

Deep Learning Techniques for Complex Problems

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ABSTRACT

Mimicking the brain is the most challenging task in the field of computer science since its origin. To achieve this many technologies were introduced namely Artificial intelligence, Machine learning, Neural networks, Deep learning. Among these Deep learning is the promising technique for the problems, which are not solved by neural network. In this paper we discussed the meaning of deep learning, its scope, classification and Application. In addition to this we also discussed the future research using deep learning technique.

Keywords:-Artificial Intelligence; Deep learning; Representation learning.

INTRODUCTION

Deep learning is a new insight for solving many real world problems, it is a technique of machine learning and neural network. During previous days the artificial intelligence was used to solve the problems which are highly difficult and complex for human beings but they are straight forward for computers.

The deep learning techniques provides the opportunities for the computers to learn from previous knowledge and understand the problem in terms of a hierarchy of concepts, with each concept defined through its relation to simpler concepts by gathering and analyzing the knowledge through epochs, this method prevents the need for human operation to formally specify all the knowledge the computer needs.

The level of knowledge base enables the computer to learn complicated concepts by building them out of simpler one. If we take a graph showing how these concepts are built on top of each other, the graph is deep with many layers. This is called deep leaning. A person in everyday life requires lot of amount of knowledge about the

world. This knowledge is subjective so it is difficult to represent in a formal way, so computers need to behave in intelligent way. This is the real challenging task in deep learning. Machine learning is an AI which requires the ability to acquire their own knowledge by extracting the patterns from raw data. We have already used Machine learning in some of the example like naive Bayes, in which the Machine learning is used to separate legitimate e mail from Spam e-mail.

Logarithmic regression is used to find whether to recommend cesarean delivery. The performance of these depends mainly on representation of the data. Each piece of information is used in the representation is known as features. Many Machine learning tasks can be solved by designing right set of features to extract for that task, then providing these features to a single machine algorithm.

In machine learning the difficulty lies in the extraction of features, this is solved by representation learning. Learned representation often result in good performance than can be obtained with manual designed representation. Which

enables machine learning system to rapidly adopt to new complex tasks with less human intervention. A representational learning algorithm can capture a good set of features for a simple task in less time or for difficult task in hours to months.

The representation learning also facing problem in feature extraction but the deep learning solves clearly this problem. Deep learning enables the user to build the complex concepts using simple concepts.

The deep learning concepts are originated from the feed forward network of neural network. The depth of deep learning allows the computer to learn a multi-step program. Network with more depth execute complex instruction The deep learning contains 3 parts known as 1) Input or visible layer 2) Hidden layer 3) Output. The hidden layer may contain lot of layers used in the feature extraction.

Finally, deep learning is a technique of machine learning, which allows computer system to improve with experience and data.

BACKGROUND

The deep learning can be used in almost all complex real world problems for example speech recognition, biometrics, computer vision, natural language processing and other commercial application.

Computer vision is a broad field containing a wide variety of methods of processing images and different category of application. Applications of computer vision range from creating human visual abilities such as identifying faces and creating a new category of high quality image technique. Here deep learning is used for object recognition or detection of some form of images.

Deep learning can also be used in speech and audio processing. The main part of

speech recognition is to map an acoustic signal containing a spoken natural language utterance into the corresponding sequence of words intended by the speaker. In speech recognition tasks, unsupervised pre training was used to build deep feed forward network. The convolution network is used to get accuracy in speech recognition.

The next research area is natural language processing, in this area the human languages such as English or French will be used by computer. The neural networks are already used in natural language processing but to achieve excellence and scale to larger application the methods of deep learning is used. The feed forward network was used in basic natural processing model but deep learning models replaces them because deep learning uses the sequence of words rather than sequence of individual character or bytes because the total number of possible words is so large, word based language models must operate on extremely high dimensional and sparse discrete space.

In addition to the above the deep learning is also used Big data analytics. The deep learning will be used in big data pre-processing, big data analytics semantic indexing, data governance and big data integration. Since deep learning enables the system to identify best feature extraction without knowledge of the domain. The methods of deep learning are very useful in information pre-processing which involves the cleanness of data, analysis of data and better information retrieval. In addition to this there are many open challenges are present in integration of data and control of data in the cloud.

To put it in a nutshell the deep learning is a promising technique which may help to solve many real world challenges.

The motivation behind my research proposal is creating model which provide

solution to the complex problems in the real world for example solving NP hard problems, in that perspective deep learning is a promising technique for solving those complex problems.

RELATED WORK

So many papers have been published in machine learning and representation learning. Deep learning is the emerging technique, which solves the problem or difficulties in older machine learning techniques.

Representation Learning: Yoshua Bengio, Aaron Courville describes the representation learning scope and future. They discussed recent works happened in unsupervised learning approach namely, deep learning, autoencoders, manifold learning and deep networks[6].

Unsupervised Learning: Adam Coates et.al discuss how simple factors such as the number of hidden nodes in the model, may be more important to achieve high performance than the learning algorithm or the depth of the algorithm[7].

Unsupervised and transfer learning: Yoshua Benigo discuss the context of the unsupervised and transfer learning challenge and why unsupervised pre training of representation can be useful and how it can be exploited in the transfer scenario[8].

Computer vision: Andrej Karpathy [4] discuss how deep learning can be applied to computer vision, he presented a model, which leverages datasets of images and their sentence description to learn about the inter model correspondence between language and visual data.

Biometrics: Albert Ali Salah discuss how machine learning will be applied for biometrics, he mainly demonstrate lifeline method for biometric template construction and recognition, information fusion methods for integrating multiple

biometrics and methods for dealing with temporal information[9].

METHODS OF DEEP LEARNING

We use many practical methodology of deep learning to many real world applications, the different practical approach used are core parametric function, approximation technology, deep feed forward network. We classify deep learning networks into:

Deep network for unsupervised or generative learning: Without any domain knowledge the deep networks faces the input with the help of learning through its hidden layer provides best possible features, which will be used in further processing. The use of Bayes rule can turn this type of generative networks into a discriminative for learning.

Deep network for supervised learning: In this type class labeling is done before the input, which is intended to directly provide the discriminative power for classification.

Hybrid deep network: Which uses both types of learning, in few application supervised learning is used to estimate the parameter in any of the unsupervised deep network, it is used in speech recognition. The different solutions in deep learning are:

1. Continuous Bag of words.
2. Default baseline models.
3. Selecting hyper parameter.
4. Stochastic Gradient Descent
5. Dropout
6. Max pooling
7. Back propagation
8. Batch normalization
9. Transfer Learning

APPLICATIONS AND FUTURE WORK

The scope of deep learning is growing from day to day, it is covering all areas of computation and predictions, where the human calculation or work is difficult, the

deep learning is occupying the space. To name a few application are as follows.

Computer Vision and Pattern Recognition

In following fields the deep learning is used for the maximum extent.

Restoring colors in black and white photos and videos: Deep learning will be used in the color restoration of old black and white videos, the mistakes in this conversion id very hard to identify.

Pixel restoration: By using this we can get high quality of images from blurred images but it is not completely achieved, still the research is taking place.

Real time multi person pose estimation: By analyzing the video the system can able to predict the pose of a person.

Photo with description: This feature can already see in Facebook and google search but the deep learning provides more information about the photo compared to others.

Real time analysis of behaviors: Deepglint is a solution that uses deep learning to get real time insights about behaviors of objects like cars, people.

Generate new images: The deep learning enables the users to create new images by analyzing the older images.

Robotics: In robotics the deep learning is using in all the operations.

Voice Generation

Google wave net generate the voice automatically; it uses deep learning but they differ from siri and alexa in which these try to mimic the human voice.

Restoring sounds in Videos

Lipnet which uses deep learning to generate the videos in muted videos. The human also do the restoration by observing

the movement of lips but its success rate is 50% where as Lipnet achieves more than 90%.

Automated Handwriting Generation

The deep learning is used to produce the handwriting of a person by training many of instances of it.

Predicting the Demographics and Election Results

Since its deep learning is used to predict the stochastic models hence it is used in predicting the election results.

Predicting the Natural Disasters

The natural disasters like earthquake can be predicted more accurately compared older methods, by doing this we can able to save lot of lives of people.

CONCLUSION

Deep learning is one of the promising techniques to solve real world problems, which are very difficult to solve by existing technologies. In future Deep learning make the human life better by solving many complex problems, few are discussed above.

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