VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi-590018

A PROJECT SYNOPSIS

ON

FOOD DETECTION USING TENSORFLOW AND KERAS
(17CSP78)

SUBMITTED BY

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2020-2021

Chapter 1

INTRODUCTION

1.1 Introduction to Food Detection using Tensorflow and Keras

Detection and classification of images is an emerging subject in machine vision. Food detection using TensorFlow and Keras is our project in which, a deep learning model is developed for image recognition and classification. Convolutional Neural Networks (CNN), a technique within the broader Deep Learning field. One main use-case is that of image classification, e.g. determining whether a picture is that of a dog or cat. In the past couple of years, these cutting edge techniques have started to become available to the broader software development community. Industrial strength packages such as Tensorflow have given us the same building blocks that Google uses to write deep learning applications for embedded/mobile devices to scalable clusters in the cloud -- Without having to hand code the GPU matrix operations, partial derivative gradients, and stochastic optimizers that make efficient applications possible. On top of all of this, are user-friendly APIs such as Keras that abstract away some of the lower level details and allow us to focus on rapidly prototyping a deep learning computation graph. Much like we would mix and match Legos to get a desired result.

1.2 Current Status

Currently we are working on getting the in depth understanding of the deep learning model and about TensorFlow and Keras. And we have decided the methods that will be implemented in our project.

1.3 Objective

The main objective of the project is to build a deep learning model which can be used in future for developing a dietary assessment system that records daily food intake through the use of food images taken at a meal. The food images are then analyzed to extract the nutrient content in the food.

1.4 Technical Details

We are making use of GitHub for collaboration and some open source libraries of python:

- **TensorFlow:**

  TensorFlow is a free and open-source software library for machine learning. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks. Tensorflow is a symbolic math library based on dataflow and differentiable programming.

- **Keras:**

  Keras is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library. Up until version 2.3 Keras supported multiple back-ends, including TensorFlow, Microsoft Cognitive Toolkit, R, Theano, and PlaidML.

1.5 Market Potential and Competitive Advantages

The model we are developing can be later used in a Smartphone application and it can be used for building a complete dietary assessment application.

Chapter 2

LITERATURE SURVEY

2.1 Food Classification from Images Using Convolutional Neural Networks by David Joseph Attokaren, Shashidhar Koolaagudi and Y V Shrinivasa Murthy in the year 2017 it was proposed that: The process of identifying food items from an image is quite an interesting field with various applications. Since food monitoring plays a leading role in health-related problems, it is becoming more essential in our day-to-day lives. In this paper, an approach has been presented to classify images of food using convolutional neural networks. Unlike the traditional artificial neural networks, convolutional neural networks have the capability of estimating the score function directly from image pixels. A 2D convolution layer has been utilized which creates a convolution kernel that is convolved with the layer input to produce a tensor of outputs. There are multiple such layers, and the outputs are concatenated at parts to form the final tensor of outputs. We also use the Max-Pooling function for the data, and the features extracted from this function are used to train the network. An accuracy of 86.97% for the classes of the FOOD-101 dataset is recognized using the proposed implementation.

2.2 The Development of Food Image Detection and Recognition Model of Korean Food for Mobile Dietary Management by Seon-Joo Park, Akmaljon Palvanov2, Chang-Ho Lee, Nanoom Jeong, Young-Im Cho and Hae-Jeung Lee in the year 2019 it was proposed that: Here segmented food item regions are used in order to increase the accuracy of their recognition system: a system that recognizes foods based on information sources including the SURF-based Bag of Features and a color histogram extracted from the segmented food item regions. In addition, artificial Intelligence (AI)-based algorithms have been used to detect food items from images obtained from a wearable device. For instance, the Deep Convolutional Neural Network (D-CNN), a state-of-the-art technology, has been reported to have reliable results even on large and diverse image datasets with non-uniform image backgrounds. The D-CNN recognized images and it provided accurate detection of food items.

2.3 Food Image Recognition with Convolutional Neural Networks by Weishan Zhang, Dehai Zhao, Wenjuan Gong, Zhongwei Li, Qinghua Lu1 Su Yang in the year 2015, it was proposed that: a food image recognition system with convolutional neural networks(CNN), which has been applied to image recognition successfully in the literature. A CNN which consists of five layers has been built and two group of controlled trials have been processed on

it. Two datasets are prepared: one is UEC-FOOD100 dataset which is an open 100-class food image dataset including about 15000 images and the other is a fruit dataset that established by ourselves including over 40000 images. We have achieved the best accuracy of 80.8% on the fruit dataset and 60.9% on the multi-food dataset. In addition, we validate the method on two groups of controlled trials and discover the effect of color under various conditions that the color feature is not always helpful for improving the accuracy by comparing the results of two groups of controlled trials. As future work, we will combine image segmentation with image recognition to get a better performance.

2.4 Segmentation of Food Items Using Watershed Algorithm and Predicting the Country of Food Items by A.D.Anantha Padmanabha Reddy, P. Sriramya in the year 2019, it was proposed that Performing segmentation on images is a challenging task and interesting task in the field of image processing. Nowadays segmenting the intake of food for every meal and classifying them has become a challenge for users. It is important to assess the food that is taken by people, patients so that they can take off their diet when they fall under any internal diseases. In addition, there exists a problem of eating various kinds of food, usually different country food, which actually decreases the resistance of the body etc. Hence, there exists the need to segment the food items and classify the food items based on country. In addition, the advancement of this can be deployed to evaluate the nutrition content by importing equations in future. However, many existing systems discuss how to develop an efficient dietary management system and nutrition estimation using various models and algorithms. The food retrieval and classification plays a vital role in every food based dietary management system. In the proposed work, we implement Watershed Algorithm to categorise from a bunch of sample food digital images by performing segmentation analysis and finally displays the unique number of segments whenever there is an overlapping in the food image. In addition, the classification model displays the country with their accuracy through image classification methods. The experimental results show the accuracy of the classifier model in python and keras tools when different numbers of epochs are used for the model.

Chapter 3

METHODOLOGY

3.1 Planning of Work

The overall training process of the CNN is summarized in the following steps:

a) Step 1: Randomly initialize the filters, filter size and weights.

b) Step 2: The training images are split into mini batches and fed into the network through the input layer. CNN performs feed forward propagation extracting essential features from the image. i.e., Convolution→ ReLU → Max-pooling →Fully connected layer.

   i. The CNN then finds the output probabilities for each class in training dataset.

   ii. Since the weights are randomly assigned to the first training, output probabilities are also random. c) Step 3: Calculate the total error at the output layer (summation over all 10 classes) Total Error = $\sum \frac{1}{2}$ (target probability – output probability) ^{2}

d) Step 4: Backpropagation algorithm is used to calculate the gradients of the error with respect to all weights in the network and use gradient descent to update all filter values/weights and parameter values to minimize the output error.

   i. The weights are adjusted in proportion to the total error.

   ii. When the same image is input again, output probabilities become closer to the target vector. This means that the network has learnt to classify this particular image correctly by adjusting its weights/filters such that the output error is reduced.

   iii. Only the values of the filter matrix and connection weights get updated during the training process while the number of filters, filter size and the architecture remains unchanged.

e) Step 5: Repeat steps 2 to 4 for all images in the training set.

f) Step 6: Test the model with an unseen (new) image by giving input to the CNN and evaluate the model in terms of classification accuracy and Mean Square Error (MSE).

Further enhancements can be made by increasing the number of training images, increasing the number of food classes, reducing image size, using color images, increasing the number of training epochs, etc.

3.2 Gantt Chart

ID	Task Name	Duration in days	September				October				November				December			
			Week1	Week2	Week3	Week4	Week1	Week2	Week3	Week4	Week1	Week2	Week3	Week4	Week1	Week2	Week3	Week4
1	Start	0																
2	Topic Discucssion	2																
3	Topic Finalisation	1																
4	Structure of Project	4																
5	Curriculum	24																
6	Discussion on Pahse 2	1																
7	Report	5																
8	Finish	0																

3.3 FACILITIES NEEDED

3.3.1 Hardware Requirements:

- Operating System – Windows 7/10

- Processor - Intel i3

- RAM – 4 GB

- Hard Disk – Minimum 10 GB

- Keyboard, monitor and mouse

3.3.2 Software Requirements:

- Anaconda
- Jupyter NoteBook

Chapter 4

BIBLIOGRAPHY

[1] Food Classification from Images Using Convolutional Neural Networks by David Joseph, Attokaren, Shashidhar Koolaagudi and Y V Shrinivasa Murthy

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[3] Food Image Recognition with Convolutional Neural Networks by Weishan Zhang, Dehai Zhao, Wenjuan Gong, Zhongwei Li, Qinghua Lu1 Su Yang

[4] TensorFlow 2.0 Complete Course - Python Neural Networks for Beginners Tutorial by FreeCodeCamp.com and TechWithTim - YouTube

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