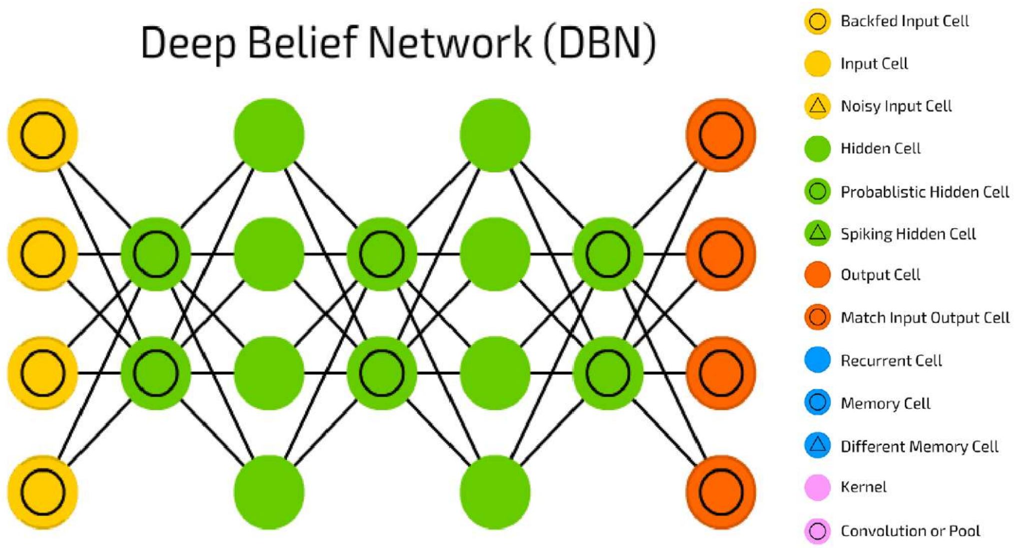
Deep Belief Network



Today we will understand Deep Belief Network(**DBN**) A type of **Unsupervised Pretrained Networks (UPNs)**

Lets define DBN first:

DBN is a class of deep neural network which comprises of multiple layer of graphical model having both directed and undirected edges. It is composed of multiple layers of hidden units, where each layers are connected with each others but units are not.

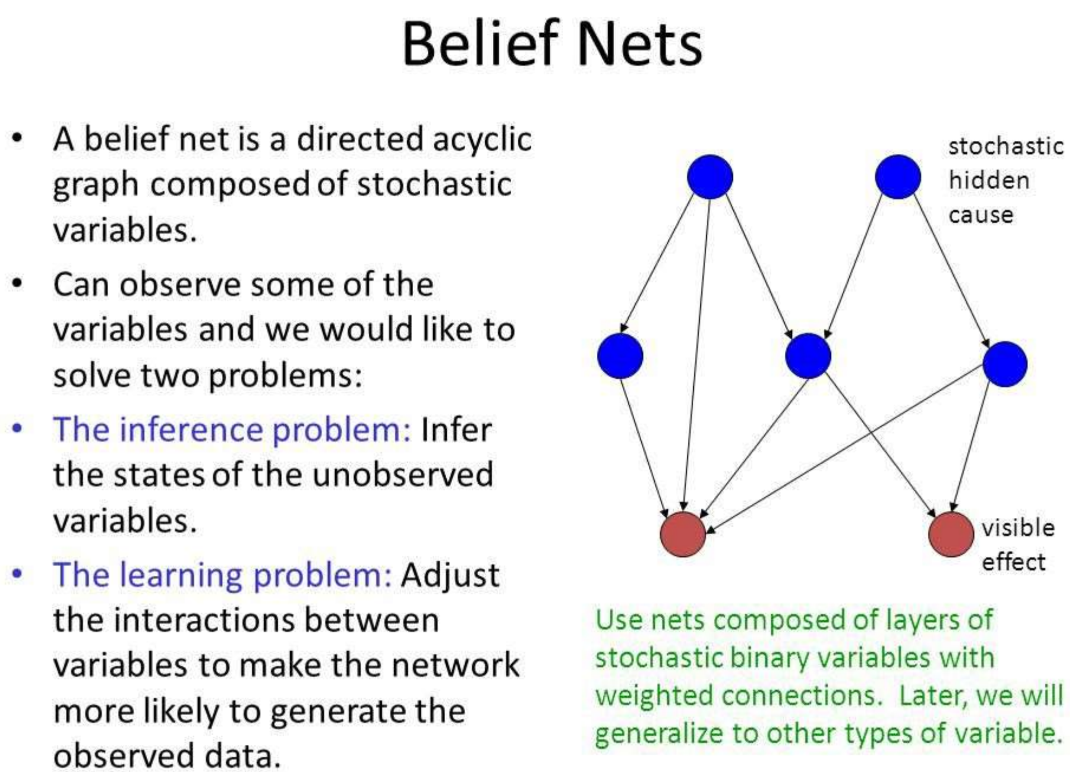
To understand Deep belief networks we need to understand two important caveat of DBN

1. Belief Net
2. RBM : Restricted Boltzmann Machine

1. Belief Network :

It consists of stochastic binary unit layers where each connected layers have some wieght. The stochastic binary units in belief networks have a state of 0 or 1 and the probability of becoming 1 is determined by a bias and weighted input from other units.

Let's understand Deep Belief Net by this Image (G. Hinton)



Dr. Geoffrey Hinton Says :

The two most significant properties of deep belief nets are:

- There is an efficient, layer-by-layer procedure for learning the top-down, generative weights that determine how the variables in one layer depend on the variables in the layer above.
- After learning, the values of the latent variables in every layer can be inferred by a single, bottom-up pass that starts with an observed data vector in the bottom layer and uses the generative weights in the reverse direction.

2. Restricted Boltzmann Machine :

Boltzmann Machine is a stochastic recurrent neural network with stochastic binary units and undirected edges between units. Due to Boltzmann Machine limitation to scale RBM was introduced which consists of hidden layers unit having restricted connection between each hidden units. This structure help RBM to learn efficiently.

See below to understand more :

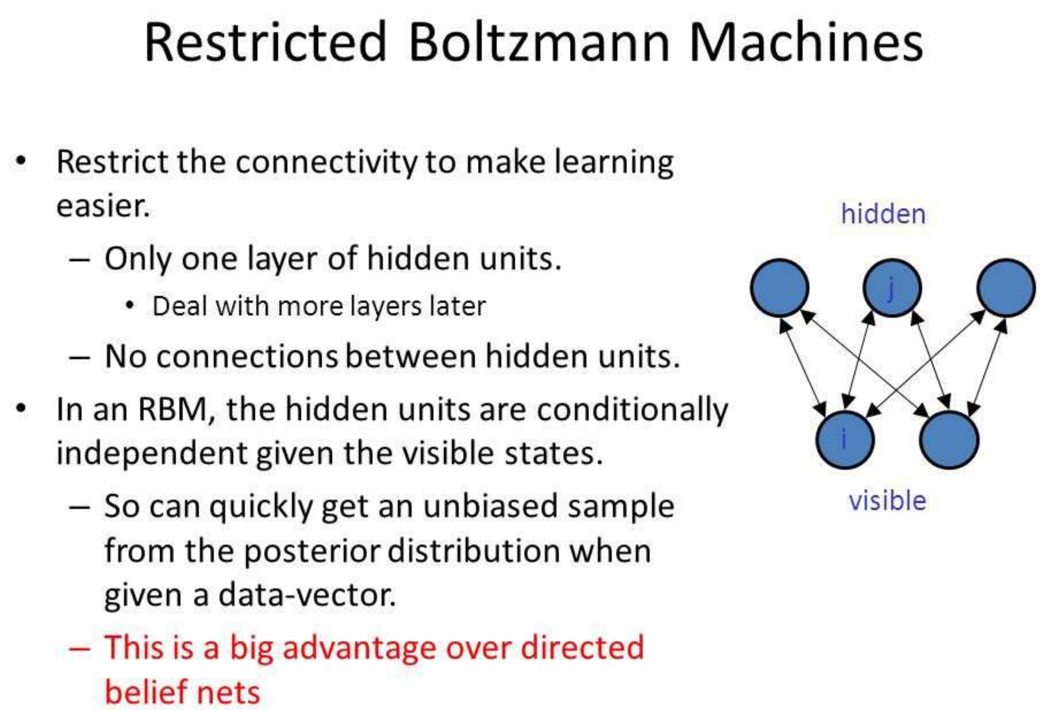
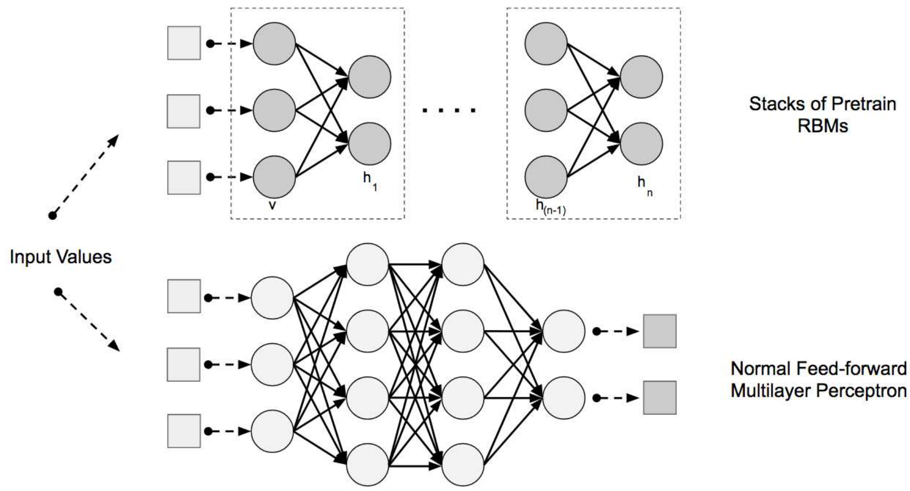


Image Source : [Geoffrey Hinton,cs.toronto.edu]

DBN Architecture :

DBNs are composed of layers of Restricted Boltzmann Machines (RBMs) for the pre-train phase and then a feed-forward network for the fine-tune phase. As shown in the network architecture of a DBN below :



How DBN Works (Basic Learning) :

Now that we have understood the basics of **Belief Net** and **RBM ,** lets try to understand how DBN actually learns. As DBN is multi-layer belief networks. where each layer is Restricted Boltzmann Machine stacked against each other to for the Deep belief Network . The first step of training DBN is to learn a layer of features from the visible units, using Contrastive Divergence (CD) algorithm. Then, the next step is to treat the activations of previously trained features as visible unites and learn features of features in a second hidden layer. Finally, the whole DBN is trained when the learning for the final hidden layer is achieved.

Greedy DBN Learning :