CAPSTONE PROJECT

Bike Sharing Demand Prediction

TEAM MEMBERS

Aditya Tadas

Nikhil Machave

Aishwarya Methe

CONTENT

- BUSINESS UNDERSTANDING
- DATA SUMMARY
- FEATURE ANALYSIS
- FEATURE ENGINEERING
- EXPLORATORY DATA ANALYSIS
- DATA CLEANING
- DATA PREPROCESSING
- IMPLIMENTING ALGORITHEMS
- CHALLENGES
- CONCLUSIONS

BUSINESS UNDERSTANDING

- Bike rentals services are often use by the peoples now a days hence this business becomes more popular having relatively cheaper rates also ease to pick up and drop at own convenience is one of the best thing to make business popular and profitable.
- It is mostly use by the people having no vehicles and having schedule to travel daily for there work and other related things.
- Bike rentals services are also often use for vacations day to travel for a long distance also minimize time and avoid congested public transport .
- For that reasons it is essential to have suppy of no. of bikes at different locations,to fulfill the demand.
- Our goal for these project is to predict suppy of bike count according to certain conditions to meet the demand of the bikes for business Profitability.

DATA SUMMARY

	Date	Rented Bike Count	Hour	Temperature(°C)	Humidity(%)	Wind speed (m/s)	Visibility (10m)	Dew point temperature(°C)	Solar Radiation (MJ/m2)	Rainfall(mm)	Snowfall (cm)	Seasons	Holiday	Functioning Day
0	01/12/2017	254	0	-5.2	37	2.2	2000	-17.6	0.0	0.0	0.0	Winter	No Holiday	Yes
1	01/12/2017	204	1	-5.5	38	0.8	2000	-17.6	0.0	0.0	0.0	Winter	No Holiday	Yes
2	01/12/2017	173	2	-6.0	39	1.0	2000	-17.7	0.0	0.0	0.0	Winter	No Holiday	Yes
3	01/12/2017	107	3	-6.2	40	0.9	2000	-17.6	0.0	0.0	0.0	Winter	No Holiday	Yes
4	01/12/2017	78	4	-6.0	36	2.3	2000	-18.6	0.0	0.0	0.0	Winter	No Holiday	Yes

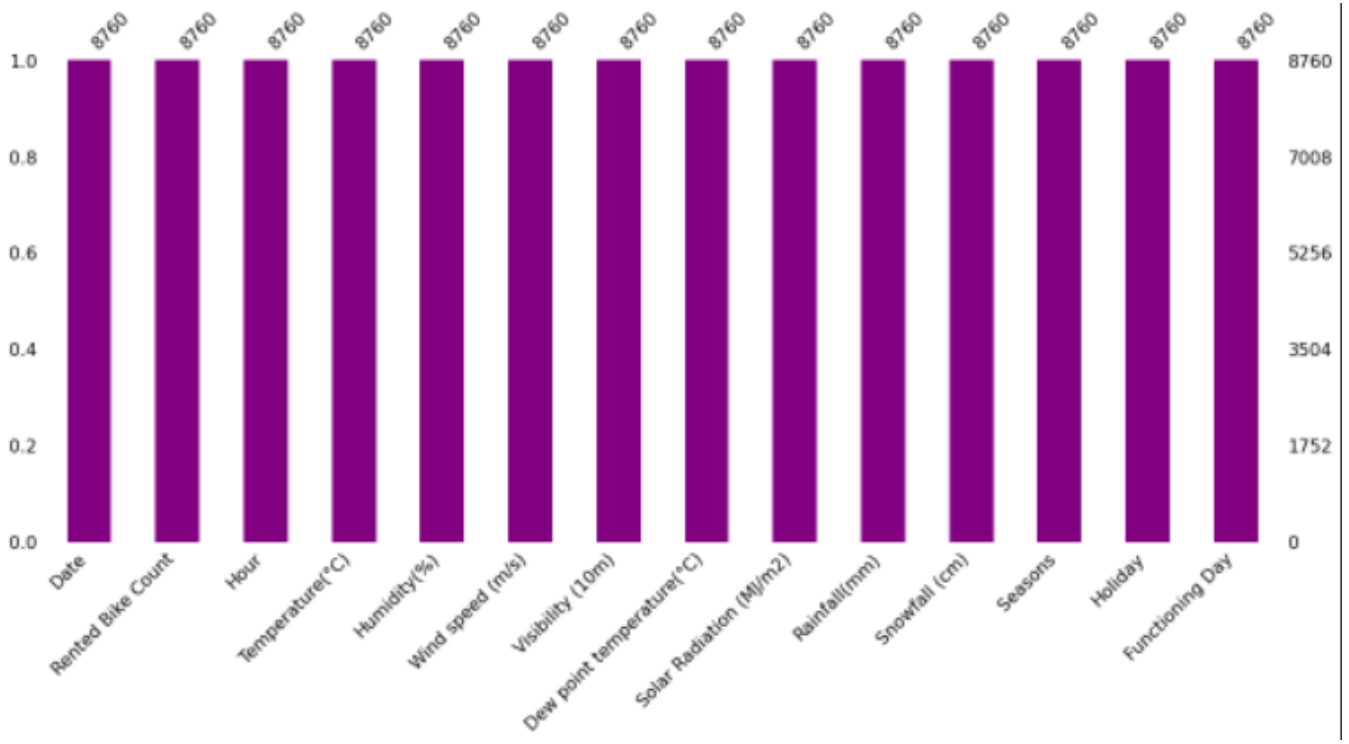
- Here We have Data Summary of our data Which shoes that these dataset contains 8760 Rows and 14 Columns.
- Three Categorical Features ‘Seasons’, ’Holiday’, and ‘Functioning Day’.
- One Date Time Feature “Date”.
- Also we have some numerical variables such as Temperature ,Humidity, Wind Speed, Visibility, Solar Radiation, Rainfall, Snowfall which tells us how environmental coditions affects Rental Bike Count.

Feature Analysis

- Date : year-month-day
- Rented Bike count - Count of bikes rented at each hour
- Hour - Hour of he day
- Temperature-Temperature in Celsius
- Humidity - %
- Windspeed - m/s
- Visibility - 10m
- Dew point temperature - Celsius
- Solar radiation - MJ/m2
- Rainfall - mm
- Snowfall - cm
- Seasons - Winter, Spring, Summer, Autumn
- Holiday - Holiday/No holiday
- Functional Day - NoFunc(Non Functional Hours), Fun(Functional hours)

INSIGHTS FROM OUR DATASET

- There are No missing values present in out dataset.
- There are No duplicates value present in our dataset.
- There are No Null values in out dataset.



FEATURE ENGINEERING

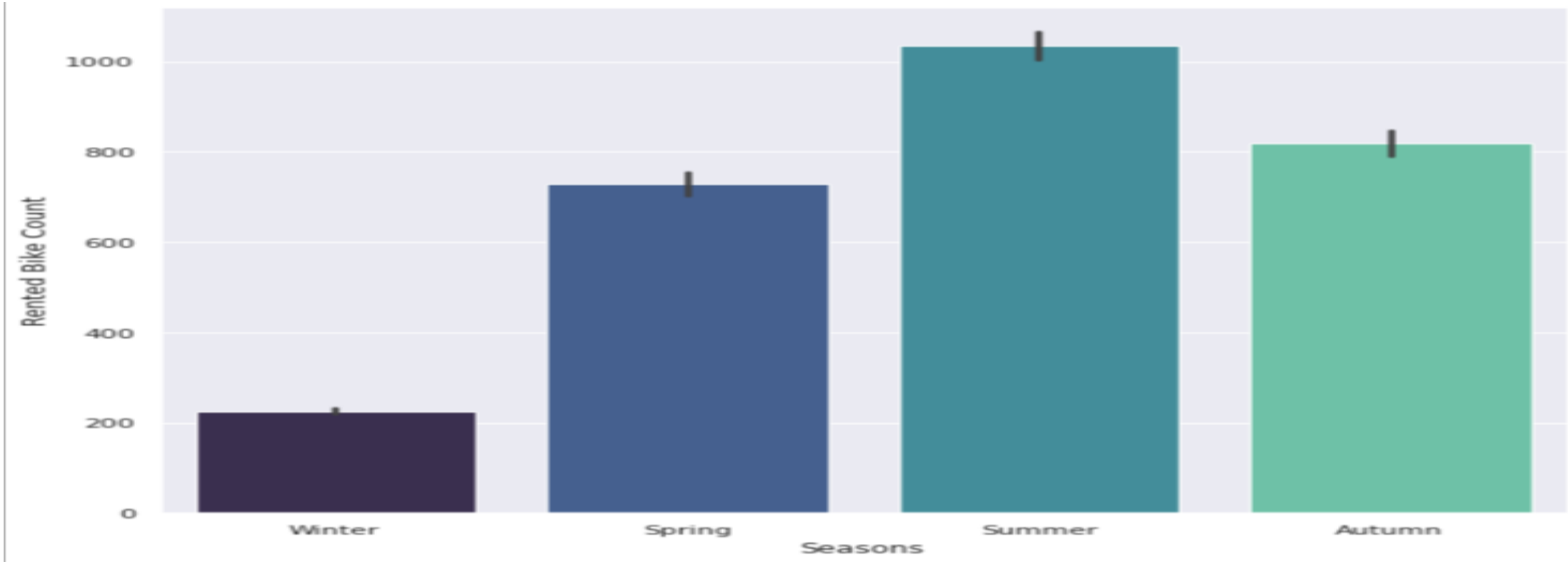
- We convert Date column into three different column i.e ‘year’, ’month,’ ‘Weeekday.
- We replace month number in words for understanding.

i.e 'Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec'

- We replace Day of week into into numbers i.e

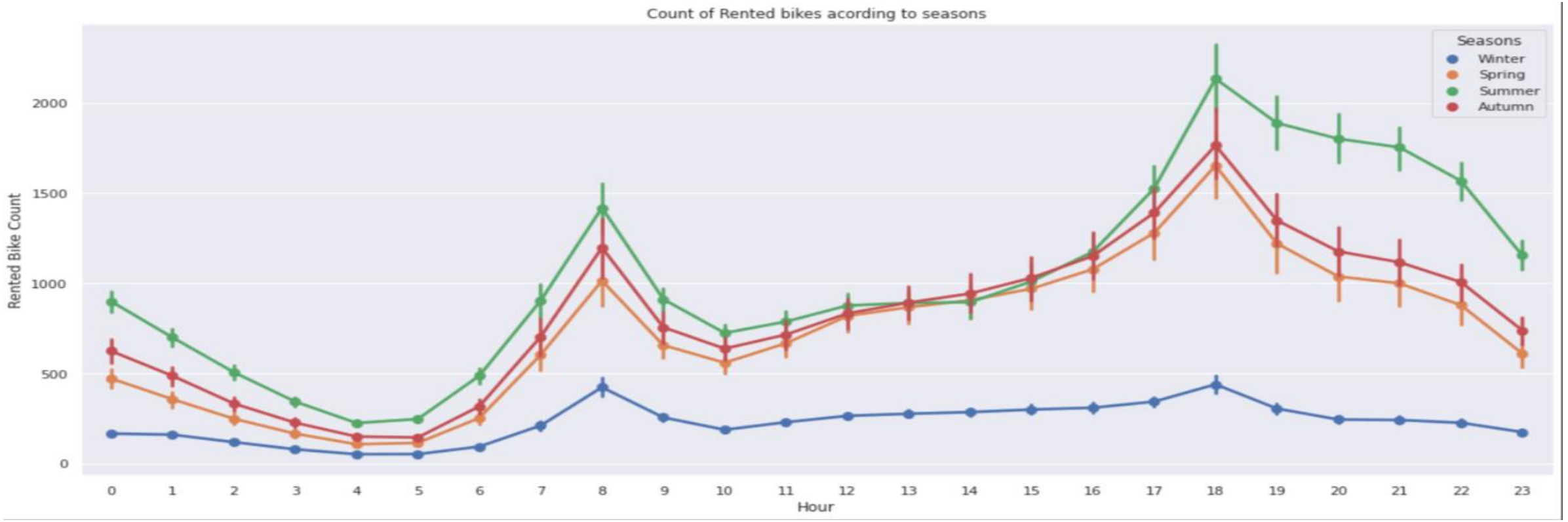
'Mon','Tues','Wed','Thur','Fri','Sat','Sun'

ANALYSIS OF SEASONS VARIABLE



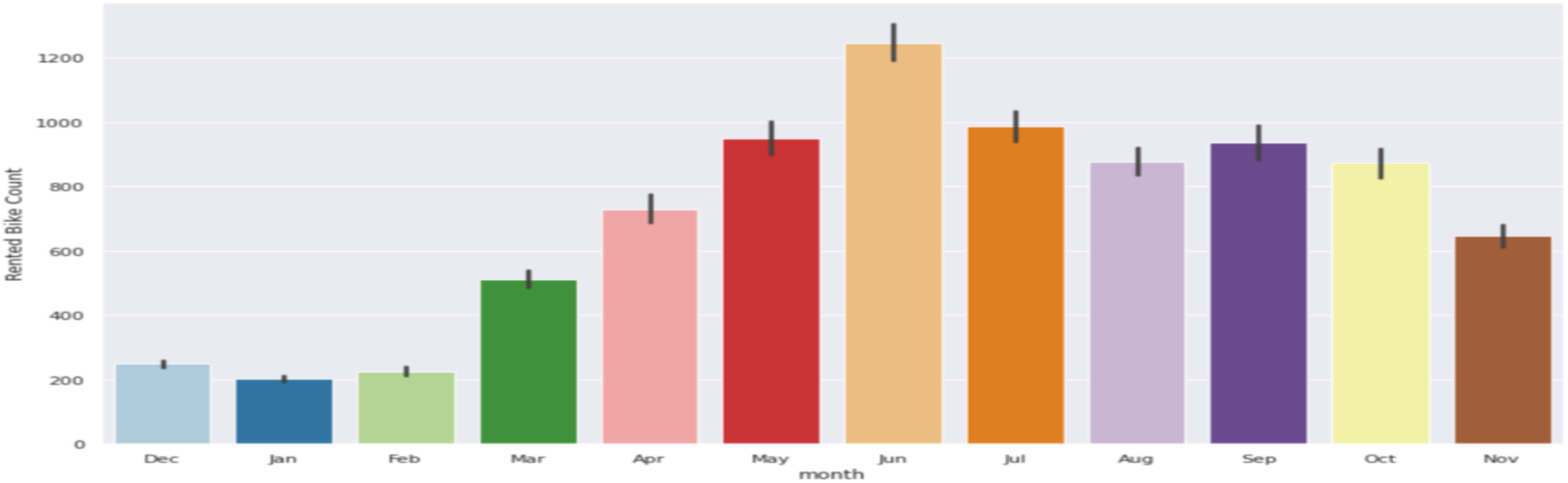
- Above Bar plot shaows that seasone wise distribution of rented bike counts.
- We can see that rented bike counts are maximum in summer season and it is miniumum in winter season.
- The spring and Autumn season has same rented bike counts.

ANALYSIS OF SEASONS VARIABLE WITH RESPECT TO HOUR VARIABLE



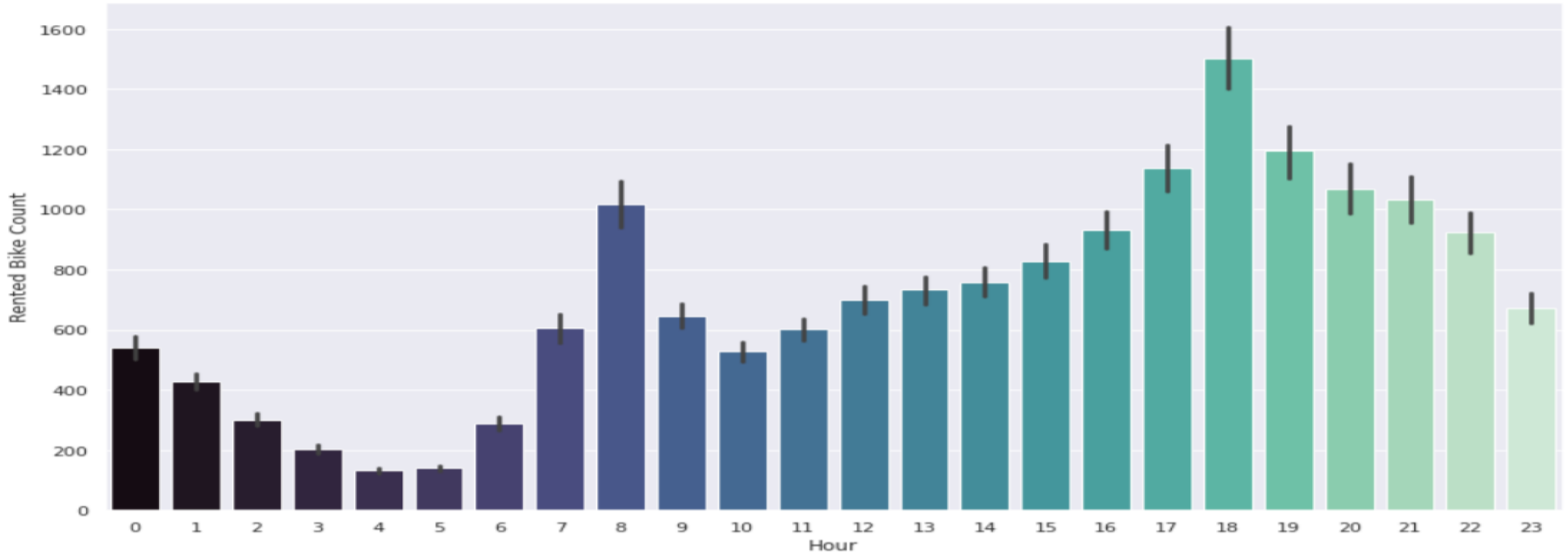
- Above line plot shows rented bike counts in seasons with respect to hours.
- From the above visualization we can clearly see that maximum rented bike counts have a high fluctuation in between 5 am to 8 am also in between 5 pm to 7 pm so most people have rented the bikes in between these two time intervals.

ANALYSIS OF MONTH VARIABLE



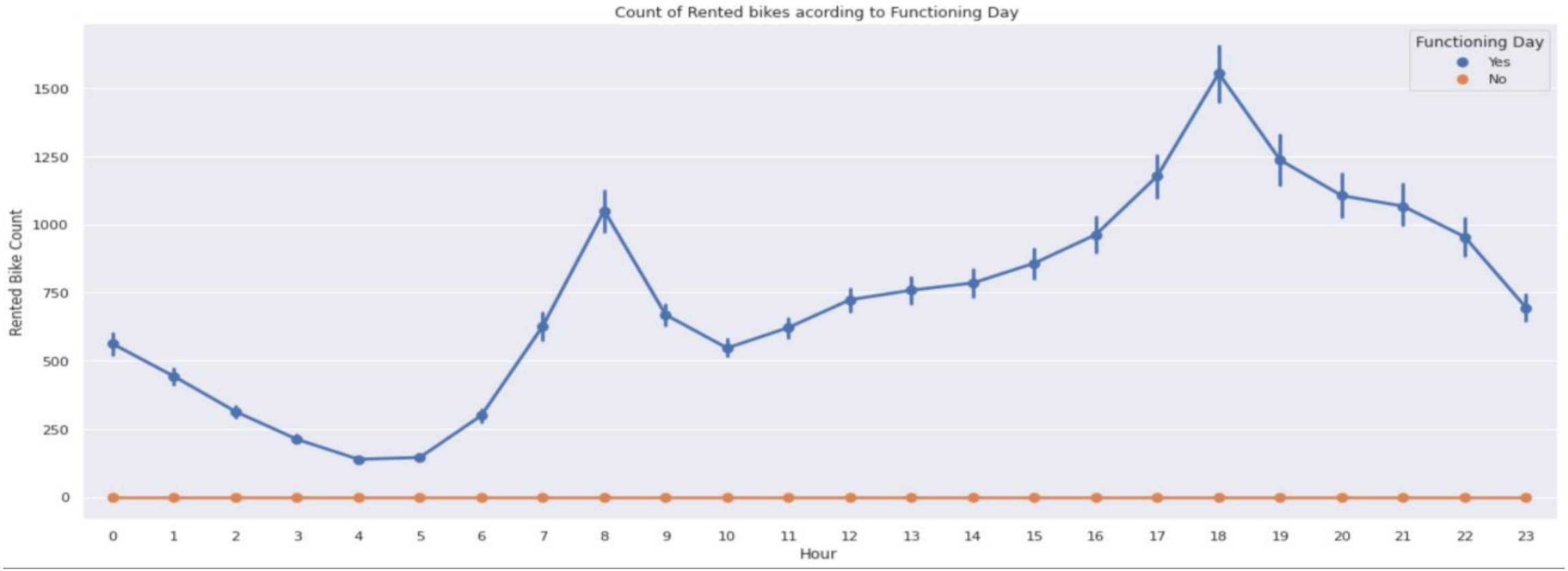
- In the above Bar plot as we can see that maximum bikes are rented in May , June , July months.
- Intermidiate bikes are rented in August , September and Octomber months.
- And there are comparatively minimum bikes are rented in December , January , Februwari and November Months.

ANALYSIS OF HOUR VARIABLE



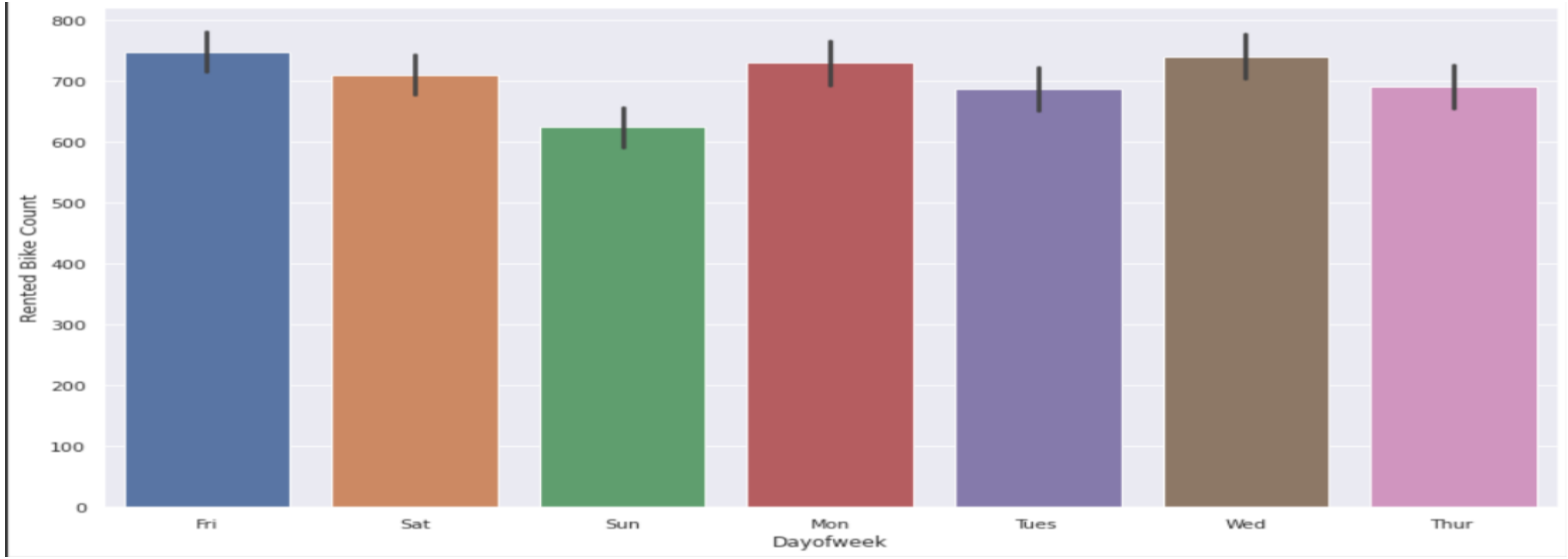
- As we can see in the following bar plot more bikes are rented in the time interval of 7 am to 9 am and 5 pm to 8 pm probably the people rented more bike to reach at office and to come to the residual place from the office
- Also we have minimum bikes are rented in between 1 am to 5 am .

ANALYSIS OF FUNCTION DAY VARIABLE WITH RESPECT TO HOUR



- As we can see in the above line plot when there is no function day peoples are not prefer to rent bikes.
- Though when there is a function day we can see the high pick in between 6 am to 9 am as well as in between 5 pm to 8 pm.

ANALYSIS OF DAY OF WEEK VARIABLE

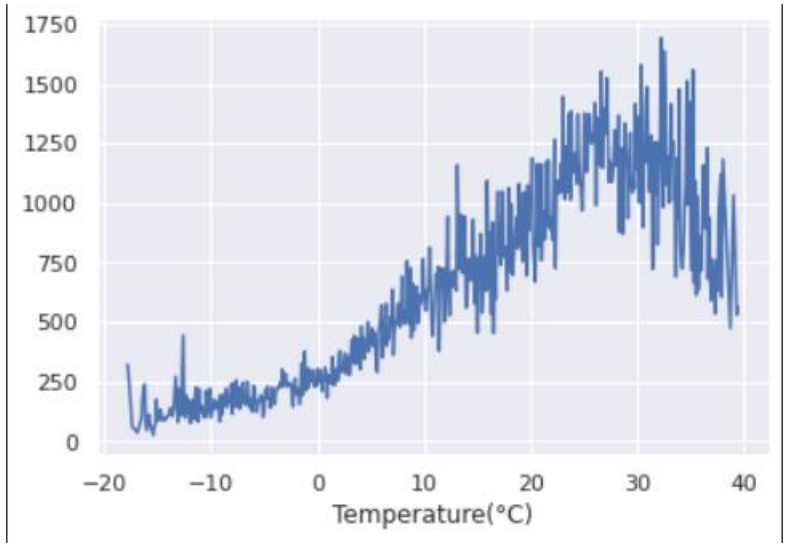


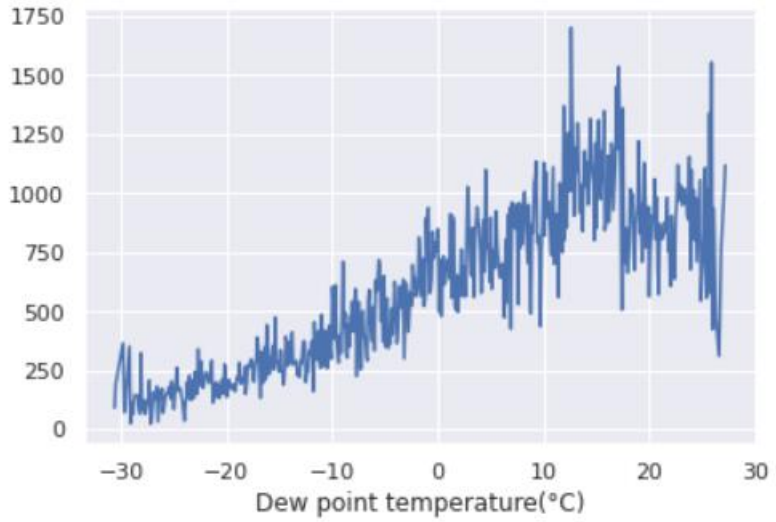
- As we can see in the following bar plot of day wise distribution of rented bike counts we can conclude that on the weekend day we have minimum bike rented as compared to weekday,

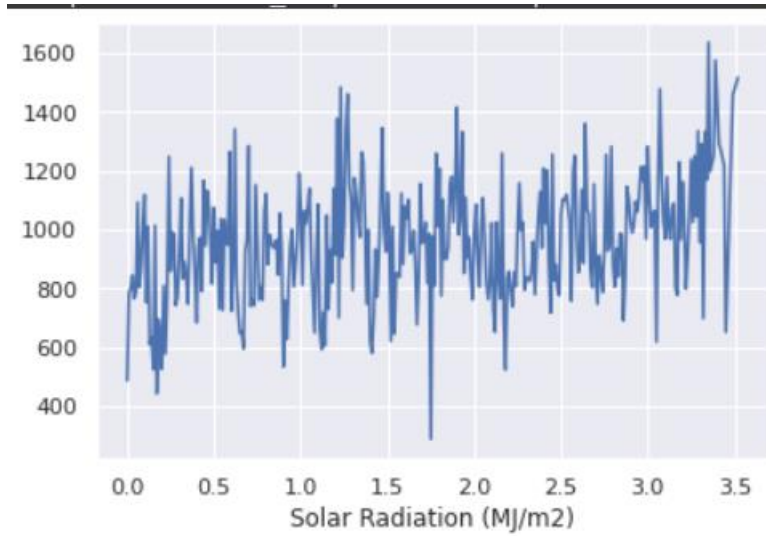
ANALYSIS OF HOLIDAY VARIABLE WITH RESPECT TO HOUR

- In the following line plot we can see that when there is No Holiday peoples rented more bikes from 6 am to 9 am and 4 pm to 7 pm.
- But when there is Holiday most number of peoples have rented bikes in between 11 am to 4 pm.

NUMERICAL VARIABLE VS RENTED BIKE COUNTS

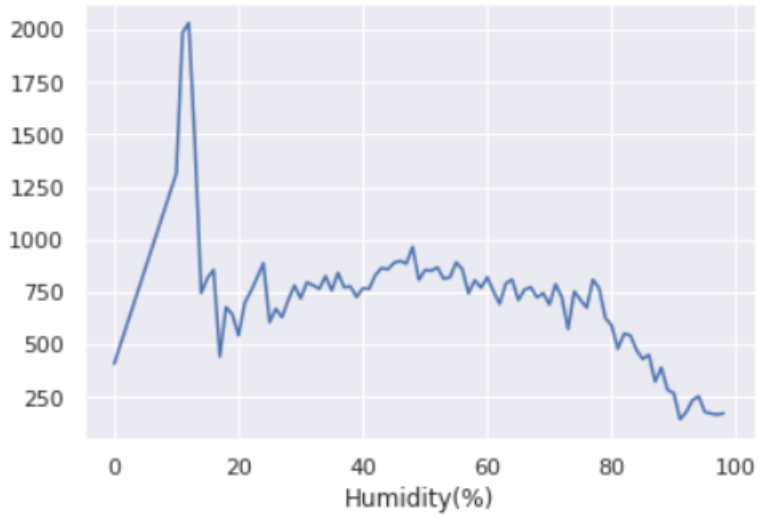


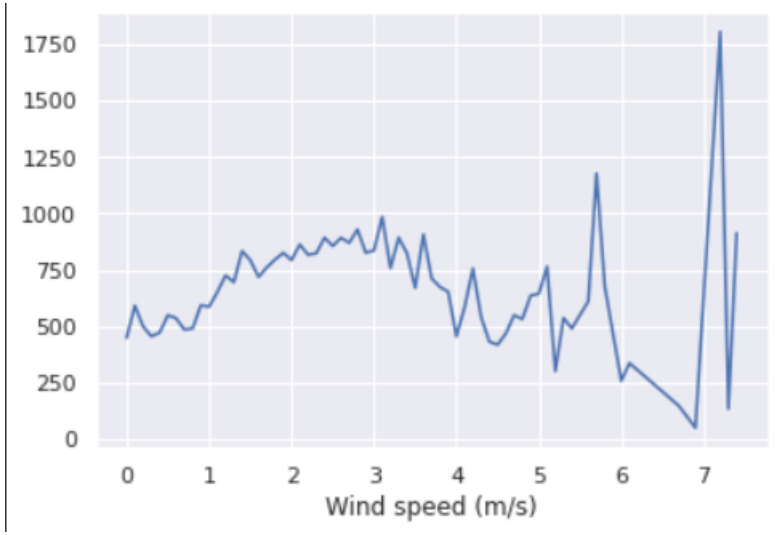


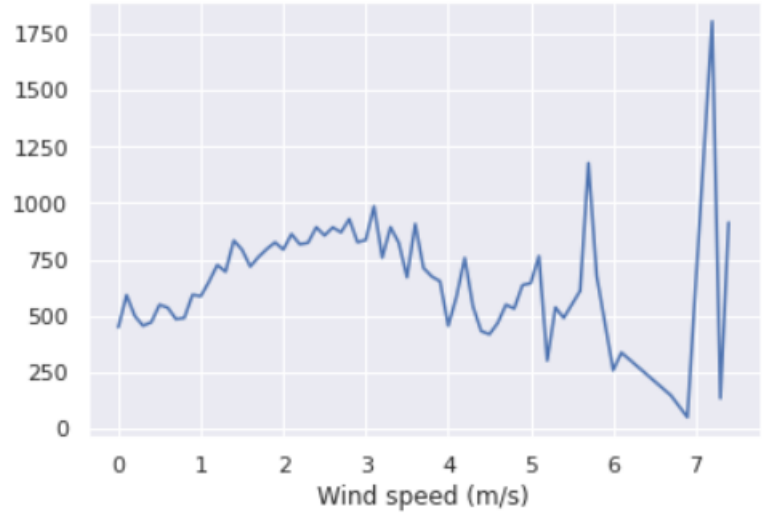


- As we can see that in the following graph No. of rented bike counts are gradualy increase as the temperture increses when the temperature lies in between 25 to 35 peoples have rented more bikes soo we can say that people prefer to rent a bikes when the temperature is normal.
- From a graph of dew point temperature also number of rented bikes incresess when the Deu point temperature increases and the rented bike counts re high se we have a 10 to 20 celcius temperature so we can say that people prefers to rent bikes when Deu point temperature is normal.
- Also from the graph of solar radiation we can say that the amout of rented bikes is huge when there is solar radiation the counter of rent is around 1000

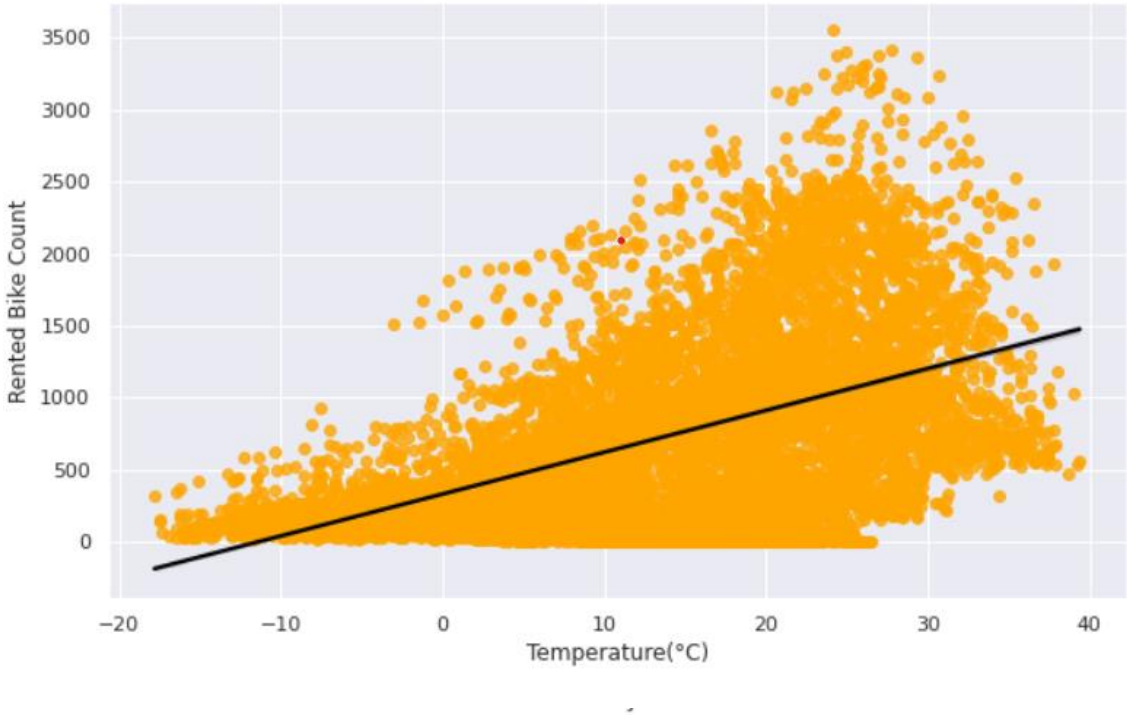
NUMERICAL VARIABLE VS RENTED BIKE COUNTS

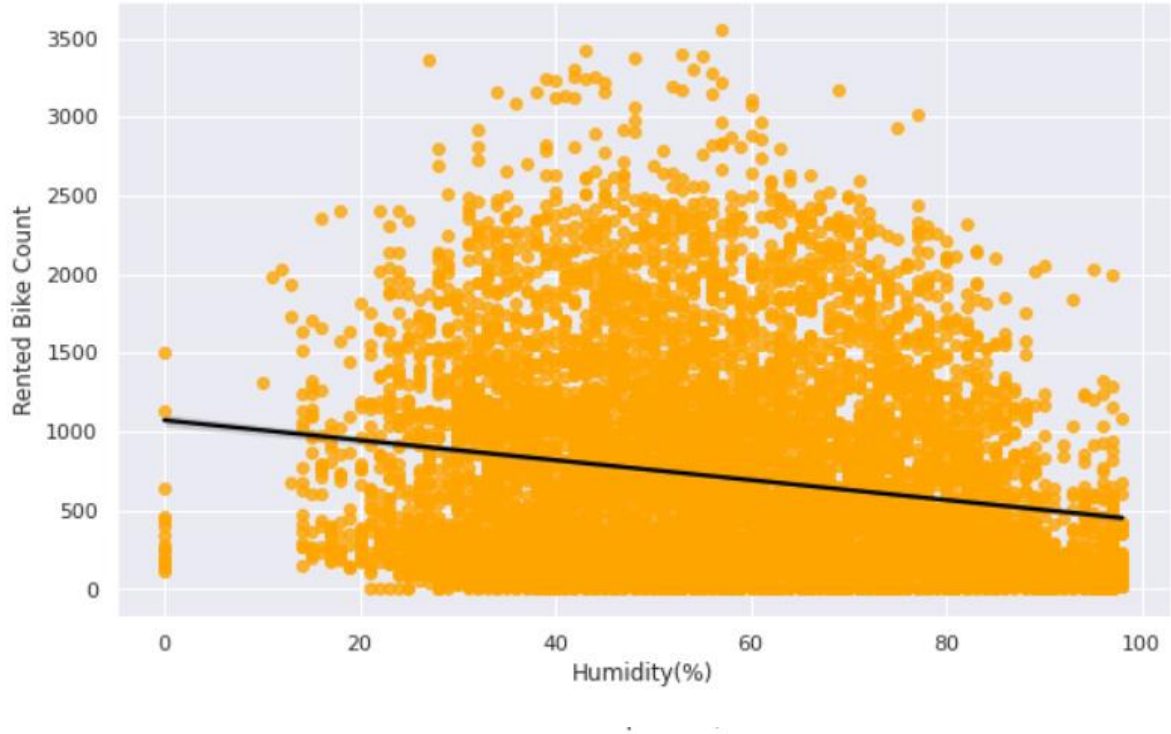


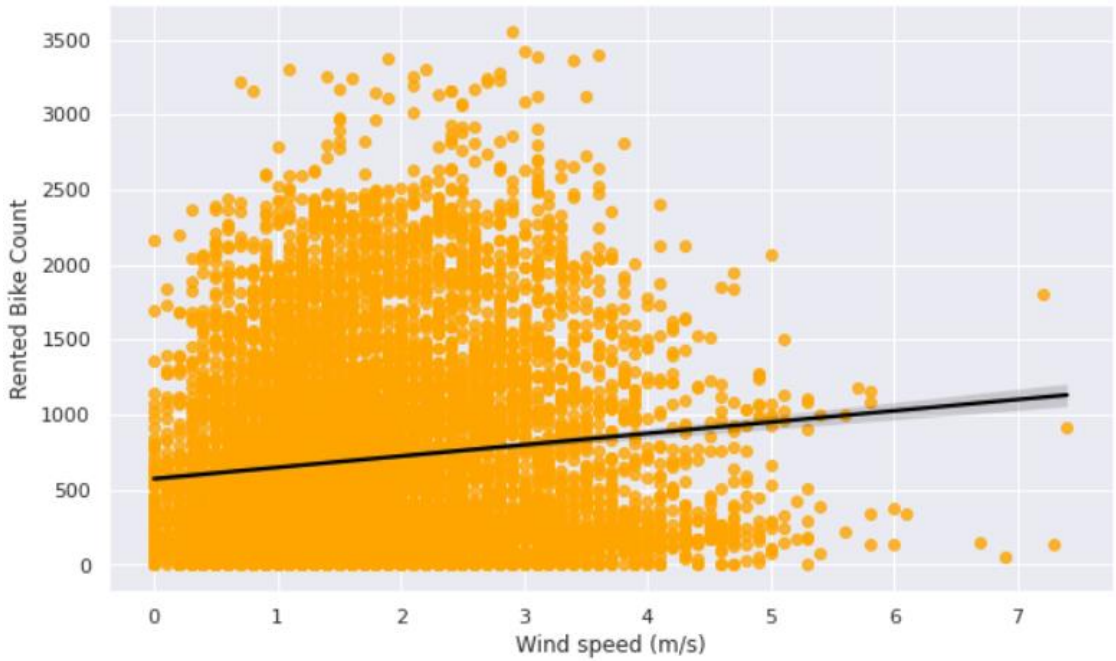


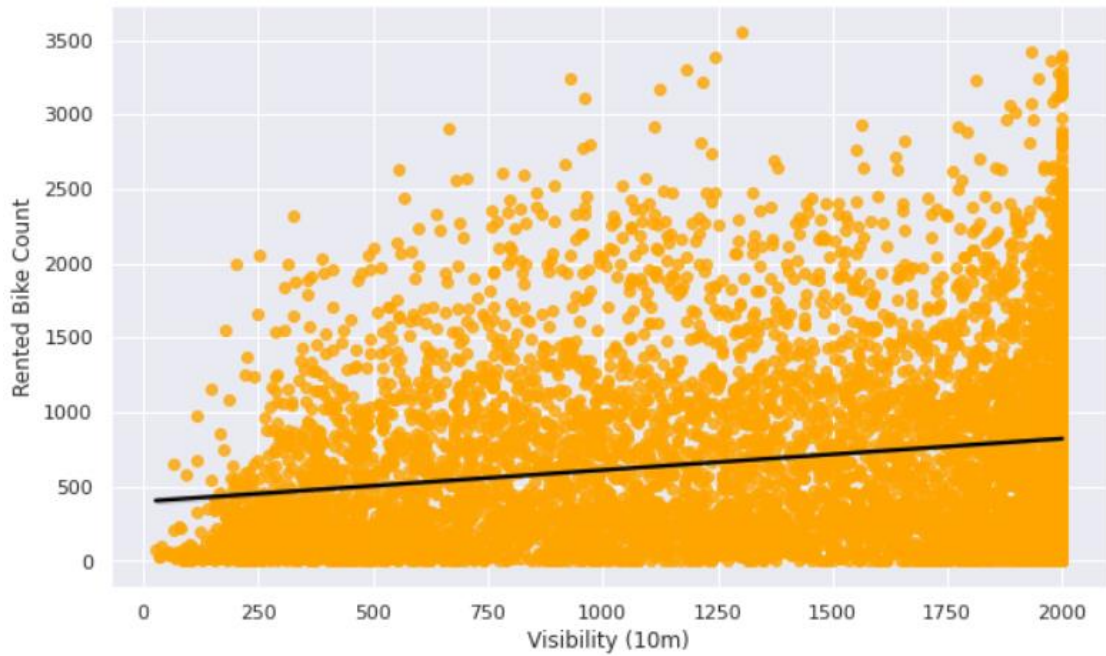


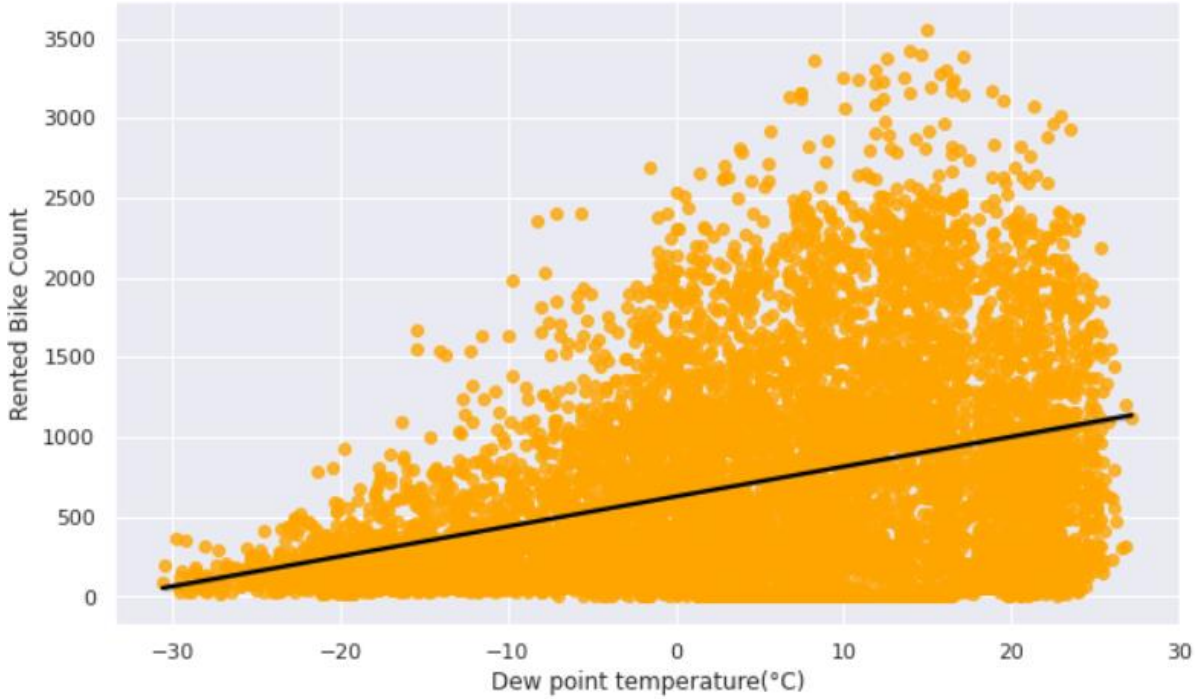
- Following graph of Humidity shows that when average humidity percentage is less 5 to 15 then most of the people rented bikes then as the average humidity percentage become incresses number of rented bike count decresses therefore we can say that most of the people rented bikes when the humidity percentage is less.
- Then we have Wind Speed graph it shows that when wind speed is about 5 to 6 then the number of rented bikes incresses
- Also when it becomes high upto 8 then we can see huge increase in number of rented bike counts therefore we can say that people prefer to rent a bike when the atmosphere is little windy.

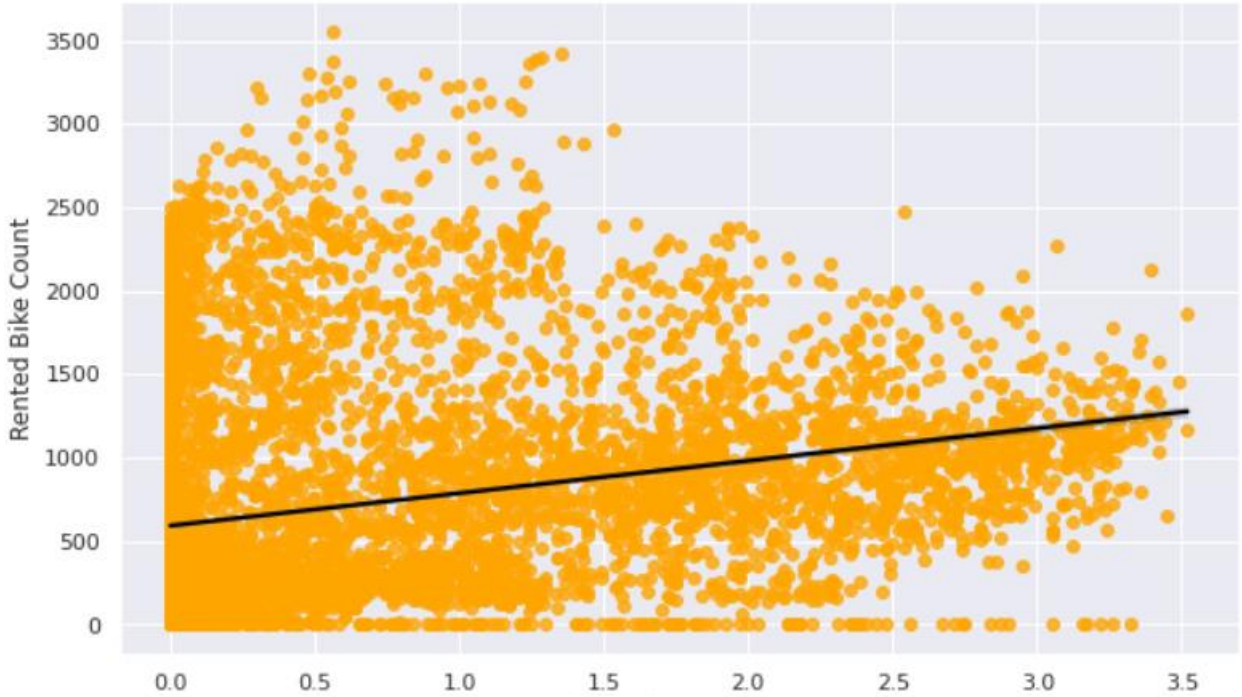

Rented Bike Count
Temperature(°C)

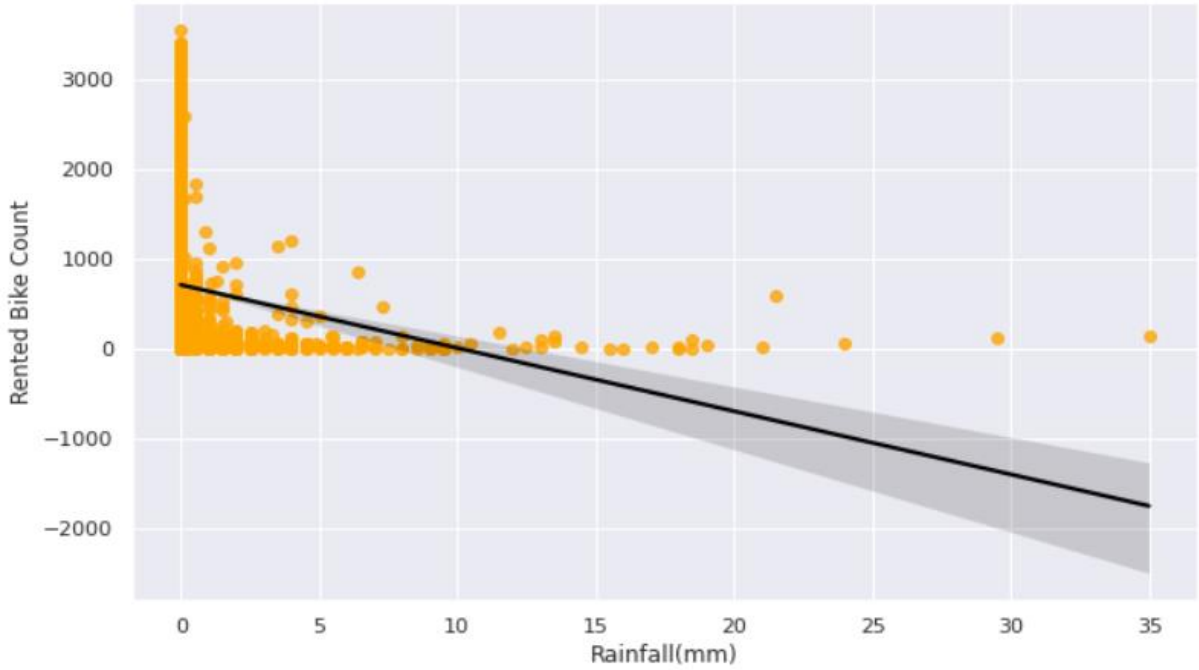

Rented Bike Count
Humidity(%)

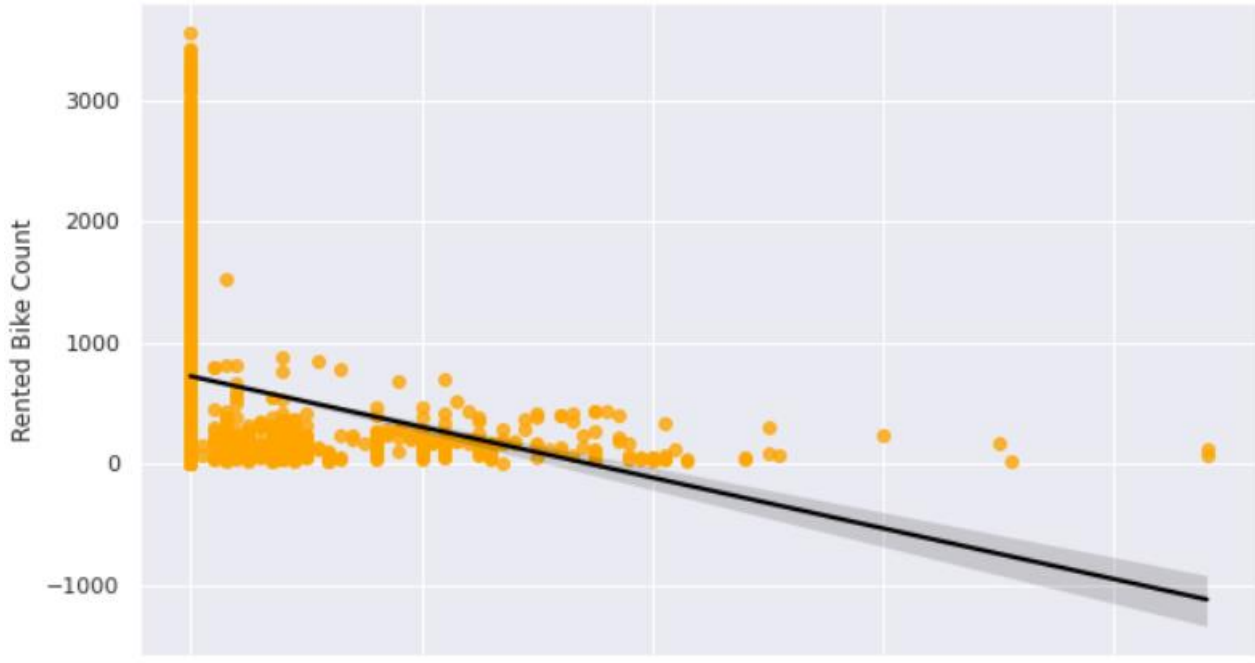

Rented Bike Count
Wind speed (m/s)


Rented Bike Count
Visibility (10m)


Rented Bike Count
Dew point temperature(°C)


Rented Bike Count

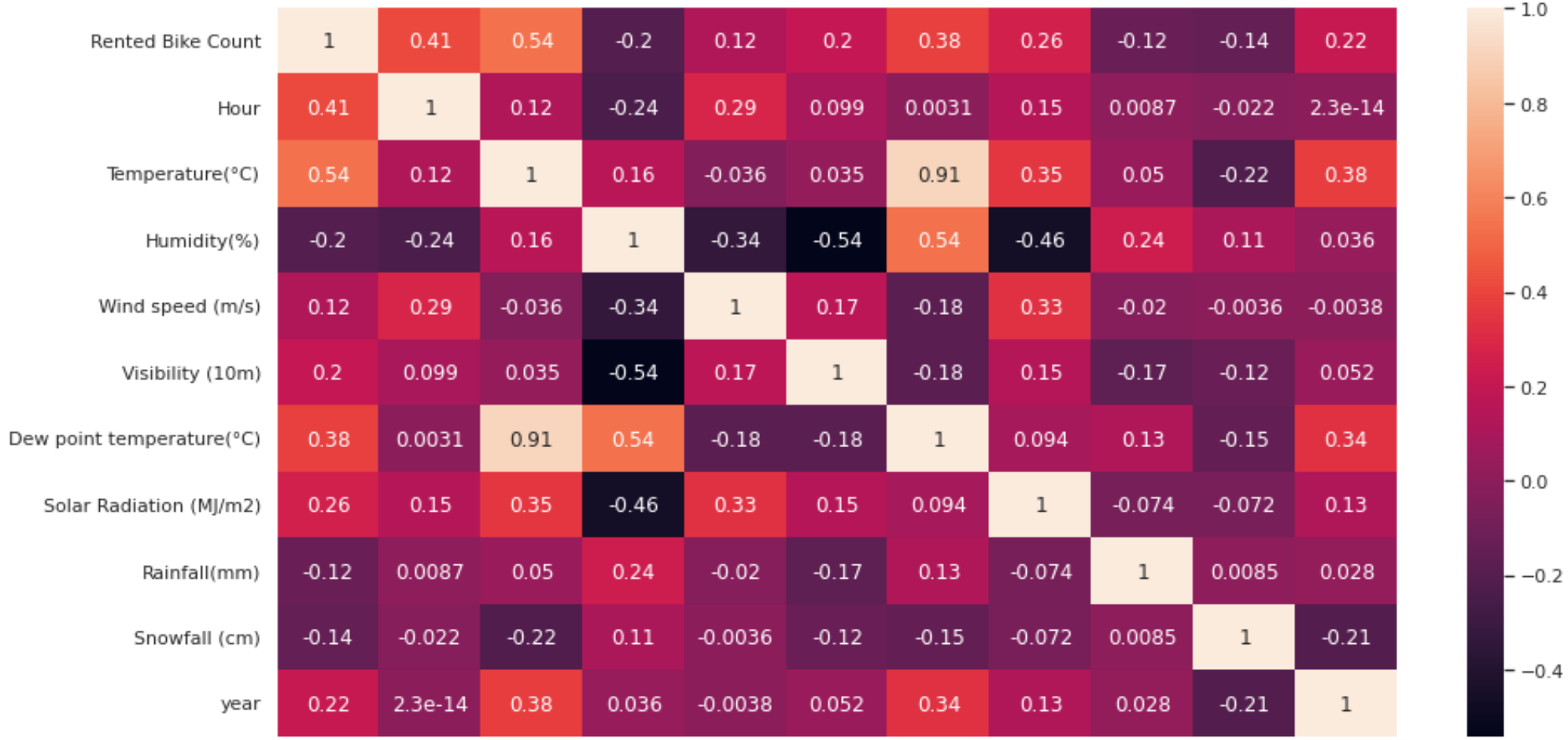

Rented Bike Count
Rainfall(mm)


Rented Bike Count

REGRESSION PLOT FOR NUMERICAL VARIABLES

- From the above regression plots we can observe that numerical features i.e ‘Temperature’, ‘Wind Speed’, ‘Visibility’ , ‘Dew Point Temperature’ , ‘Solar Radiation’ having positive relation to the target Variable.
- Which means as these feature values are increses there will be a increase in Rented Bike counts.
- Also there are some features having Negative relation to the target variables these features are ‘Rainfall’ , ‘Snow Fall’ , ‘Humidity’ as these features values are incresses Rented Bikes count Decresses.

CORRELATION PLOT



Insights From Correlation Plot

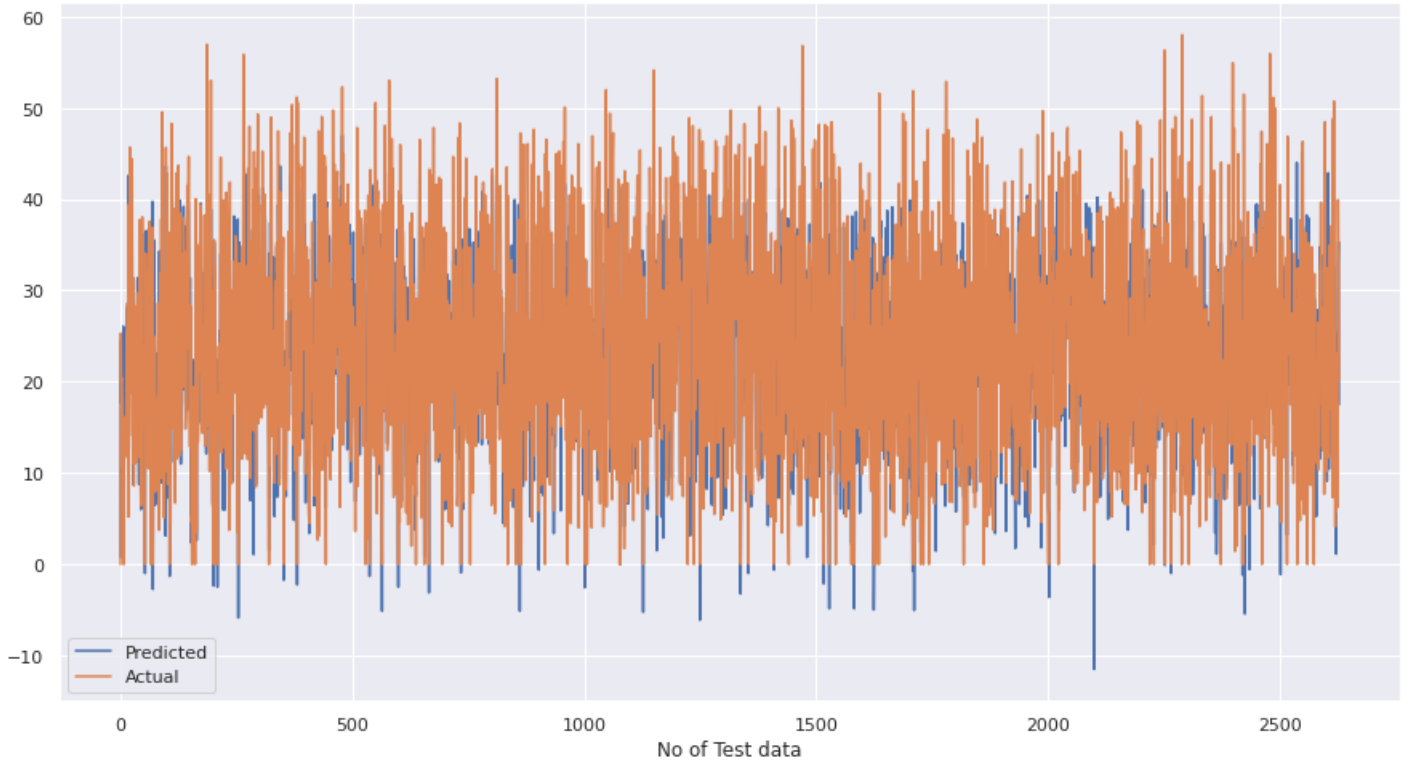
- Some features having high correlation with our target variable I.e ‘Temperature’ , ‘Hour’ , ‘ Dew Point Temperature’ these features more important while predicting rented bike counts.
- Some features having very low correltion with rented bike counts i.e ‘Rainfall’ , ‘Snow Fall’ .
- ‘Tempreture’ and ‘Due Point Tempreture’ are the high correlated variables with each it has a correlation of 0.91 hence we need to drop one of these variable because It leads to acts like a duplicate while we are training our machine learning model.

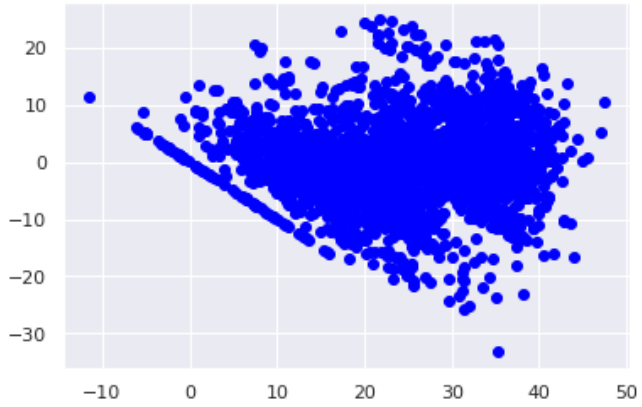
MODEL BUILDING

- LINEAR REGRESSION
- LASSO REGRESSION
- RIGDE REGRESSION
- DECISION TREE REGRESSOR
- GRADIENT BOSSTING REGRESSOR

LINEAR REGRESSOR

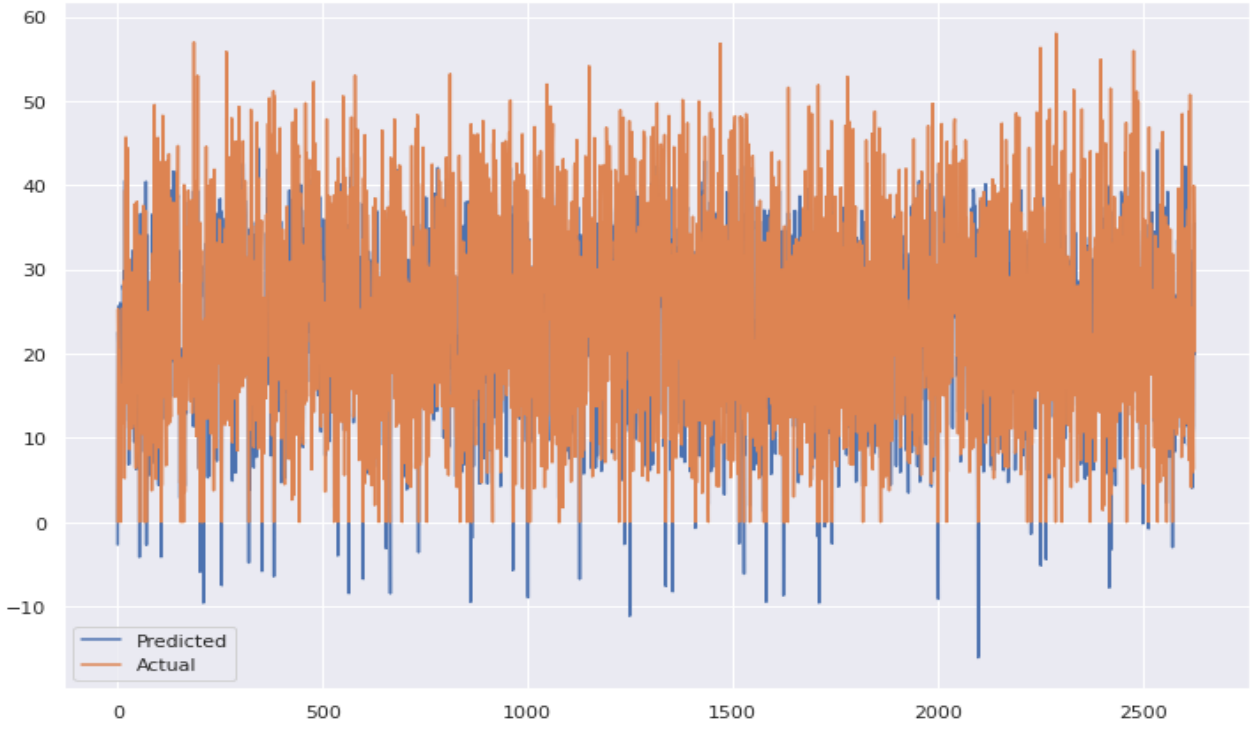
R2 - 0.673931

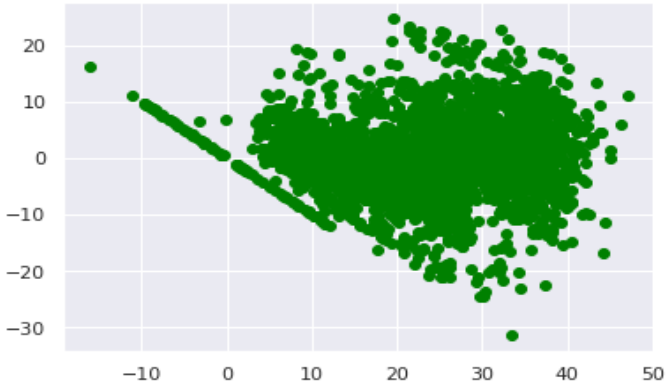




LASSO REGRESSOR

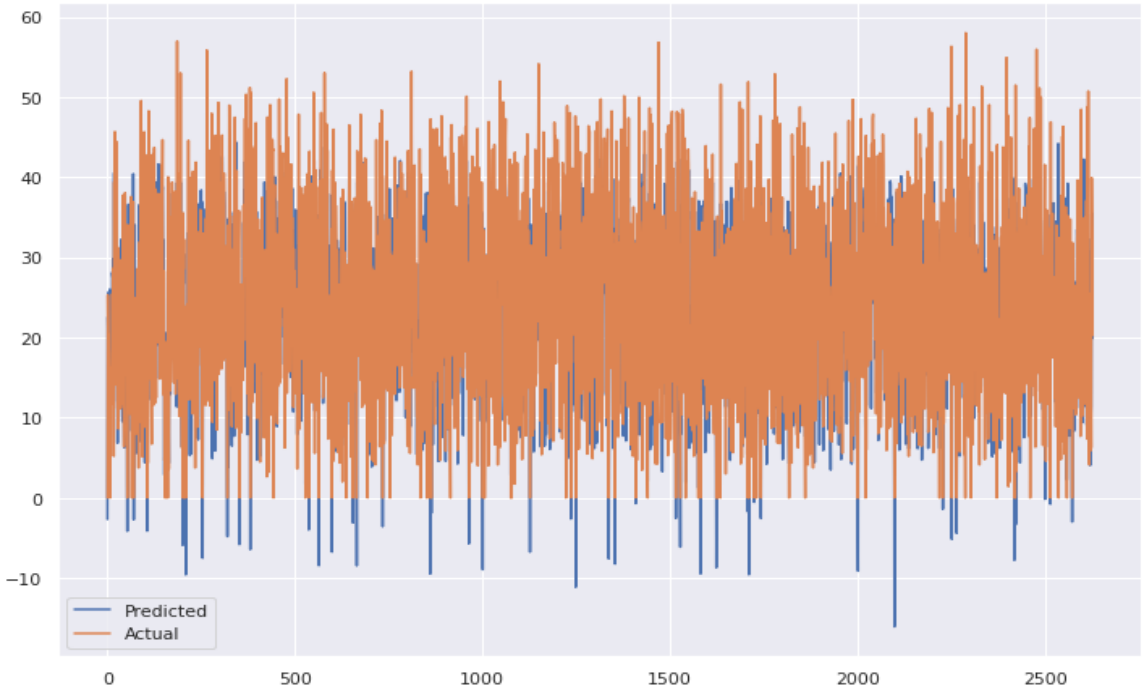
R2 - 0.674457

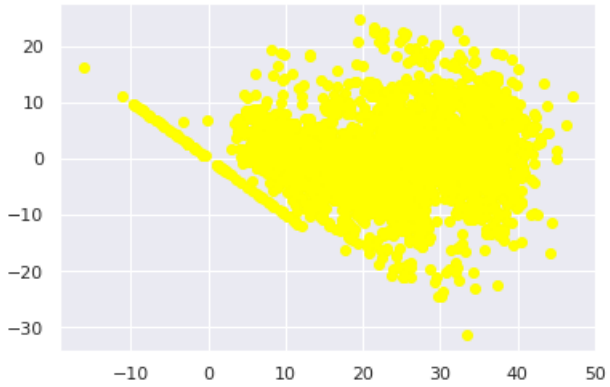




RIDGE REGRESSOR

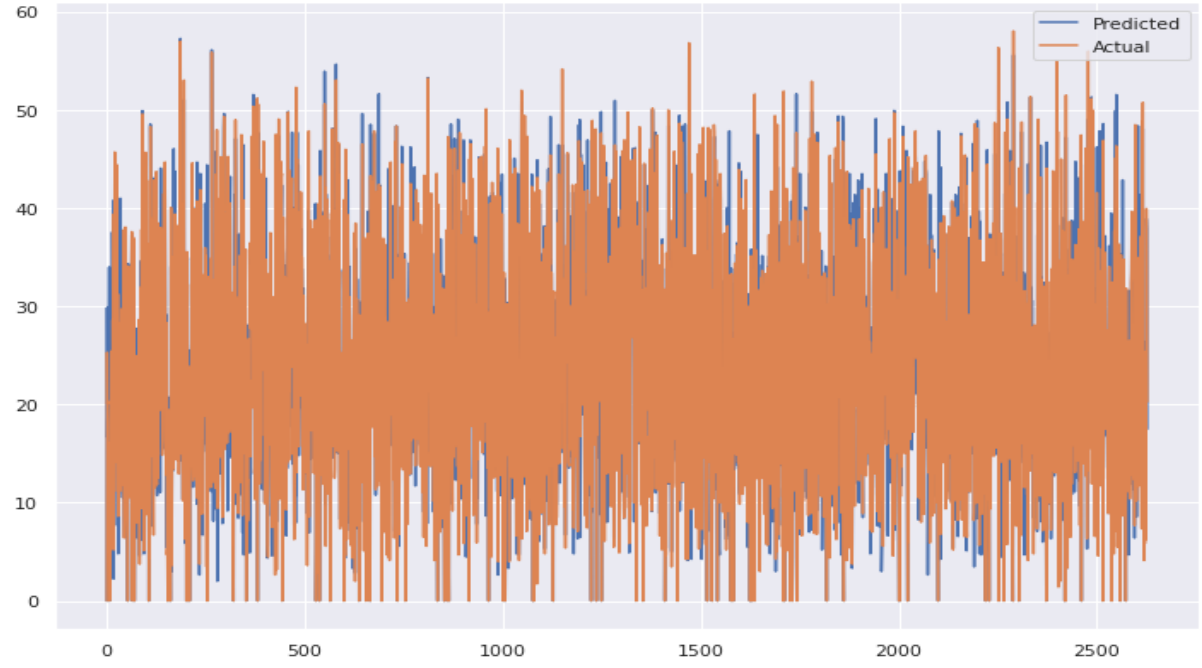
R2 - 0.874781





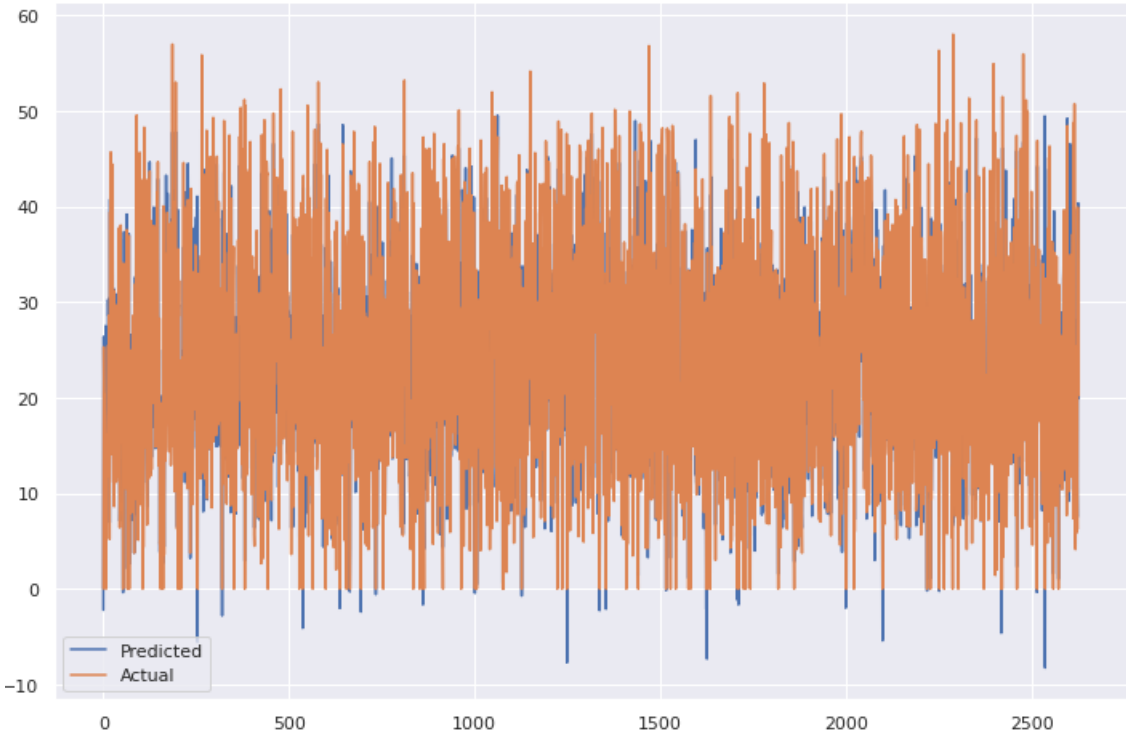
DECISION TREE REGRESSOR

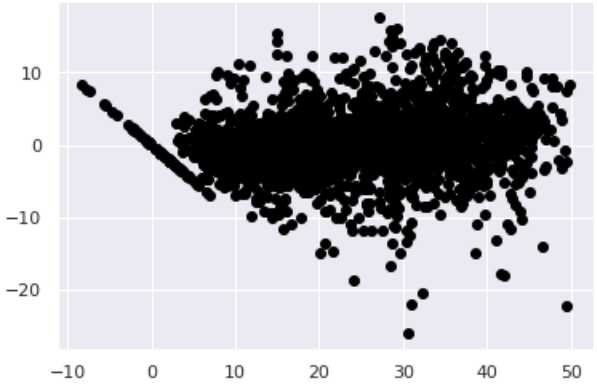
R2 - 0.886139



GRADIENT BOSTING REGRESSOR

R2 - 0.903222





REGRESSION MODELS AND ACCURACY

	REGRESSION MODELS NAME	R2 -SCORE
0	LINEAR REGRESSOR	0.673931
1	LASSO REGRESSOR	0.674457
2	RIDGE REGRESSOR	0.874781
3	DECISION TREE REGRESSOR	0.886139
4	GRADIENT BOOSTING REGRESSOR	0.903222

CHALLENGES FACED

- 1. Pre-processing the data was one of the challenges we faced which includes removing highly correlated variables from the data so as to not hinder the performance of our regression model.
- 2. Exploring all the columns and calculating VIF for multicollinearity was challenging because it might decrease the models performance.
- 3. Selecting the appropriate models to maximize the accuracy of our predictions was one of the challenges faced.

CONCLUSION

- EDA:

1. Demand for bikes got higher when the temperature and hour values were more.
2. Demand was high for low values of Humidity and solar radiation.
3. Demand was high during springs and summer and autumn and very low during winters.
4. Maximum bikes were rented in the year 2018
5. Count of rented bikes is high during no holiday and functioning day especially during office time.

Model Fitting Conclusion

1. From above its clear that Gradient Boosting regressor (CV) model is the best model for this dataset.
2. Decision tree Regressor and Gradient Boosting gridsearchcv gives the highest R2 score of 88% and 90% recpectively
3. The most important features who had a major impact on the model predictions were; hour, temperature, Humidity, solar-radiation, and Winter.

- **The model performed well in this case but as the data is time dependent, values of temperature, wind-speed, solar radiation etc. will not always be consistent. Therefore, there will be scenarios where the model might not perform well. As Machine learning is an exponentially evolving field, we will have to be prepared for all contingencies and also keep checking our model from time to time**