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Deep Learning for Big Data Analytics in High Performance Computing Environments
Md Zahangir Alom and Tarek M. Taha

Abstract
Deep Learning (DL) has been showing huge success for analysis of big data problems. However, this large scale implementation of deep learning algorithms for Big Data analytics requires huge computing resources, leading to a high power requirement and communication overhead. Recently, IBM has developed a new computing system with non von-Neumann architecture called IBM's TrueNorth Cognitive System which allows for a new direction of research on neuromorphic computing. We have implemented deep learning approach with different optimization function using Caffe, Tea and Corelet Programming Environment (CPE-2.1) on IBM's TrueNorth system which is experimented on MNIST dataset. In addition, we have implemented network intrusion detection for cyber security which being considered another big data problem. The experimental results show promising recognition accuracy for anomaly detection and classification.

Objectives and Contributions
• To utilize most influential Deep Learning(DL) algorithms for object classification and Intrusion detection for Cyber Security
• To implement and performance evaluation on low power Neuromorphic computing system(NCS) called “TrueNorth”
• To analysis of power efficiency of Neuromorphic system

Contributions:
• First ever implementation of network intrusion detection on TrueNorth(TN) system

Introduction
Nowadays, dig data is a challenging issue, and we need a high performance information processing system to solve this problem.
• GPGPU and a multicore processor consume an abundance of power and area.
• IBM TrueNorth Neuromorphic cognitive system, non-von Neumann architecture
• 4096 cores per chip, each core consists of 256 input axons and 256 output neurons connected with a 256x256 cossbar of configurable synapses [1,2]
• Chip contains 1 million programmable neurons and 256 million synapses

Experimental results
Object classification:
• Databases: MNIST
• MNIST dataset is benchmark for handwritten digit recognition
• The size of input samples of both datasets is 28x28.
• Database contains 60,000 training and 10,000 testing samples

Network Intrusion Detection or classification on TrueNorth system:
• Dataset: KDD-99 network intrusion detection dataset
• 25000 input samples from KDD dataset
• Strings are encoded with numerical values with numerical encoding
• Spike representation of Encoded data

Flow Diagram of TrueNorth implementation

References