

1 Linear Regression

1. It is a supervised Learning. This is because we need some labels before going through the algorithm. For example, we need to identify the constant or parameters or the independent variables are in the correct categories before we proceed.
2. This algorithm will be able to predict the relation between the desired labels or variables.
3. weather forecast, business forecast, scientific relations.
4. See section 1.1

1.1 Linear Regression Example

The basic equation for the linear regression is the linear equation as:

$$y = mx + c + \eta \quad (1)$$

where y is the dependent variable, x is the independent variable (input), m is the slope coefficient and η is the normalisation.

A straight forward example in this case is for example, we need to predict the salary of a worker depending on their experience. From the previous data (if we have a lot of data - the fit will be better and we are able to predict more accurately), we can input x (the years of experience) and we will fit for the y (salary).

Then from the linear regression model we can predict the desired variables.

2 Decision Tree Learning

There are two types of Decision Tree Learning:

1. Classification tree – the predicted outcome is the class
2. Regression tree - the predicted outcome can be considered a real number.

Both of these procedures also widely known under a term called Classification and Regression Tree (CART), because there are some similarity and also some differences.

1. It is a supervised Learning. It can be used as a classification trees or regression trees depending on the input data labels.
2. Widely being used as a predictive model.
3. Prediction in health, estimation in the numbers of probability of diseases or patients.
4. Matlab, R

2.1 Decision Tree *ensemble* learning

To construct the decision tree, a techniques called *ensemble* are being used such as:

- Boosted trees - building *ensemble* by training new instance to emphasised the not properly model previously.
- Bootstrap aggregated – repeatedly resampling the training data with voting and replacement to agree on a final prediction. Example:
 - Random Forest - constructing a multitude of decision trees at training time