate the result in the testing and validation process. Convolutional neural networks have achieved success in the image classification problem, as the defined nature of CNN matches the data point distribution in the image. As a result, many image processing tasks adapt CNN for automatic feature extraction.

3.1 Block Diagram



3.2 Require Tools & Softwares

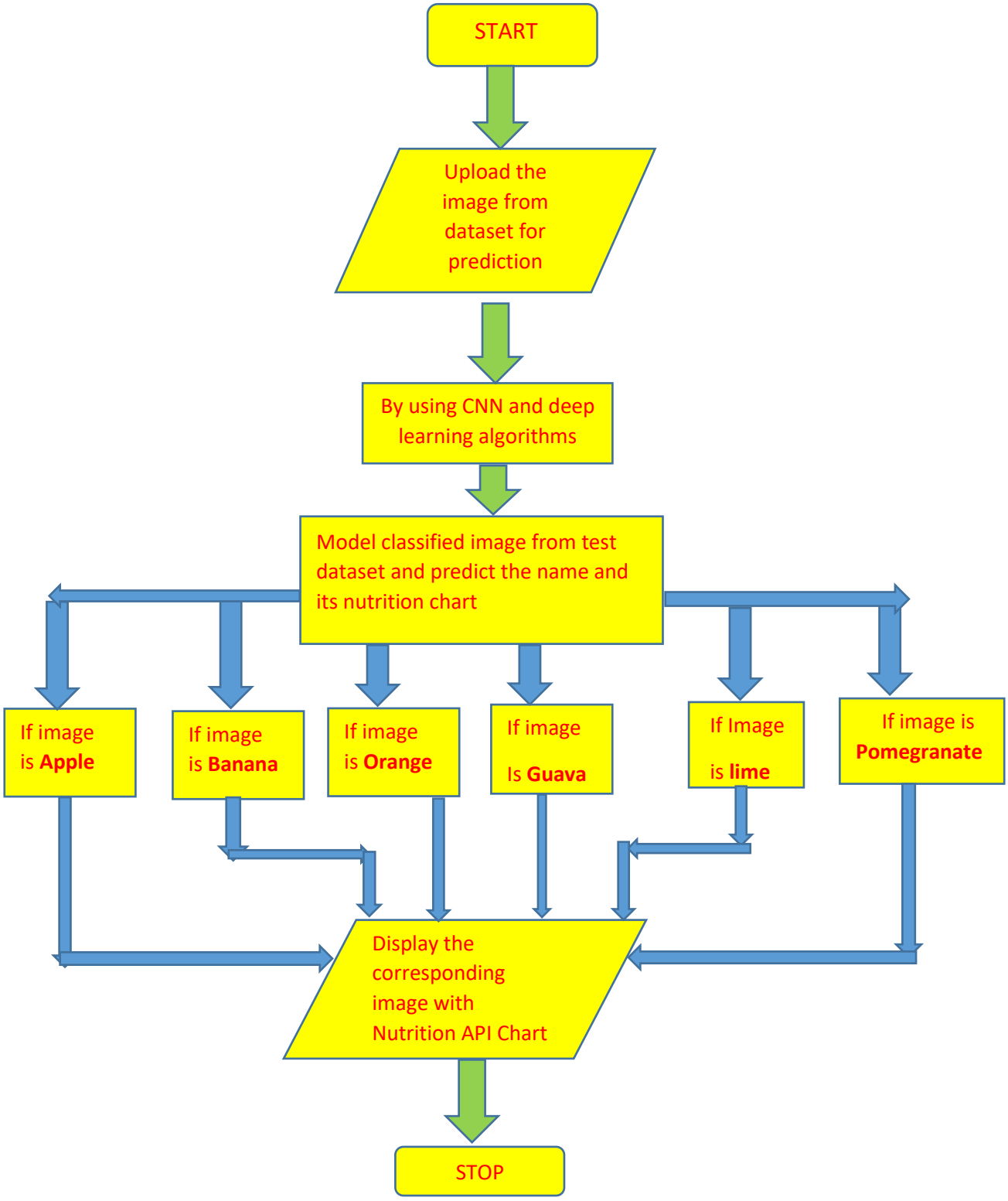
- Jupyter Notebook Environment
- Spyder IDE
- Deep Learning Algorithms
- Python (Sequential, Dense, Conv2D, MaxPool2D, Flatten)
- HTML
- Flask

We developed this Nutrition analysis by using the Python language, which is a highlevel programming language along with Deep Learning Algorithm such as CNN. For coding we used the Jupyter Notebook of Anaconda distributions and Spyder, an integrated scientific programming in python language. Flask is used as a user interface for the prediction. Hypertext Markup Language (**HTML**) is the standard markup language for documents designed to be displayed in a web browser.

4. Experimental Investigation

In our project, we have used the Fruit Dataset. This dataset contains two folders: test set and training set. In test set folder, we have Six categories called Apple, Banana, Guava, Lime, Mango and Pomegranate, where, Apple has the images having apple Fruit , Banana has the images having Banana Fruit, Guava has the images having Guava fruit, Lime has the image having Lime fruit etc. Similarly, in the training set folder. Having 4800 images belonging to 6 classes and 1200 images belonging to 6 classes.

5. Flow Chart


START
Upload the image from dataset for prediction
By using CNN and deep learning algorithms
Model classified image from test dataset and predict the name and its nutrition chart
If image is Apple
If image is Banana
If image is Orange
If image Is Guava
If Image is lime
If image is Pomegranate
Display the corresponding image with Nutrition API Chart
STOP

6. RESULT

In this Model, the CNN algorithm is used to predict its performance. The results show 90% accuracy.

Snapshots:

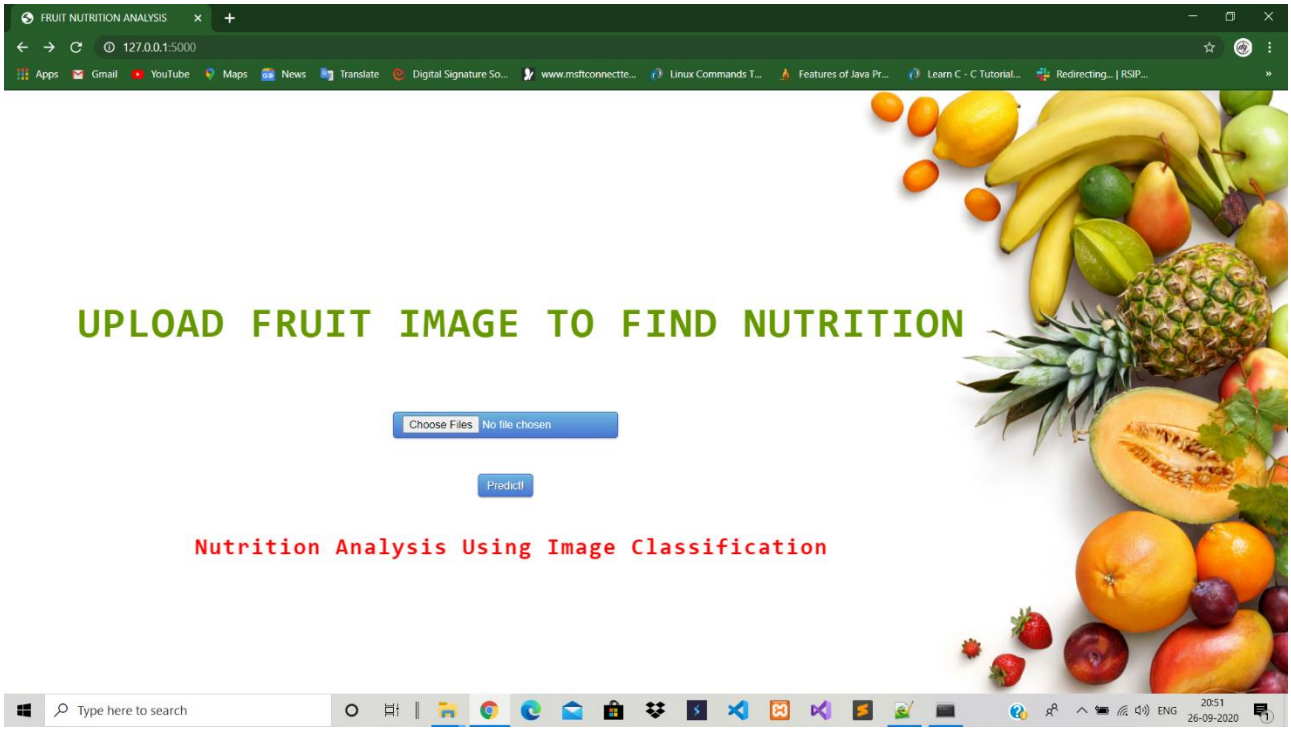


Fig:1-Home Page

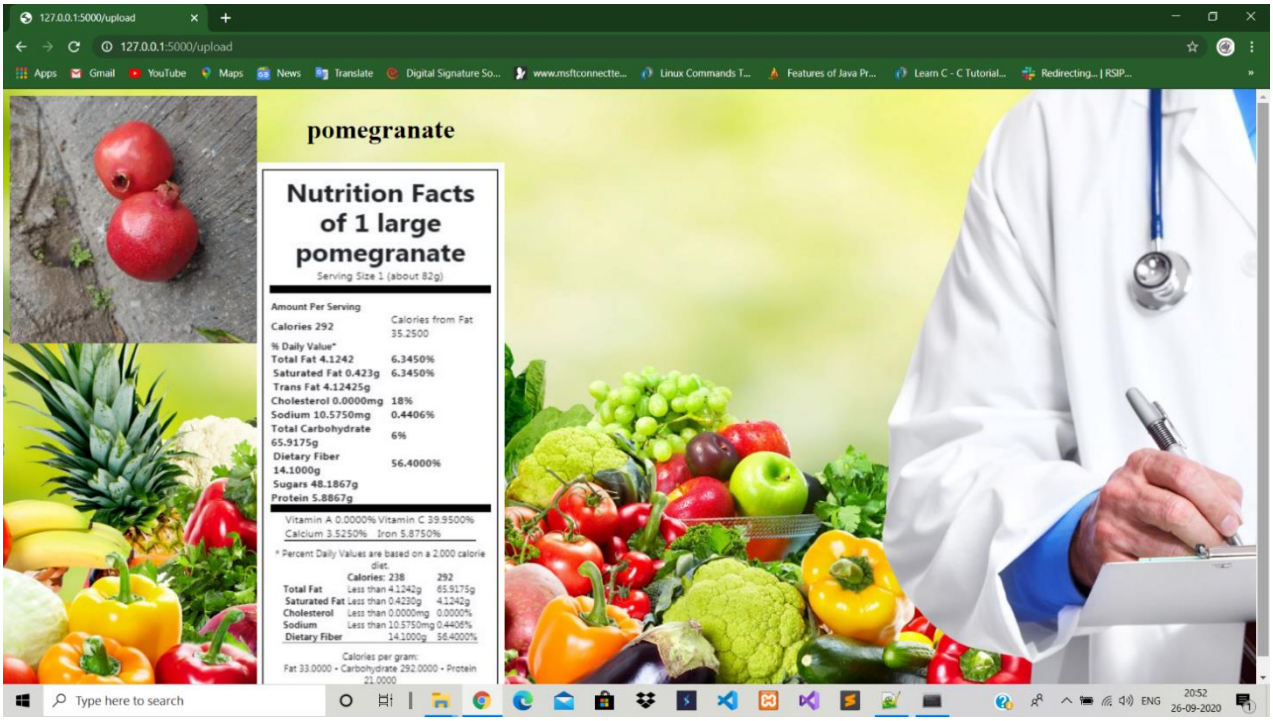


Fig:2- After click on **predict** button to see the output, and it displays name of fruit and its nutrition chart.

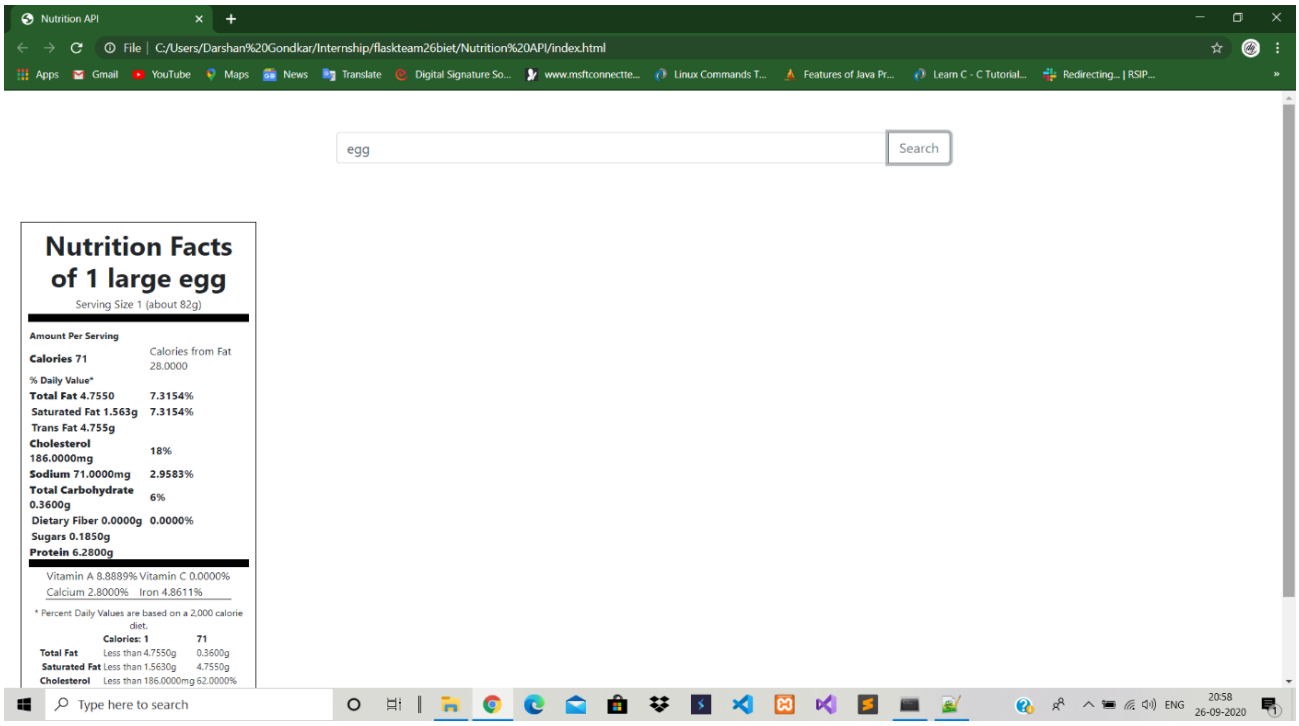


Fig:3- This is the nutrition API interface where you enter name of food, fruit etc.. it shows an Nutrition Chart of respective item.

7. ADVANTAGES AND DISADVANTAGES

Advantages:

1. Nutrition Analysis of fruits is easy to implement and understand.
2. Some processed fruits and homemade apple juice, grape juice are healthy choices that can be harmless.
3. It is applicable in training and test-time
4. Fruits may help to maintain healthy blood pressure.

Disadvantages:

1. It produces correlated images.
2. It easily generates anatomically incorrect examples.

8. APPLICATIONS:

1. "Nutrition Analysis using Image Classification" using Convolutional Neural Networks simplifies the management process of identifying and fruit data by deploying a web interface to the users.
2. Fast processing and immediate results with high security.
3. Minimizing human effort and cost-efficient databases.
4. Navigation through the site is easy.

9. CONCLUSION:

The deep neural network is trained with around 6 varieties of fruits. The intention is to get a neural network that can identify a wider array of objects from the image. The segmentation of image algorithm is a very useful processing of image method, and it is extremely useful for post-processing. An overall accuracy of 90% is achieved. In the future work, we plan to create a mobile application which takes the picture of fruits and labels them accordingly. Another

object is to expand the training and testing sets to include more items. This is time-consuming process since we want to include the items that were not used in most other examples.

10. BIBLIOGRAPHY

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APPENDIX

HTML FILE:

```
<!DOCTYPE html>
<html >
<!--From https://codepen.io/frytyler/pen/EGdtg-->
<head>
  <meta charset="UTF-8">
  <title>FRUIT NUTRITION ANALYSIS</title>
  <link href='https://fonts.googleapis.com/css?family=Pacifico' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo' rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300' rel='stylesheet' type='text/css'>
<link  href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300'  rel='stylesheet'
type='text/css'>
<link rel="stylesheet" href="{{ url_for('static', filename='css/style.css') }}">



<style>
  ::placeholder {
    color:rgb(13, 13, 14);
    opacity:0.8; /* Firefox */
    font-weight: bold;
  }
  </style>
   <script src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.0/jquery.min.js"></script>

  <script>

    $("#file-picker").change(function(){

        var input = document.getElementById('file-picker');

        for (var i=0; i<input.files.length; i++)
        {
            var ext= input.files[i].name.substring(input.files[i].name.lastIndexOf('.')+1).toLowerCase()

            if ((ext == 'jpg') || (ext == 'png'))
            {
                $("#msg").text("Files are supported")
            }
            else
            {
                $("#msg").text("Files are NOT supported")
```

```
            document.getElementById("file-picker").value ="";
          }

       }


   } );

</script>

</head>
<body style="background-image: url('{{ url_for('static', filename='image.jpg') }}');
background-repeat:no-repeat;
background-size:cover;
height:100vh;
display:flex;
">

<form id="upload-form" action="{{ url_for('upload') }}" method="POST" enctype="multipart/form-data">

<div class="login card" style="color:#669900;"><br><br><br><br>
  <pre>
  <center>
  <h1  style="width:fit-content;color:#669900;font-size:50px;position:center;">UPLOAD FRUIT IMAGE TO FIND NUTRITION</h1>

  <input class="btn btn-primary " type="file" name="file" accept="image/*" multiple><br><br>
  <input type="submit" value="Predict!" class="btn btn-primary"><br>
  <marquee behavior="alternate" direction="right" style="color:red; scrollamount="15"><h2>Nutrition Analysis Using Image Classification</h2></marquee>
</center>
  </pre>
</div>
</form>

</body>
</html>
```

“THANK YOU“