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Machine Learning Design

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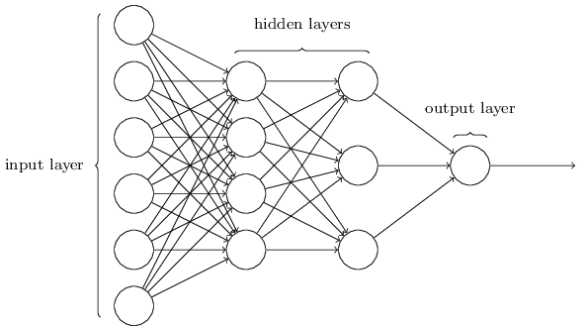
NEURAL NETWORKS

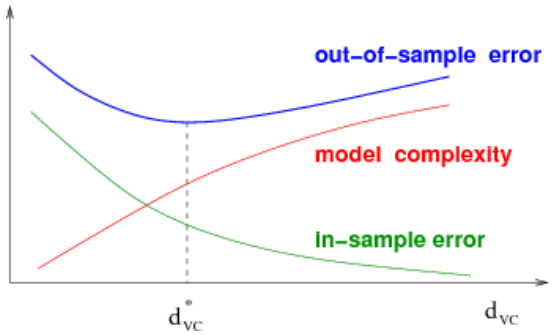
A neural net, or an artificial neural net (ANN), uses connected nodes to model neurons in a biological brain. It is key to note that though neural nets are based on biological brains they have some significant differences in structure. Typically, a neural net is used for classification of data, or prediction, though it is often not used for anomaly detection. Before use, neural networks first must be trained. Neural networks are feed using existing ground truth data, which the neural net will then learn from. Neural networks use a web of connected nodes, typically containing three layers: input, hidden and output layer.

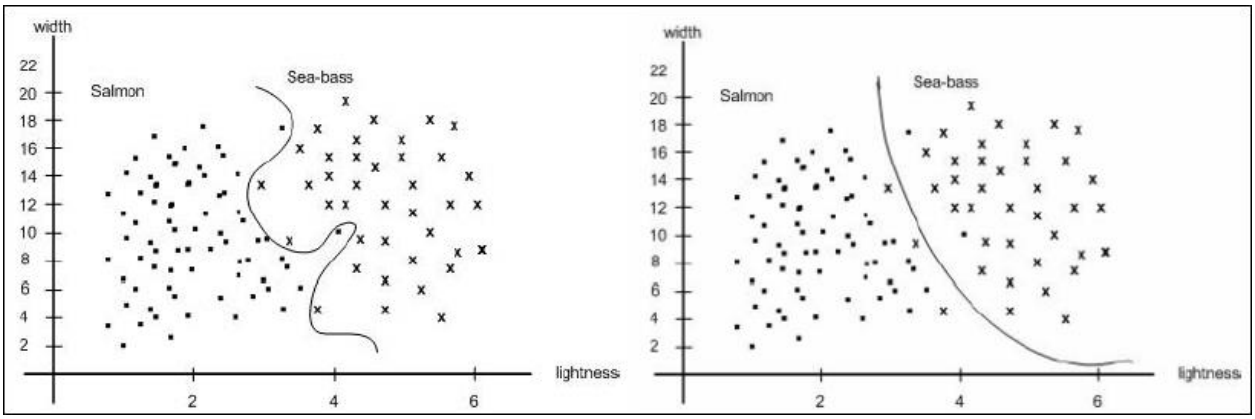
The input nodes fire when specific predefined features are identified. When fired, the input nodes send their assigned weight to the hidden nodes. (Backpropagation is used to determine node



weights). The hidden layers can be thought of like thresholds; in order for a hidden node to fire, it needs a sublimation of firing input nodes to be equal to or greater than its threshold. (The thresholds are also determined by backpropagation). There can be one hidden layer in a neural net, but multiple hidden layers are valid and are often the distinguishing factor in deep learning.

It is a common misconception that neural networks can learn on their own: this is false. Say if we were to take a neural net's results and add them to its training set we would exaggerate any initial error and the accuracy would spiral out of control. It is also true that you can over-train neural networks on observed data, where it will begin overclassifying data it observers. Because of this there is a happy medium between out of sample error and in sample error. This is a common problem, where data scientists will train and fine tune a model on simulated data, which will perform poorly when it receives new data. An example of this is shown below with fish classification.

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