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DISH RECOGNITION AND NUTRITION USING DEEP LEARNING

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ABSTRACT

Digital media dish comprehension is an intriguing issue with a significant barrier. The dish's complicated ingredient list presents a hurdle. With the advancement of deep learning, a number of useful techniques can help to partially resolve the issue. The task of dish recognition is taken into consideration in this study. It is suggested to use transfer learning and the Efficient Net architecture to create a novel dish recognition system. First, we add a number of significant layers to the EfficientNet-B0. Second, we retrain the model on a new dataset of dish images, referred to as the Food dataset, using transfer learning to make use of the best parameters discovered when pertaining the model on Image Net. The Food dataset includes pictures of Indian food that have been gathered from various sources. The proposed approach may successfully identify a dish, according to experimental findings. Additionally, it performs better than other convolutional neural network models like CNN and Mobile net. A web application is also created using the training data to assist visitors who want to learn about Indian cuisine.

Keywords: Dish/food recognition/identification, transfer learning, deep learning, Efficient Net, convolutional neural networks

I. INTRODUCTION

On the global tourism map, food tourism is a popular trend. Dishes frequently reflect the traits of the locals and each culture. The geography, culture, religion, and climate of any country are just a few examples of the many distinct aspects that influence a culinary culture. For instance, olive oil and herbs are frequently used in Mediterranean cooking. Steak and cutlets are staples of Western European cuisine. Additionally, cheese and wine are well-known ingredients in sauces. Rice is the staple cuisine in Eastern Asia and Indochina, while fish, shrimp, and soybean are typically used to make sauces.

Many tourists are willing to pay to sample distinctive dishes from the surrounding areas. Therefore, there are lots of opportunities for economic growth with culinary tourism.

In order to enhance the culinary tourism experience, we concentrate on creating a method to identify food. Convolutional neural networks and transfer learning methods are used in the system's development, which is based on deep learning.

Food tourism is a hot trend in the tourism map of the world. Dishes often contain the characteristics of each culture and local people.

The characteristics of a culinary culture depend on many different factors such as geography, culture, religion, and climate of each country. For example, in Mediterranean cuisine, the most prevalent ingredients are olive oil and herbs. For Western European cuisine, steak and cutlets are the common dishes. In addition, sauces from cheese, grape wine are famous ingredients. For Eastern Asia and Indochina, rice is a primary food, and sauces are usually made from fish, shrimp, and soybean. A large number of visitors are ready to pay for tasting characterized dishes of local regions Therefore, culinary tourism brings significant chances for economic development. Intending to improve the experience of culinary tourism, we focus on developing a system to recognize dishes. The system is developed based on deep learning with convolutional neural networks and transfer learning technique

The system focuses on Indian culture with 9 famous traditional dish classifiers: Bun, Com-Tam, Pho, Goi-Cuon, Banh-Xeon, Banh-Trang, Banh-Tet, Banh-Mi, Banh-Chung. The system can be easily extended for a larger number of classifiers, as well as for dishes of other countries. The significant contributions in this paper focus on the following manners. First, a novel convolutional neural network is developed based on Efficient Net and the transfer learning technique to recognize dishes. Second, providing a dataset of (Indian) dishes and trained data with learned features to let researchers/scientists reuse and extend it with a larger number of dish classifiers. Finally, a mobile application is developed based on the trained data to solve the task of dish recognition, and it also provided some useful information about dishes. The rest of the paper is organized as follows. Section 2 provided a systematic review of related methods. Section 3 presents materials and the proposed method to recognize dishes in 9 dish classifiers. Section 4 presents experimental results and the development of a mobile application to improve the experience of tourism visitors. Traditional image analysis approaches have achieved low classification accuracy in the past, whereas deep learning approaches enabled the identification of food types and their ingredients. The contents of food dishes are typically deformable objects, usually including complex semantics, which makes the task of defining their structure very difficult. Deep learning methods have already shown very promising results in such challenges, so this chapter focuses on the presentation of some popular approaches and techniques applied in image-based food recognition. The three main lines of solutions, namely the design from scratch, the transfer learning and the platform-based approaches, are outlined, particularly for the task at hand, and are tested and compared to reveal the inherent strengths and weaknesses. The chapter is complemented with basic background material, a section devoted to the relevant datasets that are crucial in light of the empirical approaches adopted, and some concluding remarks that underline the future directions

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II. LITERATURE REVIEW

[1]. Zhou, L., Zhang, C., Liu, F., Qiu, Z., & He, Y. Deep learning has been proved to be an advanced technology for big data analysis with a large number of successful cases in image processing, speech recognition, object detection, and so on. Recently, it has also been introduced in food science and engineering. To our knowledge, this review is the first in the food domain. In this paper, we provided a brief introduction of deep learning and detailedly described the structure of some popular architectures of deep neural networks and the approaches for training a model. We surveyed dozens of articles that used deep learning as the data analysis tool to solve the problems and challenges in food domain, including food recognition, calories estimation, quality detection of fruits, vegetables, meat and aquatic products, food supply chain, and food contamination. The specific problems, the datasets, the preprocessing methods, the networks and frameworks used, the performance achieved, and the comparison with other popular solutions of each research were investigated. We also analyzed the potential of deep learning to be used as an advanced data mining tool in food sensory and consume researches. The result of our survey indicates that deep learning outperforms other methods such as manual feature extractors, conventional machine learning algorithms, and deep learning as a promising tool in food quality and safety inspection. The encouraging results in classification and regression problems achieved by deep learning will attract more research efforts to apply deep learning into the field of food in the future.

Summary: we investigated a large number of latest articles related to the APP of deep learning in food, described in detail the proposed structure, training methods, and the final evaluation result of DNNs used to process food image, spectrum, text, and other information in each surveyed article. In the aspect of performance, we compared the deep learning with other existing popular methods, and found that the deep learning method achieves better results than other methods in these reviewed studies. We concluded the advantages and disadvantages of deep learning methods and made a detailed discussion of the challenges and future perspective of deep learning in food domain. To authors' knowledge, it is the first survey on the APPs of deep learning in the food domain. The purpose of this review is to encourage researchers and workers in this field to perform more experiments on food with deep learning methods, to present precise solutions for classification or regression problems and put them into practice for the benefits of food quality and safety inspection for human dietary health. At last, we recommend that the combination of deep learning and multisource data fusion including RGB images, spectra, smell, taste, and so on, would be considered to make a more comprehensive assessment of food, the development of full-automatic information acquisition equipment/systems with stable signal output for food and global food data sharing platforms should be studied in the future, since it is still very hard to obtain big data related to food due to the usage of semiautomatic or even manual information acquisition tools and incomplete data management and sharing platforms, the potential of deep learning technology in data mining can be evaluated in food related areas rarely explored such as food sensory and consume, food supply chain, and so on, and successful cases of deep learning such as in food (such as food image recognition, intelligent recipe recommendation APP, and fruit quality evaluation system) can be further transformed into practical products.

[2]. Farinella, G. M., Moltisanti, M., & Battiato, S. The classification of food images is an interesting and challenging problem since the high variability of the image content which makes the task difficult for current state-ofthe-art classification methods. The image representation to be employed in the classification engine plays an important role. We believe that texture features have been not properly considered in this application domain. This paper points out, through a set of experiments, that textures are fundamental to properly recognize different food items. For this purpose the bag of visual words model (BoW) is employed. Images are processed with a bank of rotation and scale invariant filters and then a small codebook of Textons is built for each food class. The learned class-based Textons are hence collected in a single visual dictionary. The food images are represented as visual words distributions (Bag of Textons) and a Support Vector Machine is used for the classification stage. The experiments demonstrate that the image representation based on Bag of Textons is more accurate than existing (and more complex) approaches in classifying the 61 classes of the Pittsburgh Fast-Food Image Dataset. Automatic food classification is an emerging research topic, not only to recognize food images for the web and social networks application domain

Summary: Evaluates the class-based Bag of Textons representation in the context of food classification. The MRS4 filter banks are used to build class-based Textons vocabularies. The image representation is coupled with a Support Vector Machine for classification purpose. This representation is compared with respect to other state-of-the-art methods on the public available Pittsburgh Fast-Food Image Dataset (PFID). The class-based Bag of Textons representation obtained better results with respect to all the other methods. Future works could be devoted to the exploitation of Textons (and/or other types of texture-like feature, such as CLBP) in joint with other kind of features as well as in encoding spatial information between local Textons (e.g., through correlograms of textons) to better discriminate food items. Moreover, could be important to test the Textons based representation (both Global and Class-Based) on bigger food image datasets for both classification and retrieval purposes.

[3]. Wang, M., Wan, Y., Ye, Z., & Lai, X. Support vector machine (SVM) is one of the most successful classifiers for remote sensing image classification. However, the performance of SVM is mainly dependent on its parameters; in addition, for remote sensing images with high-dimensional features, feature redundancy will have a major influence on the classification efficiency and accuracy. Feature selection and parameter optimization are two important factors for improving the performance of SVM and are traditionally solved separately. In fact, these two issues are affected by each other, so to obtain the better classification performance, selection of the optimal feature subset and tuning of SVM parameters should be considered simultaneously, as they both belong to the combinatorial optimization problem and could be handled with evolutionary algorithms and swarm intelligence algorithms. In this paper, a remote sensing image classification technique based on the optimal SVM is proposed, in which the parameters of SVM and feature selection are handled integrally by a modified coded ant colony optimization algorithm combined with genetic algorithm. The results are compared with other evolutionary algorithms and swarm intelligence algorithms, such as genetic algorithm (GA), binary-coded particle swarm optimization (BPSO) algorithm, binary-coded ant colony optimization (BACO) algorithm, binary coded differential evolution (BDE) algorithm, and binary-coded cuckoo search (BCS) algorithm. It is demonstrated that the proposed method is robust, adaptive and exhibits the better performance than the other methods involved in the paper in terms of fitness values, so could be suitable for some practical applications.

III. SYSTEM ANALYSIS & FEASIBILITY STUDY

Existing Method:

This model emphasizes an existing method that which is designed using the some of the algorithms of Machine learning. Here the

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process is performed using the SVM and ANN which is one of the transfer learning methods, but this could not get the high accuracy.

Disadvantages:

- Less feature compatibility
- Low accuracy

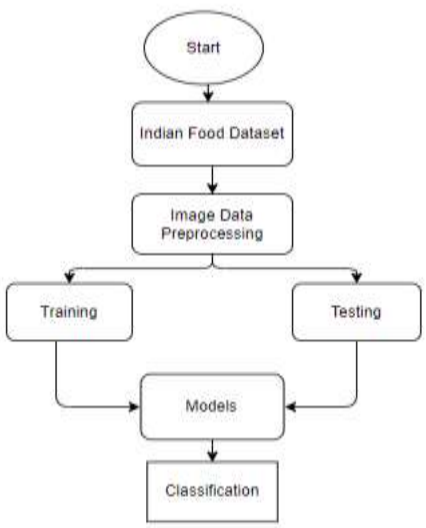
Proposed System:

In purposed method we are performing the classification of either the Dish identification using Mobile Net and Efficient Net of deep learning along with the Transfer learning methods. As image analysis based approaches for detecting and Nutrition. Hence, proper classification is important for the proper nutrition that which will be possible by using our proposed method. Block diagram of proposed method is shown below.

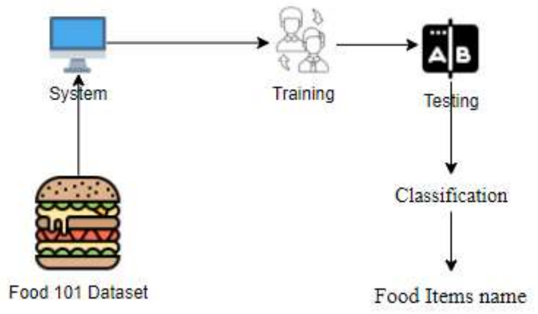
Advantages

- Accurate classification
- Less complexity
- High performance
- Easy Identification

IV. BLOCK DIAGRAM



ARCHITECTURE



V. MODULES:

SYSTEM

USER

1. System:

1.1 Create Dataset:

The dataset containing images of the Dish classification images with the Classification i.e., Dish, nutrition and ingredients prediction are to be classified is split into training and testing dataset with the test size of 30-20%.

1.2 Pre-processing:

Resizing and reshaping the images into appropriate format to train our model.

1.3 Training:

Use the pre-processed training dataset is used to train our model using CNN Deep learning along with Mobile Net and Efficient Net transfer learning methods.

1.4 Classification:

The results of our model are display of Dish classification images are either with different labels and Details

2. User:

2.1 Upload Image

The user has to upload an image which needs to be classified.

2.2 View Results

The classified image results are viewed by user.

VI. OUTPUT SCREEN SHOTS WITH DESCRIPTION.

Home: In our project, we are classifying the presence of Dish Recognition, with the help of deep learning and transfers learning.

Home Page:

About Page:

Gallery Page:

Image Upload Page:

Model Selection:

Predict Page:

Predict Page:

Predict Page:

VII.CONCLUSION:

Using deep learning and transfer learning, we were able to correctly categorise the Dish classification photographs in this research, depending on whether they were impacted by the nutrition and ingredients based on Dish images. Here, we've taken into account a dataset of dish picture training data that includes a variety of nutrition and ingredients, and that was trained using CNN, Mobile Net, and a few EfficientNet transfer learning techniques. After the training, we put our skills to the test by uploading an image and classifying it.

References

[1] Raza Yunus, Omar Arif, Hammad Afzal, Muhammad Faisal Amjad, Haider Abbas, Hira Noor Bokhari, Syeda Tazeen Haider, Nauman Zafar, Raheel Nawaz "A Framework to Estimate the Nutritional Value of Food in Real Time Using Deep Learning Techniques" pp. 2643-2652 October 17, 2018

[2] Manika Puri, Zhiwei Zhu, Qian Yu, Ajay Divakaran, Harpreet Sawhney, "Recognition and Volume Estimation of Food Intake using a Mobile Device", IEEE 2009.

[3] Xu Liu, Meiying Zhong, Bin Li, Ye Su, Jinglu Tan, Seyed Mohammad Taghi Gharibzahedi, Ya Guo, and Juan Liu "Identifying worldwide interests in organic foods by Google search engine data," 2017.

[4] Raciel Yera Toledo, Ahmad A. Alzahrani, Luis Martinez, "A Food Recommender System Considering Nutritional Information and User Preferences," 2019.

[5] Zhenfeng Lei, Shauangyuan Yang, Han Liu, Saba Aslami, Jinyu Liu Halefom Tekle,Emmanuel Bugingo, and Defu Zhang "Mining of Nutritional Ingredients in Food for Disease Analysis," 2018

[6] Sirichai Turmchokkasam and Kosin Chamnogthai, "The design and implementation of an ingredient based food calorie estimation system using nutrition knowledge and fusion of brightness and heat information," 2018.

[7] Kawano Y., and Yanai, K "Real-time mobile food recognition system" In: Proc. of IEEE CVPR International Workshop on Mobile Vision, IWMV, 2013.

[8] Matsuda et al., Matsuda Y, Hoashi H, Yanai K, "Recognition of multiplefood images by detecting candidate regions," in: Proc. of IEEE International Conference on Multimedia and Expo., 2012.

[9] Mariappan et al., Mariappan A, Bosch M, Zhu F, Boushey C, Kerr D, Ebert D, Delp E, "Personal dietary assessment using mobile devices," in: Proc. of the IS&T/SPIE Conference on Computational Imaging VII, vol. 7246, pp. 72, 2009.