regressions in ML

In machine learning, regression is a supervised learning technique that is used to predict continuous values. The ultimate goal of the regression algorithm is to plot a best-fit line or a curve between the data. The three main metrics that are used for evaluating the trained regression model are variance, bias and error.

Here are some of the most common types of regression in machine learning :

Linear regression: Linear regression is the simplest type of regression. It assumes that the relationship between the independent and dependent variables is linear.

Logistic regression: Logistic regression is used to predict a binary outcome, such as whether or not a customer will buy a product.

Polynomial regression is a type of regression analysis in which the relationship between the independent variable x and the dependent variable y is modeled as an nth degree polynomial function. In other words, it is a curve fitting technique that allows for a non-linear relationship between the variables.

The general form of a polynomial regression equation is:

$y = a0 + a1x + a2x^2 + ... + anx^n$

Polynomial regression can be used for both simple and multiple regression problems, but it requires a larger sample size than linear regression to avoid overfitting. Polynomial regression can be useful when there is a non-linear relationship between the variables, but it should be used with caution as higher degree polynomials can lead to overfitting

Lasso (Least Absolute Shrinkage and Selection Operator) is a regularization technique used in linear regression to prevent overfitting and improve the predictive performance of the model

The Lasso penalty term is the sum of the absolute values of the coefficients multiplied by a tuning parameter lambda (λ). The higher the value of λ, the more the coefficients are shrunk towards zero, resulting in a simpler model with fewer features. The tuning parameter λ is typically chosen using cross-validation techniques, such as k-fold cross-validation, to find the optimal balance between model complexity and predictive performance.

Lasso regression is particularly useful in high-dimensional datasets where there are many features that may not all be relevant for predicting the target variable. By shrinking the

coefficients of the less relevant features towards zero, Lasso can help in feature selection and identify the most important features for predicting the target variable.

Ridge regression: Ridge regression is a type of linear regression that penalizes the size of the coefficients. This helps to prevent overfitting, which occurs when the model learns the training data too well and as a result, it does not generalize well to new data.

Elastic net regression: Elastic net regression is a type of linear regression that combines the features of ridge regression and lasso regression.

Bayesian regression: Bayesian regression is a type of regression that uses Bayesian statistics to estimate the coefficients of the model. This can be useful when you have prior information about the coefficients, such as their distribution or their range.

Some of Use cases of regressions :

- **Predicting customer demand**: Companies use regression to predict customer demand for their products. This information can be used to optimize production and inventory levels.
- **Forecasting sales**: Companies use regression to forecast future sales. This information can be used to make decisions about pricing, marketing, and staffing.
- **Estimating the price of a house**: Real estate agents use regression to estimate the price of a house. This information can be used to help buyers and sellers make informed decisions.
- **Determining the effectiveness of marketing campaigns**: Marketers use regression to determine the effectiveness of their marketing campaigns. This information can be used to optimize the campaigns and improve ROI.
- **Predicting patient outcomes**: Doctors use regression to predict patient outcomes. This information can be used to make decisions about treatment plans and improve patient care.
- **Optimizing product development**: Engineers use regression to optimize product development. This information can be used to improve product performance and reduce costs.