

Deep Learning

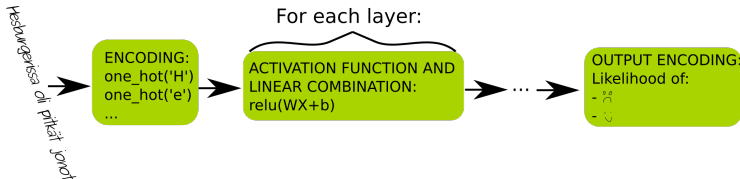
Data encoding / representation

Tero Keski-Valkama



2016-09-22

- Deep learning refers to deep neural networks. 1990s networks were shallow, and hence relatively useless.
- Neural networks are just complex non-linear models with lots of parameters. They are formed by layers of neurons, successive operations with an a linear combination of inputs from the previous layer and an activation function.
- In general, you always need a training set, a test set and a validation set. Training set is used to tune parameters, test set is used to tune hyperparameters, and validation set is used to check that the model does not overfit the test set. Bootstrapping can be used to validate the data sectioning.
- Underfitting = high bias, overfitting = high variance



- In supervised training, the neural networks requires input and target output. The system finds a layered non-linear function from input to output.
- In unsupervised training, the network is only given input, and it learns a structure that captures the input statistical distributions and correlations.
- Unsupervised training uses energy-based methods which are better able to capture deep associations than a simple backpropagation, hence it is used for pre-training.
- A good platform to use for neural network experimentation is Google's TensorFlow, based on Python.
- Data representation is critical in neural networks, in the input representation, in the output representation (and by extension in defining the loss function), and also in the internal neuron representation.

Data Representation

- Input representation
 - Boolean values, Continuous values
 - One-hot encoding for encoding exclusive choice
- Output representation
 - Boolean values, Continuous values
 - One-hot encoding for encoding exclusive choice
 - Mixture distributions
- Internal representation
 - Abstraction levels
 - Bottlenecks and compression

- One-hot





- To make neural networks learn effectively, the data must be represented in a suitable fashion.