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Recent Trends of Technological Advancement with Special Reference to Machine Learning in Data Analytics

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Abstract— In the age of technological development, an massive amount of signals is generated over the time for broad range of applications. This raw is yield from different sources, as a run time data streams. Applying data analytics over these data to determine new information, future prediction and make control decisions is an important process that makes Machine Learning (ML) a precious prototype for businesses development and creating new job opportunity. This research paper provides a through overview of economical potential and job prospect in such advance technologies. It also provides a through on using a class of advance machine learning techniques, namely Deep Learning (DL). In recent years, Deep learning and artificial intelligence based applications arose in different verticals domain, i.e. aerospace, healthcare industries, transportation, automotives, artificial intelligence (AI) based home appliances, smart city, self organized agriculture, online education platforms etc.

***Index Terms*—Artificial Intelligence (AI), Deep learning (DL), Data Analytics (DA), Digital Signal Processing (DSP)**

I. INTRODUCTION

Recent development in advances technologies like Artificial Intelligence, Wireless Sensor Networks (WSN) and Machine learning (ML) makes life more and easier. It not only just makes life smooth in sense of decision making and automation but also provide great help get a better performance to speed up managerial goals. The economical impact of machine learning is defined under knowledge work automation; "the use of computer to perform tasks that rely on complex analysis, subtle judgments and creative problem solving". The estimated potential economic impact of knowledge work automation could reach $5.2 trillion to $6.7 trillion per year by 2025. These effects definitely lead a very hazardous impact on individuals and industries, since people need to become accustomed to new means of earning income suitable for them to maintain their required living standard [1-3, 5].

In recent years, artificial intelligence-based applications arose in different verticals domain, i.e. healthcare industries, transportation systems, automotives industries, AI based smart home appliances, smart town / cities, AI based smart agriculture, AI based online education platform etc. This research paper aims to estimate the economical potential and availability of job opening in such advance technologies [4]. The available data contain a very high diversity so quite critical to process and analyze. Due to such issues a well train neural network is required which can process huge that effectively. For example, in smart agriculture/cultivation system a supervision device ready with sensors for climate, humidity, location and temperature produces a large amount of difficult data with multi–modality. Due to that reason, an advanced structures and algorithms are required for analyzing to such a massive amount of data. In addition, various deep learning structures and models are developed for such applications [6-8]. Many researchers have proposed and try to build up the effective structures for high level of classification/ predictions, identification as well the control through the liberalized analytical framework. The available data contains a very high level of complexity and variability even in single application. Most of the Several advanced machine learning architectures are like Deep Convolutional Neural Networks (DCNN), Reinforcement Learning (RL), Hopfield Networks (HN), Multi Channel Deep Convolutional Neural Networks (MC-DCNN), Deep Belief Networks (DBN), Classical Artificial Neural Network (CANN), Long Short Term Memory (LSTM), Variational Auto Encoders (VAE), Restricted Boltzmann Machine (RBM), Extreme Learning Machine (ELM), etc, have also been presented to solve the problem of such complex data processing but the performance and effectiveness was subjected to the computational cost is always be there. So researchers are trying to develop an effective and promising solution in giving field [9-12].

The main contribution of this article is to provide the effective solution to deal with the problem of data variability and computational complexity of Conventional Neural Network (CCN). The proposed Intra modal deep Convolutional neural network reflects the significant improved.

The remaining paper is organized as follows: the structure of the deep neural network is presented in section 2. Section 3 shows the framework of Deep CNN along with the realization issues. Simulation analysis to verify the usefulness of the proposed strategy is illustrated in section 4 while the paper is concluded in section 5.

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II. MACHINE LEARNING ARCHITECTURES

A promising method in machine learning domain is the DL that utilized different learning techniques like unsupervised, supervised, semi supervised and hybrid techniques for hierarchical feature learning in terms of classification and recognition in deep infrastructure. Recently, Conventional Neural Network (CCN), DCNN (deep convolutional neural network), DBN (Deep Belief Network) as well as wavelet based DCNN type of deep learning algorithms are effectively applied for the feature learning process in different fields like image/ video processing, virtual reality, speech recognition, missile tracking systems, aerospace applications and computer vision. These DL methods are appealed in large-scale models; massive number of metrics is involved. At the present time, DL has attained more consideration for researchers and engineers. In various applications like intelligent transportation, smart medical as well as industrial control, this DL is involved through a high value of producing industrial information. These large amounts of data are usually heterogeneous in nature [3, 8-9].

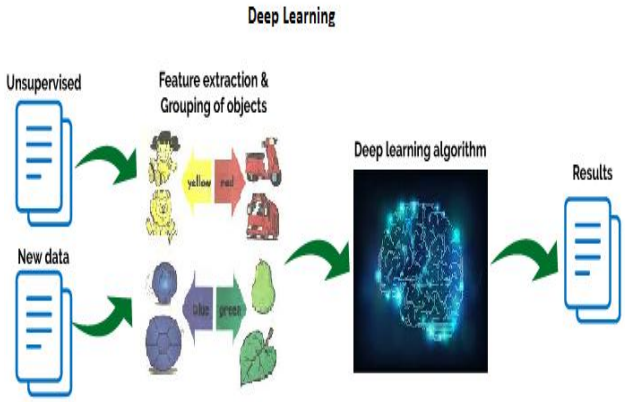

Figure 1: Deep learning model

III. DCCN FRAMEWORK

The recent advancements in the field of artificial intelligence and machine learning researches and scientists exert a pull on to developed new structures and algorithms. The convolution neural network is the one of the superior structures since last decade and efficiently applies on image classification, object detection and system identification.

Deep Learning architectures have gained more attention in compared to the conventional Machine Learning (ML) approaches. These structures are considered as a limited subset of DL. DL technique is based on hierarchy of features, in which each layer trains to a set of features. The inner most layers can recognize more complex features, since they are recombining from the previous layers.

These kinds of networks are broadly used in computer vision, image classification, recognitions, pattern identification and other similar applications. The neural network models are basically inspired from the nervous system of human body. They are simply imprecise mathematical modeling so they provide impulse of margin to researchers and scientists for its development and rectification. Most of the researchers of said field are trying to develop an effective as well efficient framework. There are different models and algorithms are already given in that direction but there is always a margin of improvement. Conventional neural network model are not enough to achieve an effective solution but they are utilized since long to solve the problems at certain extend.

The figure 2 shows the deep CNN model contains different layers including convolution layer, pooling layer, fully connecting layers and so on. The input data, purposely images given to the first layer i.e convolution layer. The convolution layer extracts the features of input image and passes to next layer. Pooling layer simply reduces the dimension of the feature map data.

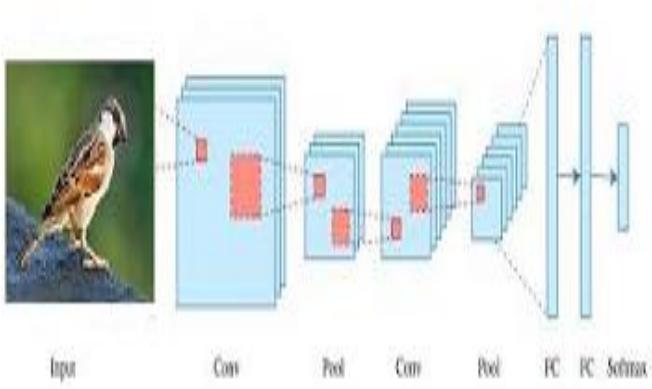

Figure 2: Deep CNN model

Proposed deep convolutional neural network is a modified version of conventional convolutional neural network where multiple convolution and polling layers are arranged in cascade. This particular arrangement will lead computation complexity of the proposed model. Here we are increases the multiple combination of convolution and pooling layers to reduce the feature map dimentions. It has been utilized as building block for function approximation in the proposed work. The learning capabilities of this deep leaning framework are significantly improved due said arrangement. However the increased the computation cost, but increase the accuracy. It results into a nonzero mean and offers an incredible estimation performance for the image data sets. The figure 2 shows the basic structure of intra model Deep CNN. The input images will first processed by convolution layer to extract the features and reduce the data redundancy. This convolution filters having good approximation capabilities so they can perfectly suitable for these data sets. The proposed Intra modal Deep Convolutional neural network reflects the significant improvement due to insertion of multiple convolution layers.

IV. SIMULATION ANALYSIS

A detail simulation analysis has been performed to evaluate the effectiveness of proposed Deep CNN and Conventional Deep CNN. The accuracy analysis for different data sets are calculated and reflected in Table 1 and in Figure.3 respectively.

Table1. Accuracy for Different data sets

	CNN	DCNN
CIFAR	83.5	91.2
SNAF2	81.7	87.4

CIFAR and SNAF2 are the two datasets used for the feature learning purpose. CIFAR and SNAF2 are the datasets which contain images of animals and natural images.

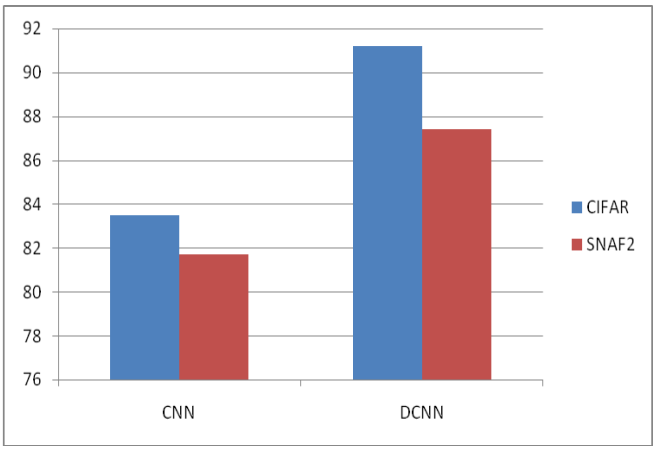

Figure 3: Accuracy analyses

The Figure 3 shows the accuracy analysis for intra model based deep CNN as well the conventional deep CNN. The accuracy of conventional deep CNN for CIFAR data sets and SNAF2 are found 83.5% and 81.7 % respectively. Whereas for the intra model based deep CNN the CIFAR and SNAF2 data sets yields better results as reflected in table, So significant enhancement has been observed for the proposed intra model wavelet based deep CNN. CIFAR and SNAF2 are the two datasets used for the feature learning purpose. CIFAR and SNAF2 are the datasets which contain images of animals and natural images.

V. Conclusion

The paper presented an effective Deep CNN for hierarchical feature learning process on available data i.e. CIFAR and SNAE2. The feature reduction was performed using convolution layers. It is observed that the redundancy in data datasets was significantly removed. The proposed method has combination of a convolutional layer, pooling layers and the fully connected layer for training the input images from various datasets. Stochastic gradient descent (SGD) with back-propagation algorithm is utilized for training the data. The weights are updated with smallest incremental order for proposed Deep CNN model. Our proposed model has more accuracy than the conventional DCNN model with less number of iterations during training of the data. The computation cost was significantly reduced. Moreover, our proposed intra model wavelet based DCNN model spends less time learning the features when compared to conventional DCNN.

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