# Lecture\_3b

Hello and welcome to this second lecture in this week. We're going to be looking at regression algorithms. In this lecture video, we are going to look at a recap of regression and we are going to look at common regression algorithms.

Regression analysis has several forms or variations, but broadly speaking, there are three popular forms: linear regression, multiple linear regression and nonlinear regression. In linear regression, we have just one explanatory variable being used against a predictor variable. In multiple linear regression, we have more than one explanatory variable against predictor variable and in nonlinear regression, we have a curved relationship point, nonlinear relationship between the predictor variable and the explanatory variable. There are many regression algorithms available which can be employed to perform regression analysis by building regression models. The regression models from the common algorithms include, but not are limited to linear regression models as explained before, nonlinear regression models as explained before, gaussian process regression,

Support Vector Machine regression, generalised linear model and decision tree models. Gaussian Process Regression is also called Kriging. Generally, Kriging models are nonparametric models that are used for predicting the values of continuous response variables, as illustrated. Gaussian process regression models are best employed for the interpolation of spatial data such as environmental data. For example, hydrogeological data for the distribution of ground water. Gaussian Process Regression models can also be employed as metamodels or surrogate models which assist the optimisation of very complex engineering designs, such as automotive engine design and optimisation. Support Vector Machine regression algorithms work pretty much in the same way as Support Vector Machine classification algorithms. However, they are modified to predict continuous responses. Also, in contrast to Support Vector Machine classification algorithms, Support Vector Machine regression algorithms do not find the optimum hyperplane that separates the data. Rather, they find a model that deviates from the measured value by a small amount, a small metric. Typically, the parametric values are kept as small as possible to minimise the model's sensitivity to error. Support Vector Machine regression models work very well with high-dimensional data

where we have a large number of predictor or explanatory variables. A generalised model is a special case of nonlinear regression model that employs linear models and to do this, the generalised linear model generalises linear regression by allowing linear model to be associated with the response variable through a link function, which is a nonlinear function and also, it allows the magnitude of the variance of each measurement to be a function of its predicted value. And this process mainly involves fitting a linear combination of the inputs to along a nonlinear function, which is the link function of the outputs.

Generalised linear models are best used when the response variables have no normal distributions. That is, they have distribution models other than a normal distribution. A vivid example is when the response variable is always expected to be positive. A decision tree is an acyclic graph, i.e., a flowchart-like structure that can be employed to make decisions. Like most machine learning methods, decision tree learning can be used for both classification and regression. In the case of classification, they are called classification trees. They are applied when there is a need for categorical variable or discrete outcomes. In the case of regression, they are called regression trees and regression trees are leveraged in cases where the response variable is continuous, but no categorical. There is an umbrella term that refers to both instances of decision tree learning, that is classification trees and regression trees and this is called classification and regression tree, cart. Classification and regression trees that is cart, depict a nonparametric decision tree learning technique that produces either classification or regression trees, depending on whether the dependent variables is categorical or numeric.

Decision tree learning is best used when a high predictive accuracy is not required and memory usage is to be minimised. Generically, in decision tree learning, responses to data are predicted by following the decisions in the tree from the beginning of the tree, that is the route, down to a leaf node as illustrated in the diagram, and this works as follows: in each branching node, a unique feature of the feature vector is examined according to some specified branching conditions. If the value is below are a specific threshold, often a trained weight, then the left branch is followed; otherwise, the right branch is followed. As the leaf node is reached, a decision is made about the response or class of the observation.

In this lecture video, we've looked at a recap of regression and we've also discussed some common regression algorithms like support vector machine, regression models, decision tree, generalised linear model and the gaussian process regression model.