Assignment-based Subjective Questions

Q1. From your analysis of the categorical variables from the dataset, what could you infer about
their effect on the dependent variable?

Answer:

- The demad of bike is less in the month of spring when compared with other seasons
- The demand bike increased in the year 2019 when compared with year 2018.
- Month Jun to Sep is the period when bike demand is high. The Month Jan is the lowest demand month.
- Bike demand is less in holidays in comparison to not being holiday.
- The demand of bike is almost similar throughout the weekdays.
- There is no significant change in bike demand with working day and non working day.
- The bike demand is high when weather is clear and Few clouds however demand is less in case of Lightsnow and light rainfall. We do not have any dat for Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog , so we can not derive any conclusion. May be the company is not operating on those days or there is no demand of bike.

Q2. Why is it important to use drop_first=True during dummy variable creation?

Answer:

drop_first=True is important to use, as it helps in reducing the extra column created during dummy variable creation.

Q3. Looking at the pair-plot among the numerical variables, which one has the highest correlation with the target variable?

Answer:

From the Pairplot we could observe that, temp has highest positive correlation with target variable cnt.

Q4. How did you validate the assumptions of Linear Regression after building the model on the training set?

Answer:

Two step model upadation hapenned in the above step.

loop-1: highest pvalue in the model; mnth_may : 0.054. As the pvalue is >0.05 it is insignificant for the model, so mnth_may is dropped and model updated.

loop-2: highest pvalue in the mdoel; mnth_aug : 0.056. As the pvalue is >0.05 it is insignificant for the model, so mnth_aug is dropped and model updated.

pvalues for all the varibles are < 0.05 so we will look for summary and VIF of model lm_1.

Q5. Based on the final model, which are the top 3 features contributing significantly towards explaining the demand of the shared bikes?

Answer:

Based on final model top three features contributing significantly towards explaining the demand are:

1. Temperature (0.552)
2. weathersit : Light Snow, Light Rain + Thunderstorm + Scattered clouds, Light Rain + Scattered clouds (-0.264)
3. year (0.256)

General Subjective Questions

Q1. Explain the linear regression algorithm in detail.

Answer:

Linear Regression Algorithm is a machine learning algorithm based on supervised learning. We have covered supervised learning in our previous articles. Here we are going to focus on Linear regression. Linear regression is a part of regression analysis. Regression analysis is a technique of predictive modelling that helps you to find out the relationship between Input and the target variable.

Regression analysis is used for three types of applications:

1. Finding out the effect of Input variables on Target variable.
2. Finding out the change in Target variable with respect to one or more input variable.
3. To find out upcoming trends.

Here are the types of regressions:

1. Linear Regression
2. Multiple Linear Regression
3. Logistic Regression
4. Polynomial Regression

Q2. Explain the Anscombe's quartet in detail.

Answer:

Anscombe's Quartet can be defined as a group of four data sets which are nearly identical in simple descriptive statistics, but there are some peculiarities in the dataset that fools the regression model if built. They have very different distributions and appear differently when plotted on scatter plots.

The quartet is still often used to illustrate the importance of looking at a set of data graphically before starting to analyze according to a particular type of relationship, and the inadequacy of basic statistic properties for describing realistic datasets
It is not known how Anscombe created his datasets. Since its publication, several methods to generate similar data sets with identical statistics and dissimilar graphics have been developed.One of these, the Datasaurus Dozen, consists of points tracing out the outline of a dinosaur, plus twelve other data sets that have the same summary statistics.
Anscombe's quartet highlights the importance of plotting data to confirm the validity of the model fit. In each panel, the Pearson correlation between the x and y values is the same, r = . 816. In fact, the four different data sets are also equal in terms of the mean and variance of the x and y values.

Q3. What is Pearson's R?

Answer:

Pearson's correlation coefficient is the covariance of the two variables divided by the product of their standard deviations. The form of the definition involves a "product moment", that is, the mean (the first moment about the origin) of the product of the mean-adjusted random variables; hence the modifier product-moment in the name.

Pearson's correlation coefficient, when applied to a population, is commonly represented by the Greek letter ρ (rho) and may be referred to as the population correlation coefficient or the population Pearson correlation coefficient.[10] Given a pair of random variables (X,Y), the formula ρ is:

The Pearson's correlation coefficient varies between -1 and +1 where:

r = 1 means the data is perfectly linear with a positive slope (i.e., both variables tend to change in the same direction)
r = -1 means the data is perfectly linear with a negative slope (i.e., both variables tend to change in different directions)
r = 0 means there is no linear association
r > 0 < 5 means there is a weak association
r > 5 < 8 means there is a moderate association
r > 8 means there is a strong association

Q4. What is scaling? Why is scaling performed? What is the difference between normalized scaling
and standardized scaling?

Answer:

What?

It is a step of data Pre-Processing which is applied to independent variables to normalize the data within a particular range. It also helps in speeding up the calculations in an algorithm.

Why?

Most of the times, collected data set contains features highly varying in magnitudes, units and range. If scaling is not done then algorithm only takes magnitude in account and not units hence incorrect modelling. To solve this issue, we have to do scaling to bring all the variables to the same level of magnitude.

It is important to note that scaling just affects the coefficients and none of the other parameters like t-statistic, F-statistic, p-values, R-squared, etc.

Normalization/Min-Max Scaling:

- It brings all of the data in the range of 0 and

1. sklearn.preprocessing.MinMaxScaler helps to implement normalization in python.

- $$\text{MinMax Scaling: } x = \frac{x - min(x)}{max(x) - min(x)}$$

Standardization Scaling:

- Standardization replaces the values by their Z scores. It brings all of the data into a standard normal distribution which has mean (μ) zero and standard deviation one (σ).

$$\text{Standardisation: } x = \frac{x - mean(x)}{sd(x)}$$

- sklearn.preprocessing.scale helps to implement standardization in python.
- One disadvantage of normalization over standardization is that it loses some information in the data, especially about outliers.

Q5. You might have observed that sometimes the value of VIF is infinite. Why does this happen?

Answer:

If there is perfect correlation, then VIF = infinity. This shows a perfect correlation between two independent variables. In the case of perfect correlation, we get R2 =1, which lead to 1/(1-R2) infinity. To solve this problem we need to drop one of the variables from the dataset which is causing this perfect multicollinearity.

An infinite VIF value indicates that the corresponding variable may be expressed exactly by a linear combination of other variables (which show an infinite VIF as well).

Q6. What is a Q-Q plot? Explain the use and importance of a Q-Q plot in linear regression.

Answer

Quantile-Quantile (Q-Q) plot, is a graphical tool to help us assess if a set of data plausibly came from some theoretical distribution such as a Normal, exponential or Uniform distribution. Also, it helps to determine if two data sets come from populations with a common distribution.

This helps in a scenario of linear regression when we have training and test data set received separately and then we can confirm using Q-Q plot that both the data sets are from populations with same distributions.

Few advantages:

a) It can be used with sample sizes also

b) Many distributional aspects like shifts in location, shifts in scale, changes in symmetry, and the presence of outliers can all be detected from this plot.

It is used to check following scenarios:

If two data sets —

i. come from populations with a common distribution

ii. have common location and scale

iii. have similar distributional shapes

iv. have similar tail behavior

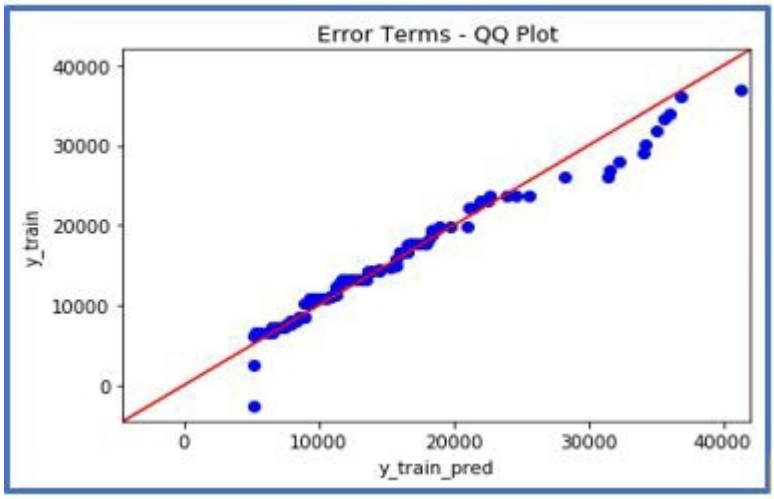
Interpretation:

A q-q plot is a plot of the quantiles of the first data set against the quantiles of the second data set.

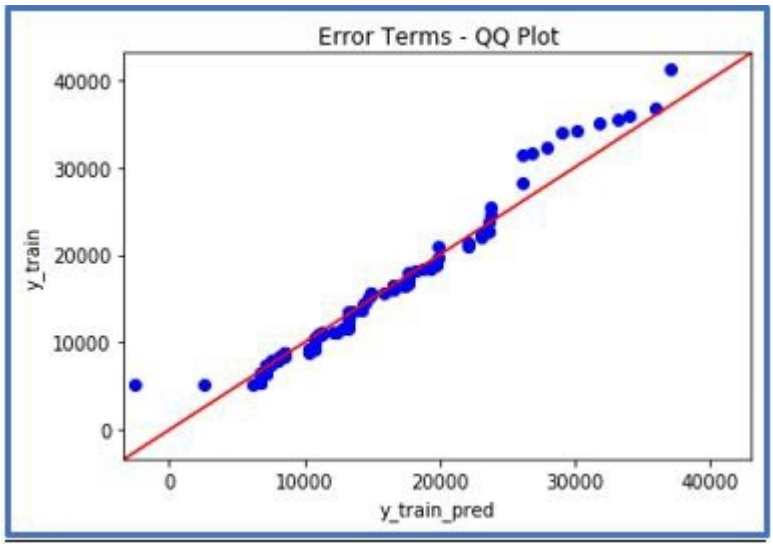
Below are the possible interpretations for two data sets.

a) Similar distribution: If all point of quantiles lies on or close to straight line at an angle of 45 degree from x -axis

b) Y-values < X-values: If y-quantiles are lower than the x-quantiles.



c) X-values < Y-values: If x-quantiles are lower than the y-quantiles.



d) Different distribution: If all point of quantiles lies away from the straight line at an angle of 45 degree from x -axis