UMass Dartmouth
COLLEGE OF ENGINEERING

Computer and
Information Science
Department

MASTER'S PROJECT (SUMMER 2017)

TOPIC: ***Deep Learning for Image Recognition Using Restricted Boltzmann Machines***

PRESENTOR: Jiahuan Li

ADVISOR: Dr. Haiping Xu

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LOCATION: Dion 302E (Demo)

COMMITTEE MEMBERS: Dr. Hua Fang and Dr. Shelley Zhang

ABSTRACT

A Restricted Boltzmann Machine (RBM) is a generative stochastic artificial neural network, which can learn a probability distribution from a set of observed data. RBMs are a variant of Boltzmann machines, where an RBM forms a bipartite graph such that the connections between the hidden neurons of an RBM are not allowed. This restriction makes an RBM very useful and efficient in machine learning, and in particular, it can be used as a build block in deep learning networks. As a typical usage, a classic Deep Belief Network (DBN) – a deep neural network, is composed of several layers of RBMs and a layer of a Back Propagation (BP) network. The hidden layer units of a DBN can be trained to capture the relevance of the higher order data from its input layer. In this project, we develop a DBN using two RBMs and a BP network for image recognition. We use the weights trained from the RBMs as the initial parameters, and then use a BP network to fine-tune the whole neural network, which can effectively avoid local minimum. To demonstrate the effectiveness of our deep learning approach, we use a case study of leaf image identification and develop a graphical user interface (GUI) using MATLAB. In our approach, we train the RBM-based deep belief network using leaf examples, and then use the network to classify a given leaf image and output the matched plants with the recognized leaf. To improve the accuracy, the system outputs the first three closely-matched plants, so the user can determine the right one by examining the output descriptions of the plants. We use cross validation to evaluate the average performance of our approach. The experimental results show that the average accuracy reaches 89% with a reasonably small training dataset.