

Deep Learning Frameworks: An Analysis on Business Perspective

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Abstract : In recent time the amount of data handled by any traditional machine learning system is huge due to big data analytics. Deep learning plays a major role in this respect by retaining the performance of the system with huge amount of data. Deep learning research is constantly growing in last 25 years due to its huge potential in business system. Machine learning system are transforming from shallow architecture learning algorithm like SVM, Perceptron, kNN to deep architecture. In this paper we have discussed the importance of Deep learning in the introduction part and we have done an analysis of different type of software libraries in Deep learning and applications like Torch, Theano, TensorFlow and Caffe. Finally, Deep learning application in business perspective is discussed.

Keywords: Feature Hierarchy, Convolution Neural Network, Unsupervised Learning, Trading Systems

I. Introduction

Deep learning has a huge application domain like business application, financial application, share value prediction, image recognition, speech identification, gene and disease classification, natural language understanding, sentiment analysis etc. Deep learning totally changes the traditional way of pattern recognition, where hand crafted features are extracted from different type of object like image, audio, text etc. and the these features are feed to the simple classifier. Deep learning architecture uses neural network with multiple hidden layer and in each layer multiple non-linear operations are performed. In deep learning a hierarchy of trainable feature extraction and transform is used for lower level to higher level feature. In image recognition, lower level feature like pixel and middle level features like edge or motif and higher level feature like image part and finally object is used in different hierarchy. In deep learning these layer feature hierarchy is generated by learning algorithm. Deep learning, sometimes called end-to-end learning has three types of deep architecture Feed-Forward, Feed-Back and Bi-Directional. Selection of deep architecture is a trade off in between time complexity and space complexity. The beginning of research and development deep learning started in early 1970's where deep network based Group Method of Data Handling was developed by Ivakhnenko. In 1980's the efficient back-propagation algorithm is used to optimize cost and for the development of Convolution Neural Network. In 1995 supervised recurrent Deep Learner was developed. In the decade of 2000-2010, improved Convolution Neural Network with GPU (Graphics Processor Unit) support was developed. One of the main advantages of deep learning is, we can design deep learning for Supervised Learning, Unsupervised Learning and Reinforcement Learning. As the human learning system is an unsupervised learning system the future research trends of deep learning depend upon the development of deep unsupervised learning.

II. Various software libraries in Deep Learning and Applications

Deep Learning is a branch of Artificial Intelligence based on many efficient algorithms mainly for unsupervised learning. Deep learning uses the lower level features to learn and form higher levels of the hierarchy. There are various frameworks that support machine learning algorithms under this platform-

1. Torch[8]: It is a highly efficient and easy to use framework based on LuaJIT, a scripting language, with CUDA implementation. It has neural network based model with C interface with lots of optimized routines with support to iOS and Android . Torch comes with many community driven packages for image and video processing, computer vision etc.
2. Theano[9]: It is a Python library for large scale computation. It uses GPU for computations and thus it is faster and efficient approach to evaluate mathematical expressions involving n-dimension array. It checks many types of error and provides support for symbolic computation.
3. TensorFlow[10]: It is a C++ engine with Python API for reinforcement learning and similar algorithms. It is much slower than other frameworks (like Theano) and error prone. Even though TensorFlow was initially developed considering deep learning but due to its wider scope and applicability, TensorFlow is used in other computational domain as well. It uses data flow graphs for numerical computations and is very close to neural network. It also supports distributed computing.
4. Caffe[11]: This library is mainly intended for image processing and feedforward networks. Here Python is used as API as well as ported certain Matlab's implementation. It has poor performance for big and recurrent networks. Caffe2 is the successor of Caffe which is more scalable and robust.

There are other libraries also like Lasagne, Keras etc. Each library have very expressive architecture, state-of-the-art code and communities for continues improvement. All these libraries are highly user friendly and reusable, even addition of new modules is very simple. They also support distributed environment.

III. Deep Learning Applications in Business

Deep Learning is that domain of Computer Science which exploits the huge historical data available with the business organization to train the algorithms. These trained algorithms will help in finding market trends like producing the right product, promoting it at the right time to the right customer base as well as cost cutting of the production and reducing time for servicing.

Deep Learning has huge application in the domain of Medical Science which includes accurate and quick diagnoses, mining medical data for faster treatment [16]. Deep learning is used to identify how genetic variations lead to disease, and accordingly providing personalized medicine and therapies. Deep learning is a boom in the field of finance; it helps in managing trading systems, producing robust trading algorithms and prediction of economic developments [17]. Even deep learning is used for image classification, weather forecasting etc.

IV. Conclusion

This article is a review of various API used in deep learning. Their brief overview with pros and cons are discussed. Torch, Theano, TensorFlow and Caffe are the deep learning libraries which are used by the big software industries like Facebook, Google etc. This is an article to introduce the concept of unsupervised Feature Learning and popular libraries for deep learning.

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