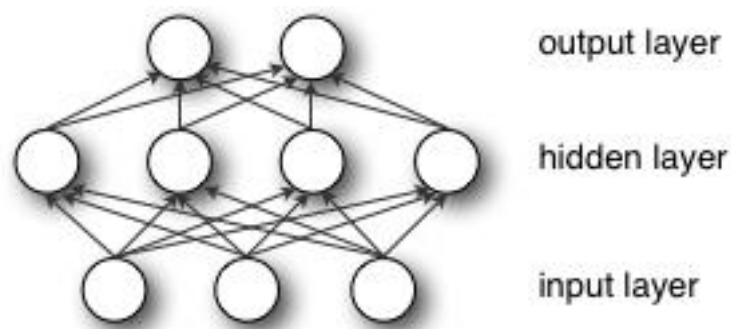


Machine Learning Lab 6

Multilayer Perceptron

A multilayer perceptron (MLP) is a class of feedforward artificial neural network. An MLP consists of, at least, three layers of nodes: an input layer, a hidden layer and an output layer. Except for the input nodes, each node is a neuron that uses a nonlinear activation function. MLP utilizes a supervised learning technique called backpropagation for training. Its multiple layers and non-linear activation distinguish MLP from a linear perceptron. It can distinguish data that is not linearly separable.



The dataset

The dataset used to perform this experiment is the wine quality dataset, it is a combination of data on two types of wine variants, namely red wine and white wine, of the portuguese “Vinho Verde” wine. The dataset contains information on the parameters for fixed acidity, volatile acidity, citric acid, residual sugar, chlorides, free sulfur dioxide, total sulfur dioxide, density, pH, sulphates, alcohol.

Experiment

In this experiment I used the sklearn’s multi-layer perceptron algorithm to predict if a wine is fit to drink or not.

Using the pandas library in I loaded the red wine and white wine datasets into the memory from their respective csv files and then merged the two datasets into one single pandas dataframe. Then using a threshold quality values, in this case 6, I segregated the data points for each sample of wine in the good wine and bad wine. That is the points with quality levels more than or equal to 6 are good and the rest are bad. This also helps in reducing the skewness of the data.

Using the `pandas.DataFrame.describe()` function in pandas I calculated the various statistical measures of each of the columns of the dataset.

For performing the experiment I started with plotting the distribution of the quality of wine with respect to the various levels of alcohol in the dataset. The inference that can be made out of this graph is that the good quality wine has a moderate level of alcohol in it whereas the bad quality wine has extremely high quantity of alcohols in it.

Next I used a multi-layer perceptron based classifier with 10 hidden units to classify the data. I am able to achieve a score of 0.80 on the training set.

Finally I increased the number of hidden units from 10 to 20 and 15, i.e. two layers of hidden unit first with 10 and the second with 15 and the score increased to 0.815.

Finally, I plotted the decision surface for the good and bad quality wine. The activation function I used all along was 'relu' and the value of alpha was 10^{-5} with an adaptive learning rate and a maximum iteration of 3000.

The code and plots can be found in the accompanying jupyter notebook.