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PRODUCT IMAGE RECOMMENDATION AND CLASSIFICATION

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ABSTRACT

The plethora of e-commerce products within last few years has become a serious challenge for shoppers when searching relevant product information. This has consequently led to the emergence of a recommendation assistant technology that has the capability to discover relevant shopping product. Recommender systems (RS) are designed to eliminate the information overload problem in today's e-commerce platforms and other data-centric online servicesthis paper develops an image-based RS using deep learning techniques To perform the research, we use convolutional neural network (CNN) models to extract the features of the products' images. Then, the system uses the features to calculate the similarity between images. The selected CNN models are Inception V3, This method also provides more accurate product recommendations on e-commerce platforms than traditional methods.

Keyword*: E-commerce products, Recommender systems, convolutional neural network (CNN)*

1. INTRODUCTION

Recommender systems (RS) are designed to eliminate the information overload problem in today's e-commerce platforms and other data-centric online services. They help users explore and exploit the system's information environment utilizing implicit and explicit data from internal e-commerce systems and user interactions. Today's product catalogues include pictures to provide visual detail at a glance. This approach can effectively convert potential buyers into customers. Since most e-commerce stores use product images to promote, arouse users' visual desires and encourage them to buy products, this paper develops an image-based RS using deep learning techniques. To perform the research, we use convolutional neural network (CNN) models to extract the features of the products' images. Then, the system uses the features to calculate the similarity between images. The selected CNN models are Inception V3. We also analysed four versions of the Experimental dataset Results of the experiment showed a significant increase in accuracy compared with traditional approaches. Also, we express many related open issues including use of multiple images per item, different similarity metrics, other CNN models, and the hybridization of image-based and different RS techniques for future studies. This method also provides more accurate product recommendations on e-commerce platforms than traditional methods

1. Propose an inception product image feature extraction algorithm that delivers an effective product image representation for large product classes.

2. The results of this method can serve as an image segmentation approach in e-commerce applications such as recommended system to resolve inherent limited content analysis problem

3. The final classification model obtained from this work can be easily integrated with any other decision supporting applications in e-commerce domain to improve its quality.

2. LITERATURE REVIEW

Image feature extraction and classification methods are two important tasks in the recognition process convolutional neural network (CNN)and Deep neural network(DNN)that have been applied to e-commerce product and supporting tasks with some degree of success. Specifically, CNN have a set of input variables in the user profile and corresponding preferences of the user. Large number of product data often caused overfitting when an CNN is integrated with any e-commerce applications such as recommendation systems. To overcome this overfitting problem, cross-validation is considered to be one of the most effective methods to ensure overfitting does not occur Here, available data is usually partitioned into three sets which are training, testing and validation. The training set is used to adjust the connection weights, the testing set is used to check the performance of the network at various stages of learning and training is stopped once the error in the testing set increases. The validation set is used to evaluate the performance of the model once training has been successfully accomplished .This partitioning-based cross validation can be accomplished in recommendation systems using time, item rating (which can come in the form of user preferences expressed in numeral or product-item feature), categorization and user-stratification. e-commerce products was developed using a combination of convolutional neural nets (Deep Learning) To further improve image based product classification accuracy, many researchers have investigated the technique of combining the predictions of multiple classifiers which is known as deep learning. Ensemble learning has been reported to be effective in many application areas such as facial expression recognition, Bioinformatics, image processing big text corpora and object detection Experimental results have shown that the use of ensemble learning often produces better performance than any individual classifier in isolation. An explicit example of this in recommendation system is the work in which deep learning methods were used for music recommendation. In addition inception v3 to combine user preferences to produce movie recommendations in a collaborative filters setting.

3. MATERIALS AND METHODS

The proposed image –based product classification architecture is as shown in fig.1, which is an extension of the architecture presented by Jayapriya V. the extension of the architecture was motivated by the need to reduce complexity through the feature to improve classification.

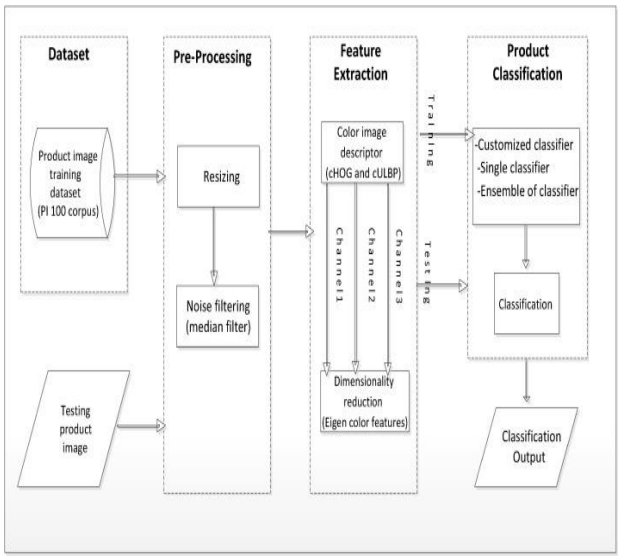


Fig. 1. Enhanced image based product classification

3.1. Dataset

The first block in the proposed architecture as shown in Fig. 1 involves the acquisition of experimental datasetsuch as the PI100 corpus . The corpus contains ten thousand low resolution colour images of e-commerce products that are grouped into 100 classes. Each image contains the dominant object in relatively stable forms, which is exactly the way product images normally appear on e-commerce websites such as Amazon.com, Jumia.com, eBay, Web.com . Fig. 2 shows 80 selected sample images from ten classes in the PI100 dataset. These classes are baby shoe, jacket, nutrition, cowboy-hat, earring, flower, can, helmet, hiking backpack and briefcase. The items in each class are similar in shape and appearance, but with little variation in the colour content. However, there is a wide difference between product images across the different classes in term of their shapes and sizes of

their semantic features Considering the need to avoid the curse of dimensionality that may occur in the event of the sparse number of instances per image class, we collected 20 image samples per class for each of the 100 classes in the corpus that culminates in 2000 colour images of e-commerce products.

Fig. 2. Selected product image from PI100 dataset

3.2. Pre-processing

Pre-processing operations that were applied on the selected product images are image resizing and filtering. We have used to gradient (medium filter) for contrast enhancement. The median filter is a non-linear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise (but see the discussion below), also having applications in signal processing. In this work, pre-processing operations that were applied on the selected product images are image resizing and noise filtering. To achieve image resizing, all images were standardized in size of 300×300 pixels. To get a smooth output from the product images, the resized images must go through the filtering process. This filtering stage is highly imperative because many image based problems are heavily influenced by noise. An image pixel is considered noisy if its value is much different from other values in its neighborhood . Failure to take specific measure against noisy data may lead to poor classification performance . We implemented noise filtering for the proposed architecture in this study by applying an existing method called median filter on each of the three channels of the colour images separately .

3.3 Feature extraction

The feature extraction components of the proposed architecture .It is well establishing that accuracy of product image classification largely deponds on the extracted features. In digital image processing, colour, shape and texture are important primitive features for product description. Existing feature extraction algorithms in the literature for this primitive featureTo further improve on the spatial alignment of the image, a 3D colour model is integrated. The RGB colour model was selected based on its superior performance over other colour models as reported in . Dimensionally reduced feature vectors have been reported in the literature to produce an improved performance in classifiers . In particular, because of the low dimensions of some genomic images, in their effort to reduce dimensions of feature applied minimum dimensions of 2×2 block of cells and 9 bins to generate a compact HOG genomic feature vector of 36 elements from a greyscale image. Hence, we developed a simple dimensionality reduction algorithm based .This becomes necessary because accuracy results obtain the product.

3.4. Product classification

A convolution tool that separates and identifies the various features of the image for analysis in a process called as Feature Extraction. A fully connected layer that utilizes the output from the convolution process and predicts the class of the image based on the features extracted in previous stages and we calculate the distance has used to manhatten distance.

The Manhattan distance as the sum of absolute differences

Manhattan Distance

$[\{a, b, c\}, \{x, y, z\}]$

$\rightarrow$Abs $[a - x]$ + Abs $[b - y]$ + Abs $[c - z]$

3.5. Ensembles classifiers

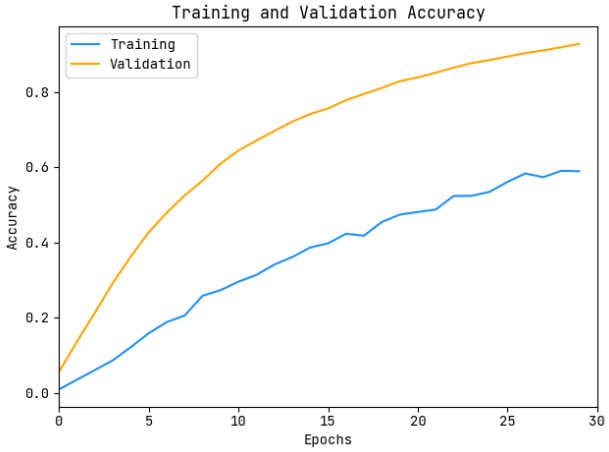
Many researchers have investigated the technique of combining the predictions of multiple classifiers to achieve better accuracy, a concept that is generally referred to as ensemble learning Two popular methods for creating accurate ensemble are bagging and Boosting In the author stated categorically that bagging is one of the most efficient methods that can effectively be applied in problem learning. On this background, we applied Bagging ensemble in this study.

4. EXPERIMENTAL SETUP

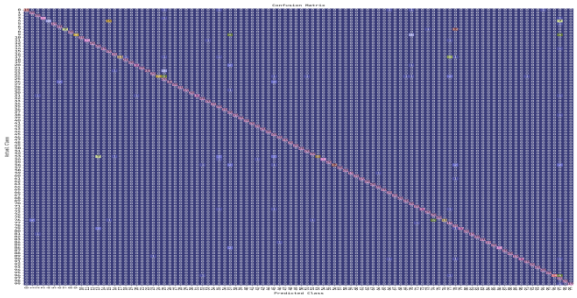
In this study, different experiments were performed to established the appropriate modules and classifiers for the proposed architecture in fig. 1. All the experiments were performed in inception v3 environment it has used to experimental datasets and pre-processing operations that were performed on them were exhaustively described respectively. The model of highest accuracy was adopted as the base classifier and experiments are reported in the succeeding section.

5. DISSCUSION AND RESULTS

The outputs of the pre-processing operation using the median filterin the second block of the architecture are shown in Specifically contain the raw images of one item each in the Can and Baby-Shoe classes as well as the histograms of their red, green and blue channels respectively. The images, as well as the histogram of each of the colour channels after the median filter was applied are also shown respectively. A qualitative comparison of the channel histograms of the raw images and those of the filtered images has shown that the pixel distributions of the filtered image channels are different from those of the original channels. For instance, the pixel distribution density of the red channel between 150 and 200 intensities is more than the pixel distribution density between 150 and 200 intensities in the corresponding red channel of the filtered image in This clearly illustrates the smoothening effect of median filtering, thereby enhancing the extraction more discriminating colour features from the images. This result agrees with the position of other researchers on the effect of noise filtering on image features extraction.



Learning curves are a widely used diagnostic tool in machine learning for algorithms that learn from a training dataset incrementally. The model can be evaluated on the training dataset and on a hold out validation dataset after each update during training and plots of the measured performance can created to show learning curves.Reviewing learning curves of models during training can be used to diagnose problems with learning, such as an underfit or overfit model, as well as whether the training and validation datasets are suitably represented



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