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IMAGE CLASSIFCATION USING CNN

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Abstract

Research on images is quite challenging nowadays since there are few techniques available to be used in the processing and classification of images. Classification of images based on contents is one of the most studied topics in computer vision. Today, this problem can be easily addressed with modern techniques such as Convolutional Neural Network data. Image classification is referred as Classification of the images from many predefined categories. Image classification is to input an image, and then use a certain classification algorithm to determine the category of the image. The main process of image classification: image preprocessing, image feature extraction and classifier design. Our system present Convolutional Neural Network (CNN), a machine learning algorithm being used for automatic classification the images. We will use the Blood cells data set as a bench mark for classification of the grayscale image. The grayscale images in the data set used for training that require more computational power for classification of images.

Keywords: CNN, Object, Image Classification, Neutral Networks, Deep Learning.

1. Introduction

Such tasks include computer vision, such as image classification, localization, segmentation, and object detection. Image classification is central to all the problems mentioned above and can thus be regarded as a basis for any other computer vision task [1-8]. Traditionally, before the 1990s, machine learning was applied only to image classification. Such bottlenecks as problematic and scanty classification, and many others including manual feature extraction procedures, limited it. Such functions in deep neural networks, lately discovered to be extremely useful tools for applications that recognize sophisticated patterns within humongous sets of data by means of using a developed algorithm of a technique called back-propagation, had been able to achieve satisfactory performance [9-15]. Within DNN, the convolutional neural networks proved spectacularly successful in computer vision, Convents are specifically a type of multi-layer neural networks derived from the mechanisms by which living organisms process visual information [16-24]. Hubel and Wiesel discovered that cells in the visual cortex of an animal respond to light falling within small receptive fields. Based on this discovery, in 1980, Kunihiko Fukushima invented the noncognitions-a kind of multi-layered neural network that could learn to recognize hierarchical visual patterns [25-36]. This network is the conceptual forerunner to CNNs. In 1990, LeCun et al. published a practical CNN model and created LeNet-5. Trained with the backpropagation algorithm, LeNet-5 could classify visual patterns directly from raw pixels without any feature engineering. Secondly, CNN's fewer connections and parameters as opposed to conventional feedforward neural networks of comparable size made model training easier. However, at that time, with so many advantages, the performance of CNN on complex tasks like high-resolution image classification was still limited by limited training data and poor regularization methods, not to mention in fact, today we see sets much bigger in number, millions of high-resolution labelled images within thousands of categories, as ImageNet and LabelMe [36-37]. Along with more powerful GPU machines and better regularization techniques, CNNs can bring exceptional performance in image classification tasks. In 2012, Krizhevsky et al. reported striking results of a large deep convolutional neural network called Alex Net on the ImageNet Large Scale Visual Recognition Challenge. Such fantastic results were presented to inspire subsequent development of numerous CNN models in subsequent years, including the ZNet, VGGNet, Google Net, ResNet, Dense Net, Caps Net, SENet [38-40]. It provides you with the state of the art of how to classify images using convolutional neural networks.

2. Literature Review

Number of tasks for which CNN is applied have great performance in other applications. This application contains one of the very first implementations of the CNN architecture: recognition of handwritten digits [41-43]. Since the introduction of CNN, there has been an advancement of networks by the introduction of new layers and implementation of different techniques of computer vision [43-44]. Convolutional Neural Networks have been mostly used in the ImageNet Challenge that is with various combinations of sketch datasets [45]. Some of the researchers reported the comparison between a human subject and trained network by detection capabilities on image datasets. The comparison results showed that human being corresponds to a 73.1% accuracy rate on the dataset whereas the outcomes of a trained network show a 64% accuracy rate [46]. In [47], the classification of images that are achieved by extracting features from the image.
Most midlevel feature learning methods, usually focus on the coding or pooling process; but here they highlight that the mechanism behind the composition of an image also greatly influences the extraction of features from an image. In the feature extraction process, image content exploration is well performed using the hierarchical decomposition approach to an image. Here, each image is factored as a sequence of semantic components that are similar to the structure and texture images. The semantic image content-structure and texture can then be matched using other images with different feature extraction methods. The following two are dissimilar schemas applied for the illustration of varied image-related property such as the feature of feature, one the first set has been hand-crafted features used in a one-staged network and the second ones learn feature from raw pixel automatically by a multistage network. In [48], discussed the classification of Natural images using biological stimulated models. Its applications are well known analogous developments in visual information systems and inference procedures of the brain functionality. This model is primarily made use of for image analysis and Natural classification. This system consisted of three major units that were biologically inspired for visual International Journal of Pure and Applied Mathematics Special Issue 1310 selective attention unit, Knowledge structuring unit and Clustering of visual information unit. It utilizes the low-level features in the images to automatic extraction of major relationships between images. The system follows the limitation in the human visual system to achieve higher accuracy in classifying images. It has two parts: the bottom-up saliency map module constructs a salient region from low-level features extracted from images of natural scenes, and the top-down selective attention module makes decisions about interesting objects by interacting with humans. These two elements closely follow the mechanism used by the human brain's visual what pathway and where pathway. These modules have been integrated into the knowledge structuring module. The clustering of visual information is done on the basis of the output produced by the knowledge clustering module, and it relies on the high-level top-down model of classification and perception of visual information. In [49-50], spoof fingerprint detection using Convolutional Neural Network (CNN), reports that the aim of biometrics is to be able to reach automatic discrimination between subjects in a reliable manner according to the needs of the target applications. The basis for this discrimination relies one or more signals acquired from traits such as face, fingerprint, iris, voice, or written signature. What are the benefits of biometric technology compared to traditional security methods, namely something we remember or know: PIN, PASSWORD, and so on versus something we physically own, Deep learning architectures are quite many. This category of classifiers developed in this paper depends on the most efficient and useful deep neural networks for the data type themselves, [8]. In the recent years, a lot of methods [50-55] has been proposed and compared the local facial features and classification of images using the geometric model of human face.
Other approaches focus on methods of template matching that are used to detect the local sub-feature This system detects the semi-frontal human faces in complex images databases by classifying image as face image or non-face image. CNN also used to automatically extract the important feature from the images. Apart from that, the process of pre-processing is not required and fast processing is done automatically by successive simple convolutional and subsampling operations. CNN have three different types of layers to perform operation on the images. They are convolution layers, sub sampling layers, and classification layers having sigmoid neurons [55-57]. The convolution layers have specific number of planes. Every airplane is assumed to be a feature detector. Once the image feature is obtained, then it needs to find the images. Then, it uses a subsampling layer that reduces the dimension of the input while preserving the information on the image. Then, it uses the function of the sigmoid neuron [57-59].

3. Proposal work

The CNN can be represented as a hot topic in the domain of deep learning, used for face recognition, object detection, and image classification. CNN usually has several layers and is fully connected like the neurons in the biological brain. These neurons communicate in 'message' form of with cells and surround many of others. CNNs work on the same principle; multiple other layers are connected to these layers. That makes the output of this layer to be an input for quite few other layers, which are directly connected to the preceding layer. CNN is used to process very different types of an inputs, like audio signals, or images, or even structured samples in general.

CNN algorithm is mostly applied to image classification because they can ear hierarchical feature like edges, textures, and shapes enabling to make accurate object recognition in images are very good in this task because they have the ability of automatically extracting meaningful spatial features from images. As have mentioned above, there were different layers present in the CNN: Convolutional Layers

Feature Extraction These Layers are used for feature extraction. It learns how to do the process of an extract edges, textures, shapes elements in the also called to be known as these and visual elements

Pooling Layers

Pooling applies to reduce the spatial dimension of feature maps generated by the type convolutional layers. The pooling layers do down sampling and include only the useful information, suppressing all the extra details . This will make a network translation invariant and reduces its size to achieve.

Fully Connected Layers

One or more fully connected layers which flatten the output of the last pooling layer and connect to it. Layers classify the extracted features. It consists of layers that learn the complex relations between features and output class probabilities or predictions.

Output Layer

These are the last layers of the CNN algorithm. As shown in the image above, this layer comprises the number of neurons equal to the number that classification has to classify into. The output would be determined in this layer since the probability of classification or the predictions for all classes.

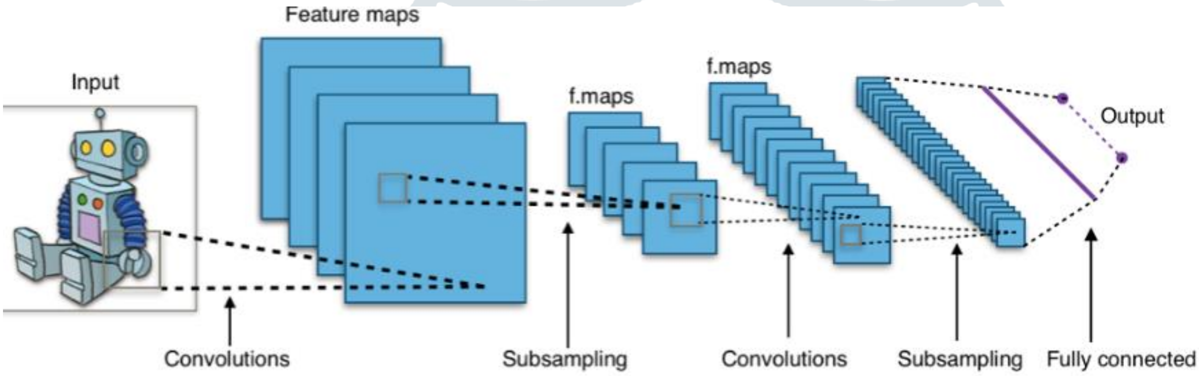

Fig-1 Typical CNN Architecture

CNN IMAGE CLASSIFICATION

Step 1: select a dataset. Here we choose an Blood cells Image Dataset for the experiment in this paper.
Step 2: Import all required libraries.
Step 3: Prepare Dataset for training
Step 4: Create Training Data.
Step 5: Assign Labels and Features.
Step 6: Normalise X and convert Labels to Categorical Data
Step 7: Split X and Y for use in CNN.
Step 8: Define, Compile and Train the CNN model.
Step 9: Accuracy and Score of Model.
By these 9 steps we can classify any images with CNN.

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4. Result

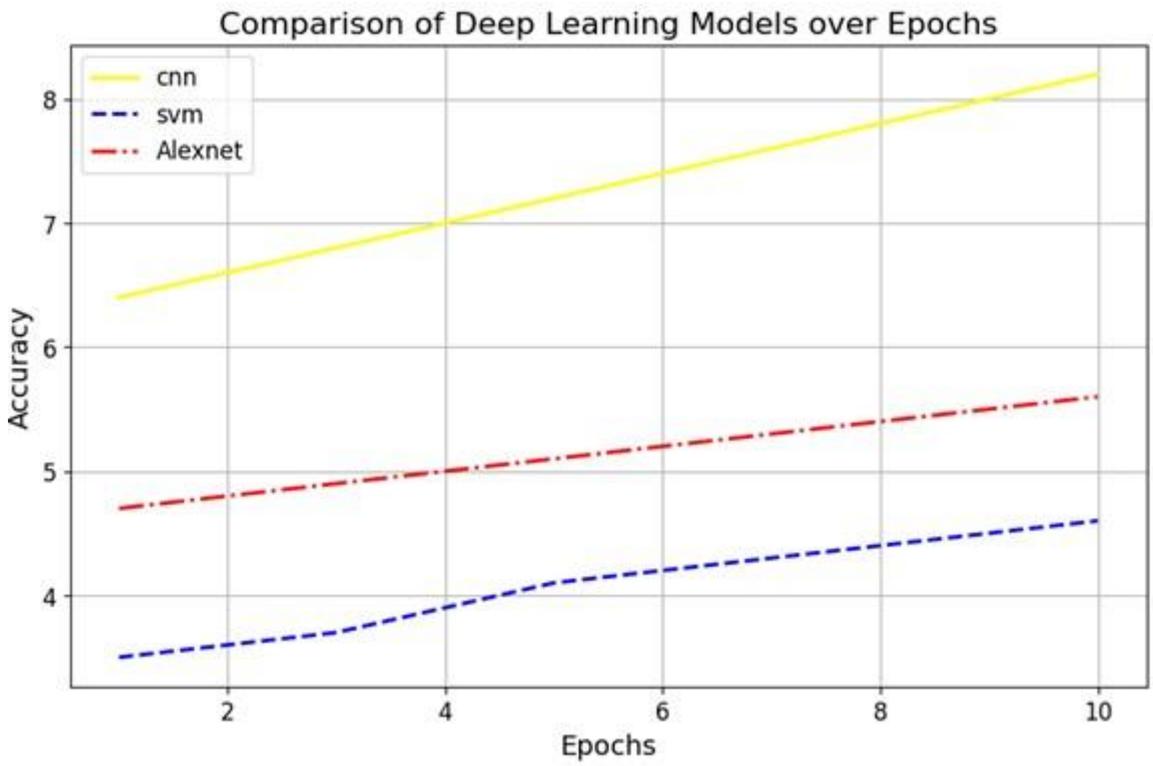

Fig-2 Comparison of Deep Learning Model over Epochs.

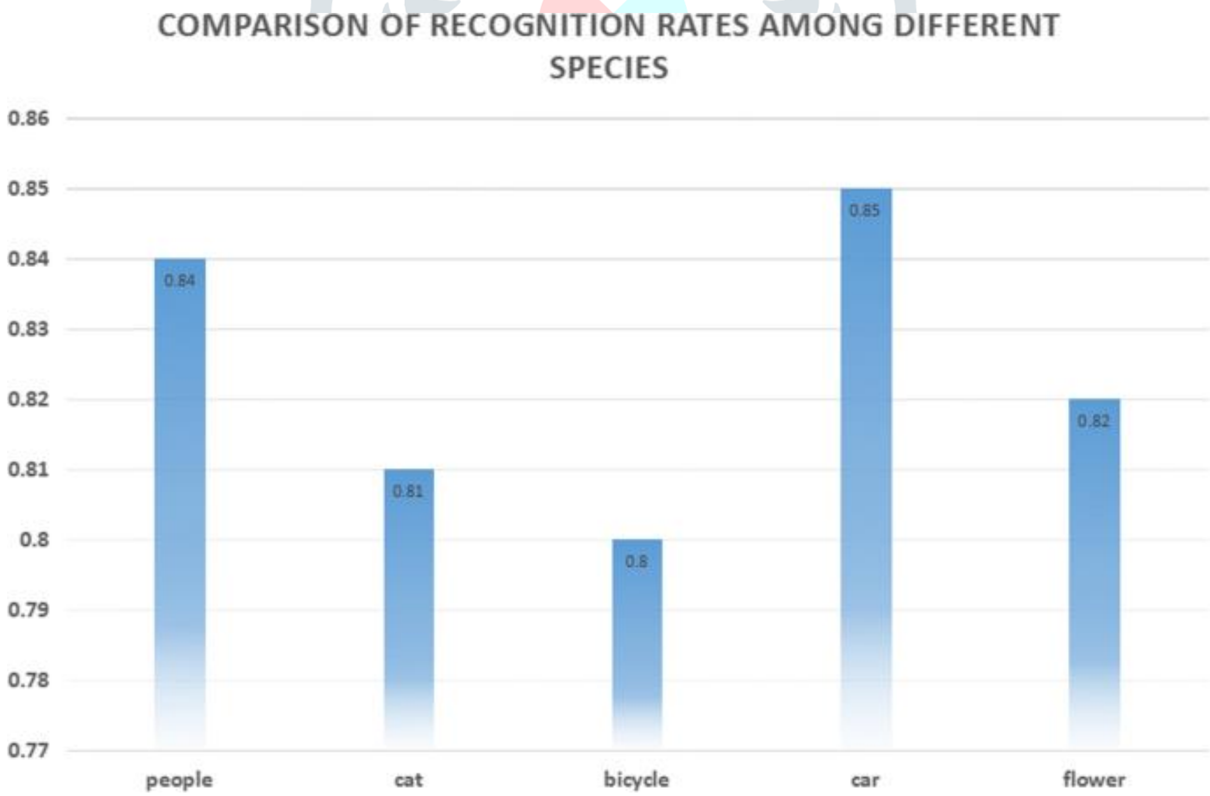

Fig-3 Comparison of Recognition Rates Among Different Species.

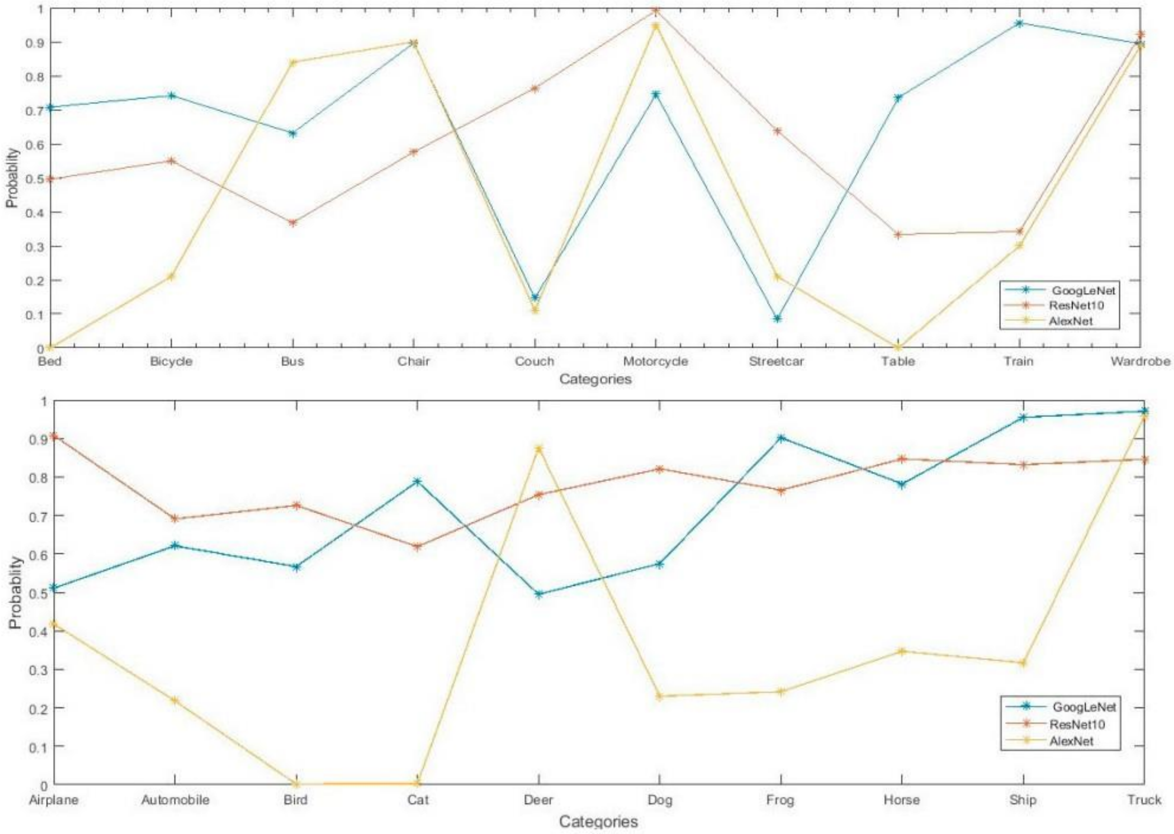

Fig-4 (a**)**Probability vs Categories graph for CIFAR- 100 dataset (b) Probability vs Categories graph for CIFAR- 10 dataset.

The code below is an image comparison based on the accuracy between three machine learning models over the course of ten epochs using Python's Matplotlib and NumPy libraries: First, import all libraries including a definition of epochs as well as their respective accuracies for each model. A plot is generated with specified dimensions and for better clarity, the accuracy of each model is plotted as a separate line with the use of a colour, line style, and markers. The plot is equipped with titles and axis labels in order to make it useful with optional features that are helpful such as setting the limit for the y-axis, customising tick sizes, and adding a grid. Finally, this plot can be saved as a PNG file and then displayed to the user for the purpose of rendering a clear visual analysis of model performance over the particular epochs.

5. Conclusion

Deep convolution neural networks are used to identify scaling, translation, and other forms of distortion-invariant images. In order to avoid explicit feature extraction, the convolutional network uses feature detection layer to learn from training data implicitly, and because of the weight sharing mechanism, neurons on the same feature mapping surface have the same weight. The *ya* training network can extract features by *W* parallel computation, and its parameters and computational complexity are obviously smaller than those of the traditional neural network. Its layout is closer to the actual biological neural network. Weight sharing can greatly reduce the complexity of the network structure. Especially, the multi-dimensional input vector image WDIN can effectively avoid the complexity of data reconstruction in the process of feature extraction and image classification. Deep convolution neural network has incomparable advantages in image feature representation and classification. However, many researchers still regard the deep convolutional neural network as a black box feature extraction model. To explore the connection between each layer of the deep convolutional neural network and the visual nervous system of the human brain, and how to make the deep neural network incremental, as human beings do, to compensate for learning, and to increase understanding of the details of the target object, further research is needed.

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