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SURVEY ON VARIANTS OF BOLTZMANN MACHINE AND THEIR APPLICATIONS

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Abstract

The Artificial Intelligence system has become an important technique in the field of Deep leaning, machine learning, and image processing and using this technique we perform and solve more complex problems in respective above fields. However in recent years this become more challenging in research also in this paper we focus on Boltzmann machine and their applications and restricted Boltzmann machines.

I. Introduction

Deep Learning models are broadly classified into supervised and unsupervised models Boltzmann machine can be defined as it is an unsupervised learning Model it is network that can be systematically connected like neurons that are stochastic decision about whether to be on or

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off and these models are undirected. So that the connection goes both the ways. Boltzmann models are called non deterministic models. The main purpose of Boltzmann Machine is to optimize the solution of a problem. It is the work of Boltzmann Machine to optimize the weights and quantity related to that particular problem.

In this feature selection by using binary vector in fully connected Boltzmann network that can be divided in o hidden layers and visible layers or also call input layers and all the layers are connected to each other and the machine can be find the relationship between the inputs by using respective features like hidden layers and this machine there is no output layers simple we find correlated data by using this feature relationship can be found so that it can be used in recommended system.

Types of Boltzmann Machines:

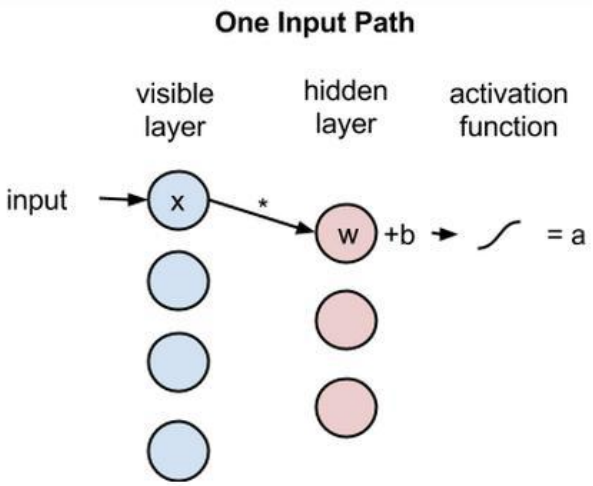
- Restricted Boltzmann Machines (RBMs)
- Deep Belief Networks (DBNs)
- Deep Boltzmann Machines (DBMs)

In fully connected machine produce so many inter connections so that it is difficult to processing .this difficulty can be solved by using Restricted Boltzmann Machines.

In Restricted Boltzmann Machines the network can be divided in to two parts hidden layers and input layers the major important point is in this machine the hen layers are not connected and input layers are also not connected. But every input layer will be connected in hidden layers.

II. Architecture

Restricted Boltzmann Machine has two layers one is hidden layer and input layers .hidden layers are also called latent variable in this we provide label information .rbm is called symmetrical bipartitive graph each node of input layer connected to hidden layer and each hidden node will be connected to input layer. There is no connection between hidden and input layer so that it form as restricted it also like Gradient Based Constructive Divergence. RBM is also used in deep learning architecture. It is basic component in deep belief network.



In RBM all the nodes in network are either bidirectional or unidirectional. RBMs are a two-layered artificial neural network with input and hidden layer. They have the ability to learn a probability distribution over its set of input. RBMs were invented by Geoffrey Hinton and It be used for dimensionality reduction, classification, regression, collaborative filtering, feature learning, and topic modelling.

In this WE use symmetric bipartite graph where no two units within the same group are connected. Multiple RBMs can also be stacked and can be fine-tuned through the process of gradient descent and back-propagation. Such a network is called a Deep Belief Network.

III. Working

1. Input Feeding

In RBM we feed the input by using one hot encoding this can be used for latent variables For example there are two categories like indoor and outdoor games like football, cricket and tennis.

By using hot encoding it can be represented in

Foot Ball = F

Cricket = C

Tennis = T

Then it can be represented as $[F, C, T]$

then (1, 0, 0), (0, 1, 0), (0, 0, 1)

It can transforms categorical features and it will be used for classifications it can be support for supervised learning and additive learning it supports Generative Stochastic ANN.

2. Deriving Equations to train the RBM

Energy of Joint Configuration:

$$E(v, h) = -\sum_{i \in visible} a_i v_i - \sum_{j \in hidden} b_j h_j - \sum_{i,j} v_i h_j w_{ij}$$

The relation between Energy Function and Probability Function

$$p(v) = \frac{1}{Z} \sum_{h} e^{-E(v, h)}$$

$$Z = \sum_{h} e^{-E(v, h)}$$

Z here is the partition function and is given by summing over all possible pairs of visible and hidden vectors:

$$p(v) = \frac{\sum_{h} e^{-E(v, h)}}{\sum_{v,h} e^{-E(v, h)}}.$$

Uses of RBM

1. It can be used for classification of images, xml data and also text data

2. It provides imbalanced data problem that is one class dominates another in the training data

3. It can reduced noisy label data problem

4. Challenging the issuing values that means some features are unknown

5. Challenging in unstructured data like data can be represented in various forms like images and videos and ext data.

IV. Conclusion

The main purpose of RBM to train the weights of connections. Advantage of learning this model we can create samples that look like they come from the distribution of data, and more importantly we can do pattern completion. It is symmetric nature the disadvantage is that RBMs are tricky to train well, since the common algorithm used, Contrastive Divergence, requires sampling from a Monte Carlo Markov Chain.

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