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A Survey on Deep Learning Feature Extraction Techniques

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Abstract—The major advancing techniques in machine learning are mainly two, they are deep learning and computer vision. The advanced deep learning techniques are highly promising to increase the interest in research within the upcoming years. This is often because the eminent benefits in overcoming the drawbacks within the outdated techniques for producing the result accurately. The theme of this paper is to provide a comprehensive description on the convolution neural network and its recent improvements which includes the CNN – S convolution neural network segmentation, CNN – CBIR convolution neural network – content-based image retrieval system. This survey paper provides a detailed summary within the latest advancements in the domain of CNN with various extended applications through its classification for improved understanding. Analysing the performance is done considering the speed, accuracy and ease.

Keywords: deep learning, CNN – S, CNN – CBIR, neural network.

INTRODUCTION

Various images can be analyzed using a class of deep learning network called as CNN. CNN is a supported shared weight architecture system. CNN are being regularised by using multilayer perceptron. Every neurons are interconnected in the network forming a chain of neurons. The important advantage of this network is that the hierarchical pattern in which the data is organized using a very smaller and less complex pattern. It is inspired and mainly compared between various image processing softwares for it speed and accuracy. It employs a calculation called convolution which can be a special reasonably linear operation. Multiple layers are employed in neural network for quickening the process. Convolution is defined by width and height, by the quantity of input and output channels and thus the depth of the convolution filter. Convolution includes the usage of pooling layers for computation which have local and global pooling layers.

LITERATURE REVIEW

Dimensionality reduction is a technique which became of transparent need in medical field in the form of automated application. Machine learning may also be considered as a branch of AI, and in many cases, almost becomes the application of AI. Increasingly, these applications fall under the category of techniques are called deep learning. Representation learning can get better and a little bit abstract with sufficient number of transformations and really complex functions are often learned in the end.

Text feature extraction identifies text information in order to represent a message, it is defined as the idea of text processing. Text feature is the essential component of the Text extraction. Selecting a

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variety of features from some effective ways to reduce the dimension of feature space, this can be termed as feature extraction. During feature extraction, data of less importance or coreealations are to be deleted. As a way of knowledge pre-processing of learning algorithm, feature extraction can improve the accuracy of learning algorithm to a great extent and shorten the time consumed to process the data. Selection from the document part can reflect the knowledge on the content words, and thus the calculation of weight is known as the text feature extraction. Primitive methods of feature extraction require exclusively selected features. Creating such feature can be a long and tedious process which consumes a lot of time, and deep learning is often aimed towards new applications which are being developed and quickly acquire modern, effective characteristic representation from training data.

Deep learning does not demand a lot of engineering manually, so there is an advantage with the volume of data being processed. Deep learning performs a very good job when it comes to identifying non structured data. Most of us know the media like images, sound, video, and text, all belonging to similar kind of data. Its the work of the deep architecture to provide deep learning, which paves way for the the likelihood of solving much more complex AI tasks. Latest technoloical advancements in deep learning feature representation includes autoencoder, restricted Boltzmann model, deep belief network, convolutional neural network and recurrent neural network, etc.

The most contribution of this work are often presented as follows:

• Having read a large piece of literature, the text feature extraction method and the deep learning method is summarized

• Most application of deep learning have been summarised in text feature extraction methodology.

• The application of the deep learning method in text feature extraction is being summarized.

• Improving the quality of the data that has been considered in the process.

• Increasing the data accuracy.

• Feature set reduction enables us to to save lot of resources within the next iteration of knowledge collection or during utilization.

• Performance improvement.

• Understanding the data to realize knowledge about the method that generated the information or just visualizes it.

DIMENSIONALITY REDUCTION APPROACHES

Deep learning approach

Hinton et al proposed the deep learning in 2006 and defined it as a class of unsupervised learning. Deep learning has a multi layered structure with many strata. By combining lower level features, higher level representation of property classification scan be made to get the most out of distributed feature representation of knowledge.

Deep learning as against a surface learning, now tons of learning methods are surface structure algorithm, and that they exist with a few smaller limitations, like within the case of limited samples of complex function ability is restricted to an extent. Its generalization ability for complex classification problem is restricted by a few things. Deep learning is by learning a sort of deep nonlinear network structure and implementing complex function approximation, consistent with the characterization of the input file distributed, and within the case of sample set, the essence characteristic of the data set is rarely or otherwise not at all studied. The main difference between deep learning and other traditional

pattern recognition methods is deep learning has the capability to automatically adapt better and modernised features from big data, rather than adopting features which are already made. Considering the new applications, deep learning is currently in a very good position to quickly recieve new effective feature representation.

Techniques which are employing Deep Learning include NLP tasks, which includes semantic parsing, retrieval of information, labelling of semantic network, sentimental analysis, answering questions, machine translation, classification of texts, summarization, and text generation, as well as information extraction, including named entity recognition.

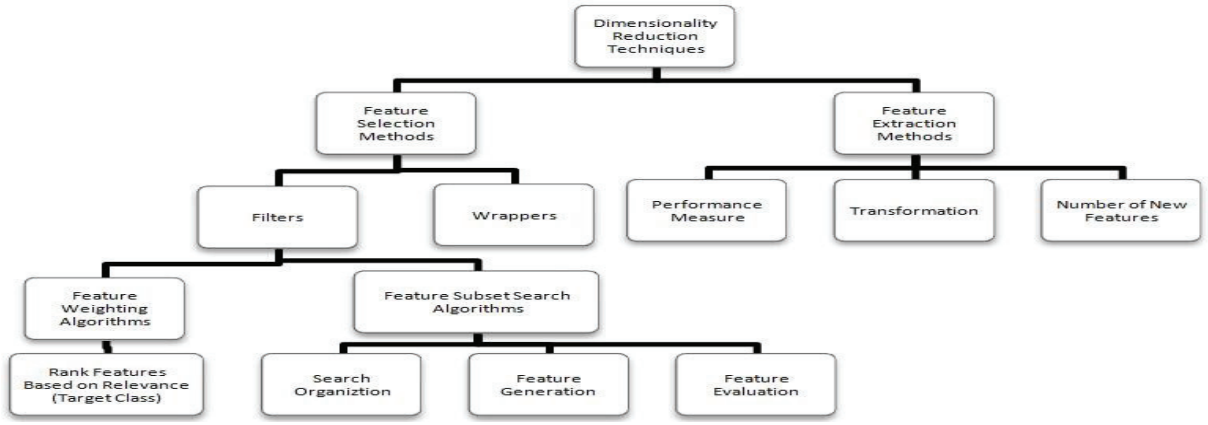

Fig 1: Hierarchical Structure of Dimensionality Reduction Approaches

High dimensional data might contain a lot of features that can be irrelevant, misleading, or redundant which increase search space size resulting in difficulty to process the data further and complicates the process thus not contributing to the learning process feature.

Subset selection method is defined as the process of selecting the best features among all the features that are present in a class. Feature selection algorithm (FSA) is a computational model that is activated by a particular definition of relevance. A comparison is presented between various feature selection algorithms.

ANALYSIS OF DIFFERENT TECHNIQUES

CNN Techniques

The important step other than convolution is pooling and padding. These can be taken into thought as layers in the input and output images. The main idea in CNN is to deliver the exact needed information through the use of convolution techniques. R-CNN Region Convolution Neural Network, it is defined as a method that is used to extract image from the particular region. The CNN will be acting as a feature extractor. To classify the availability of the object in that candidate region

proposals, S-CNN Segmentation Convolution Neural Network. CNN-CBIR content based image retrieval is a well known technique which is helpful in bringing the images from a vast database systems.

Feature extraction

Object detection is achieved in simple terms through CNN by extracting the features in the image, classifying the object based on the extracted features. There are various classifiers like support vector machine, navie bayes classification, logistics functions etc which are used in feature extraction.

Description

The input image which is to be recognized is feeded into three different types of filters and checking for any possible biasing is done. The maps undergo the process of sub sampling by adding weights and passed into the feature maps. Then another convolution is performed on this and the result thus arrived is then combined into a single vector.

CBIR

Content Based Image Retrieval is defined as a process framework which is widely known for its efficient retrieval of images from a collection based on the similarity of the objects. The retrieval process relies completely on extracting the necessary characteristic quantities explaining the desired contents of the images. Adding to that, suitable querying, matching, indexing and searching techniques are also employed to retrieve the images of objects.

S- CNN Segmentation –Convolution Neural Network

S- CNN is mostly used for the purpose of processing images. It involves in providing segments of image as the input to the Convolution Neural Network. CNN which is used to label the pixels is used to identify the image by classifying every pixel to determine the context of the image.

A segment is the representation of the objects in the image or parts of the objects or the composition of pixels. Which can otherwise be called as super pixels. Analysation of the image is done on three levels. They are

- Classification

It is used to classify the parts into various class similar to plants, animals, etc.

- Object Detection

Detecting the object by identifying the same with a rectangle box.

- Segmentation

Parts of the image is identified by using segmentation. The work of segmentation is to detect the objects and to classify into the respective classes.

The various segmentation methods that are used previously include

Thresholding

This method splits the corresponding image into foreground and background respectively. A threshold value will be set to separate the pixel value of each image to separate the object from one object to another. In this method the grayscale image objects are converted into binary images and which are identified as lighter and darker pixel images.

K-means clustering

This algorithm identifies the given input data in groups. This algorithm also assigns each data in a group based on similarity. In the previous methods the data will be checked on regards with the predefined groups rather than that clustering method which works with organising chunks of data.

Histogram based image detection

Histogram does the process of segmentation in this method. The task of grouping the observed cells based on gray levels isdone here. The background will comparitively be larger when compared to the background of object level, hence the larger peak is called as the background and the smaller peak is the image.

Edge Detection

Its task is to identifies the sharpness and the brightness in the image. It usually identifies the sharp changes which can be found in the image.

When the segmentation is performed, there are two different types based on the two levels which include Semantic and instance image segmentation.

Semantic Segmentation:

This method differentiates the pixels into meaningful objects. These classes are correspond to the objects in the real world.

Instance Segmentation:

It is entirely different from semantic segmentation in the way that it will not categorize the images based on pixels. If there are three flowers, the semantic segmentation classifies as under a single category flower but instance segmentation identifies each flower.

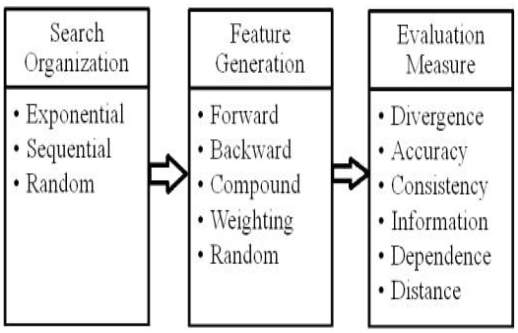

Fig 2.Description:An example for semantic segmentation

The semantic segmentation is the one which group or categorize the pictures.In the given S- CNN architecture there are various layers like pooling, convolutional layers and interleaving of non – linearities. Pooling involves in sliding down a 2D filters over each channel of feature map and summarize the features lying within the region. Convolution layer is the core building block of the architecture which consists of a set of learnable filters which can be adapted or modified according to the new filters.

CONCLUSION

Now the critical task is for this problem - why CNN/deep learning method is only used for feature extraction. Why not use it as a classifier also?. There are two main reasons for the problem which includes the following:

Local pattern: The data we used in this business problem (which is applicable to most of the scenarios where we use structural data), consists cross sectional(static)variables as well, where we will not find any local pattern. So we can't use CNN on the entire data as classifier. We have the reason for the data which holds Shift/Translation Invariance property, we can use CNN as end classifier.

Infrastructural challenges: The Buildings in large-scale industrial data and bringing into production requires significant infrastructural support (GPUs, AWS etc.), which may not available to every organization.

Latency in model run: Even with proper infrastructure, forward propagation of decently complex deep learning models takes significantly higher time than highly effective classifiers like XGBoost, RF, SVM etc which can increase the time complexity of the model leading to inconsistency in the performance.

The best solution for some applications in that case is to extract feature data with an automated technique like CNN feature extraction and then to add relatively simpler classifier.

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