FOOD CLASSIFICATION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT
In this research, image classification is enforced upon vegetarian food by applying various deep learning approaches. In this research, food information is extracted by scanning the images of different cuisines by a smartphone. These three datasets along with the new collection of data are evaluated to achieve the best performance. This research is aimed to develop Convolutional Neural Network (CNN) techniques to vegetarian food image recognition dataset. To identify the vegetarian cuisine from a photograph, collection of real time food images which are captured by a camera, smartphone, food blog website or internet resources. This proposed system of supervised learning technique helps to identify the different attributes of vegetarian cuisines like name of the dish, type of the dish(category)and the state of the dish from it belongs along with the images and to get these features food classification process is used by implemented various models to obtain optimized accuracy for vegetarian dishes.

Keywords: Food Classification, Neural Networks, pre-processing, filters, edge detection.

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Introduction

Food plays an ineluctable role in everybody's life. In this pace of global economy, food cognizance from digital media has inclined and insist upon major operations in large number of contrary territories. Computer Vision technicians has promoted unfamiliar programs for capturing motorized food intake, it is required for classification and recognition of food photographs. Recording various food dishes is very complicated. So, to recognize food images deep learning models have been implemented. However, sometimes food items contain more than one image to be recognised rather than one image for instance, dal Makhani and Chapati. Therefore, this research is proposed to recognize multi- food images at the same time along with a method for detecting the candidate region of that food image captured is proposed too rather than other states only dishes are highlighted. Neural Networks plays a vital role in food image recognition and to record the best accuracy speed in this research. Indian Food Images Datasets and some information is searched from the internet to collect proper data of food dishes. These three datasets along with the new collection of data are evaluated to achieve the best performance.

Literature Review

Research had shown their survey in the field of Food image recognition, where abundant of techniques that remains in existence along with their comparisons were made for food classifications, their outcomes were recorded and scrutinized. This, research provides a cognizance about contracting programs, techniques, models related to Indian local food which is going to be implemented in this food image recognition study. The search terms for this research includes article descriptions, recommendations, evaluation, and implementations for the improvements and for best accuracy results in vegetarian food image recognition. Different models and techniques from the perspective of deep learning.

In 2019, (Afsana Ahsan Jeny, 2019) some researchers have proposed Deep Residual Neural Network for food image recognition by using local food pictures. Total real pictures in the experiment are 600 which has 100 images per class.

Many of the researchers have proposed CNN for classifying the food pictures, though it is the best method to detect the food images with high accuracy speed. Similarly, (Attokaren & Fernandes, 2017), have used Food -101 dataset having 101 classes along with 101000 pictures.

Design and Implementation

Dataset

In this vegetarian food image recognition experiment, we collected plethora of food images as beauty of Punjab is as magical as its cuisines, so computer vision methodology is required to supervise the food intake. Images are camera -

native captured by different cameras from various VISION dataset. The dataset collected is consists of native images obtained from various smartphones/tablets of several different brands. And to get resolution of same images we trained models on some images (Barni, et al., 2019). Especially the image size ranges from 224 x224. VISION dataset images in JPEG format are evaluated. The datasets are train and validate set along with test set to produce an image for different manipulated class, namely, median and resizing. All these images were converted into grayscale.

For this local vegetarian food recognition, more than 4000 pictures are collected. The total real image of our experiment were all the computer vision techniques have been performed are nearby 1000 images. Some of them are shown below.

Fig. 1 Food image data set

Data Pre-processing

Data Pre-processing is the most critical task to be performed in this project, after generating the dataset of multiple pictures. Data have been resized and the picture size is 28x28 pixel. Various operations are performed on each image like fliters, wavelet, monophology, image processing algorithms for recognition and detection along with various CNN models were implemented to get the accurate result.

Filters:

This project contains several techniques for data preprocessing to get the perfect output from multi pictures and for which image pre-processing plays a vital role, image flitters are applied to each image which are utilized to reduce the amount of noise and for enhancing the edges of an image. This experiment project has number of image flitters from the library to apply various filter effects to the picture (Sekhon, aug, 2019). Accuracy of the models can be improved by an image pre-Processing filter. Model can attain more accurate result by comparing the pre-processing images with not pre-processed images to train more complex models.

Following filters are applied to the images in Vegetarian food Image Recognition:

1.Mean Filter:

This filter is used to blur the picture to remove the noise. This involves the pixel values as **n x n** kernel where the intensity of the element in the centre is replaced by the mean. It smoothes the edges of an image by detecting all noise from it. Having colorful food image of vegetarian cuisines, it is mandatory to first convert the RGB to HSV since its dimensions are dependent on each other.

2. Gaussian Filter:

This filter has a parameter sigma and involves a weighted average of the pixels surrounded. Here the kernel serves a discrete approximation of Gaussian distribution. Although, it blurs the edges of the picture similarly as in mean filter. Preserving edges of an image is performed much effectively than mean filter sizing it similarly.

3. Median Filter:

Pixel median is calculated by using this median filter, centre pixel is surrounded as a n x n kernel. Where the median than replaces the pixel intensity of the centre pixel. This filter is better than mean

and Gaussian filter of removing the salt and pepper noise. It does not deal with the speckle noise its best for preserving the edges of the image.

Edge Detection:

Image processing has another technique as Edge Detection which is used to find the boundaries of the object in an image. Detecting all the discontinuities in brightness of an image is the major task of this technique to perform. Mainly most of the information related to shape of the image is enclosed in the edges, so this technique is very beneficial to extract effective data from it. Image noise can be detected effectively and rapidly while distinguishing the grey level variations in the image. Sobel edge detecting algorithm is one of the most common edge detection algorithm of image processing, which has 3*3 convolution kernels.

Fig 2. Edge Detection

Image Processing

Each image in this world consists of imperative instructions which can be appropriate in several approaches. The information of an image can be processed with the help of various techniques known as Image processing to achieve different objectives (Khandelwal, nov2021). The outcomes of this processing can be utilised in the form of image or its feature for making decisions or to analysis the data. Computer vision techniques plays a vital role in this era of technology having paradigms as robotics, automatic cars, object detection and image recognition etc. Image processing is widely used in every field, though it transforms and manipulate plethora of images at the same time to essence the profitable observations from it.

There are various types of images:

- RGB image: These images comprise of three layers of 2D image as Red layer, Green layer, Blue layers known as channels.
- Grayscale image: These images are comprised of black and white layers having a single channel.

Image processing using Neural Networks

Multi -layered networks consisting of various neurons and nodes are known as Neural Networks. These neurons are like human brains which are significant neural network processing unit. Here, the data is taken, is recognized to train the data and the results are predicted.

There are three basic layers of neural network as shown:

- Input layer
- Hidden layer
- Output layer
-

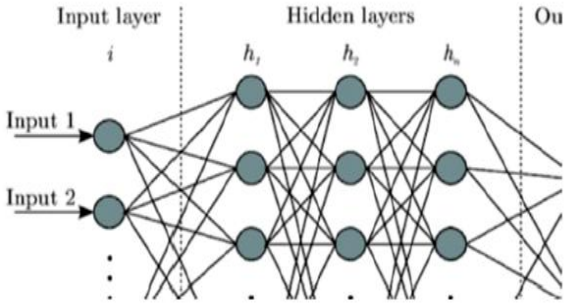

Fig 3. Basic Neural Network structure

Conclusion

In this research deep learning CNN technique is implemented to classify vegetarian food image recognition by categorizing it with various attributes like dish name, type of diet and state. This Vegetarian food image recognition dataset have been categorized in three categories like Veg, Non-Veg and Vegan. Vegetarian dishes are more as compared to Non-Veg and Vegan food images around by 86.21% although Non-Veg food images are 10.34% and Vegan dishes are the least nearby 3.45%. The most crucial and challenging task is the preprocessing the data. Moreover, selecting the best model among was another hustle for this development. Having 4000 images to be processed demands for different combination of models to be

trained every day. Finally, YOLO approach works successfully to predict and classify the Vegetarian Food Image Recognition with its accuracy around by 98% over the test data.

References

1. Rajayogi, J.R., Manjunath, G. and Shobha, G., 2019, December. Indian Food Image Classification with Transfer Learning. In 2019 4th Inter-national Conference on Computational Systems and Information Technology for Sustainable Solution (CSITSS) (Vol. 4, pp. 1-4). IEEE.
2. Reddy, V.H., Kumari, S., Muralidharan, V., Gigoo, K. and Thakare, B.S., 2019, May. Food Recognition and Calorie Measurement using Image Processing and Convolutional Neural Network. In 2019 4th In-ternational Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT) (pp. 109-115). IEEE.
3. Subhi, M.A. and Ali, S.M., 2018, December. A deep convolutional neural network for food detection and recognition. In 2018 IEEE-EMBS conference on biomedical engineering and sciences (IECBES) (pp. 284-287). IEEE.
4. Burkapalli, V.C. and Patil, P.C., TRANSFER LEARNING: INCEPTION-V3 BASED CUSTOM CLASSIFICATION APPROACH FOR FOOD IMAGES.
5. Fruit Recognition and its Calorie Measurement: An Image Processing Approach Manpreetkour Basantsingh Sardar1, Dr. Sayyad D. Ajij2 (2016)
6. Raikwar, H., Jain, H. and Baghel, A., 2018. Calorie Estimation from Fast Food Images Using Support Vector Machine. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), pp.98-102.
7. Subhi, M.A. and Ali, S.M., 2018, December. A deep convolutional neural network for food detection and recognition. In 2018 IEEE-EMBS conference on biomedical engineering and sciences (IECBES) (pp. 284-287). IEEE.
8. Zhang, W., Zhao, D., Gong, W., Li, Z., Lu, Q. and Yang, S., 2015, Au-gust. Food image recognition with convolutional neural networks. In 2015 IEEE 12th Intl Conf on Ubiquitous Intelligence and Computing and 2015 IEEE 12th Intl Conf on Autonomic and Trusted Computing and 2015 IEEE 15th Intl Conf on Scalable Computing and Communications and Its Associated Workshops (UIC-ATC-ScalCom) (pp. 690-693). IEEE.
9. Pathanjali, C., Salis, V.E., Jalaja, G. and Latha, A., 2018. A Comparative Study of Indian Food Image Classification Using K-Nearest-Neighbour and Support-Vector-Machines. J. Eng. Technol, 7, pp.521-525.
10. Christodoulidis, S., Anthimopoulos, M. and Mougiakakou, S., 2015, September. Food recognition for dietary assessment using deep con-volutional neural networks. In International Conference on Image Analysis and Processing (pp. 458-465). Springer, Cham
11. L. Zhou, C. Zhang, F. Liu, Z. Qiu and Y He, "Application of Deep Learning in Food: A Review", Comprehensive Reviews in Food Science and Food Safety, vol. 18, pp. 1793-1811, 2019.
12. G. M. Farinella, M. Moltisanti and S. Battiato, "Classifying food images represented as Bag of Textons", International Conference on Image Processing (ICIP) Paris, pp. 5212-5216, 2014.
13. B. Zhou, A. Lapedriza, J. Xiao, A. Torralba and A. Oliva, "Learning deep features for scene recognition using places database", Proceedings of the 27th International Conference on Neural Information Processing Systems, vol. 1, pp. 487-495, 2014.
14. G. A. Rahmani, "Efficient Combination of Texture and Color Features in a New Spectral Clustering Method for PolSAR Image Segmentation", National Academy Science Letters, vol. 40, pp. 117-120, 2017, [online] Available: https://doi.org/10.1007/s40009-016-0513-6.
15. M. Wang, Y. Wan, Z. Ye and X. Lai, "Remote sensing image classification based on the optimal support vector machine andmodified binary coded ant colony optimization algorithm", Information Sciences, vol. 402, pp. 50-68, 2017, [online] Available: https://doi.org/10.1016/j.ins.2017.03.027.