```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from scipy.stats import ttest_ind,f_oneway
```

```
data = pd.read_csv('https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/001/428/original/bike_sharing.csv?1642089089')
data.head(5)
```

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	casual	registered	count
0	2011-01-01 00:00:00	1	0	0	1	9.84	14.395	81	0.0	3	13	16
1	2011-01-01 01:00:00	1	0	0	1	9.02	13.635	80	0.0	8	32	40
2	2011-01-01 02:00:00	1	0	0	1	9.02	13.635	80	0.0	5	27	32
3	2011-01-01 03:00:00	1	0	0	1	9.84	14.395	75	0.0	3	10	13
4	2011-01-01 04:00:00	1	0	0	1	9.84	14.395	75	0.0	0	1	1

Next steps: Generate code with `data` View recommended plots

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10886 entries, 0 to 10885
Data columns (total 12 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   datetime    10886 non-null  object
 1   season      10886 non-null  int64
 2   holiday     10886 non-null  int64
 3   workingday  10886 non-null  int64
 4   weather     10886 non-null  int64
 5   temp        10886 non-null  float64
 6   atemp       10886 non-null  float64
 7   humidity    10886 non-null  int64
 8   windspeed   10886 non-null  float64
 9   casual      10886 non-null  int64
 10  registered  10886 non-null  int64
 11  count       10886 non-null  int64
dtypes: float64(3), int64(8), object(1)
memory usage: 1020.7+ KB
```

```
data.isnull().sum()
```

```
datetime      0
season        0
holiday       0
workingday    0
weather       0
temp          0
atemp         0
humidity      0
windspeed     0
casual        0
registered    0
count         0
dtype: int64
```

```
data.shape
```

```
(10886, 12)
```

Let's Convert categorical attributes

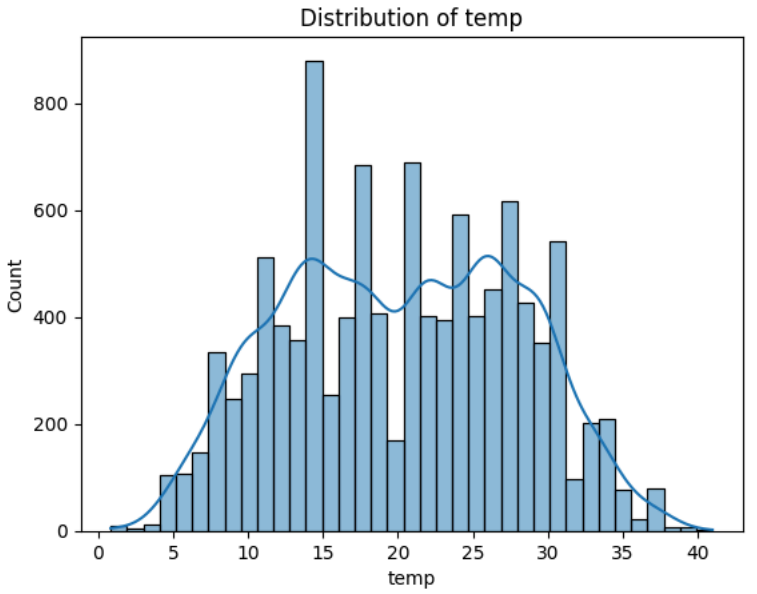
```
df = data
df['season'] = df['season'].astype('category')
df['holiday'] = df['holiday'].astype('category')
df['workingday'] = df['workingday'].astype('category')
df['weather'] = df['weather'].astype('category')
```

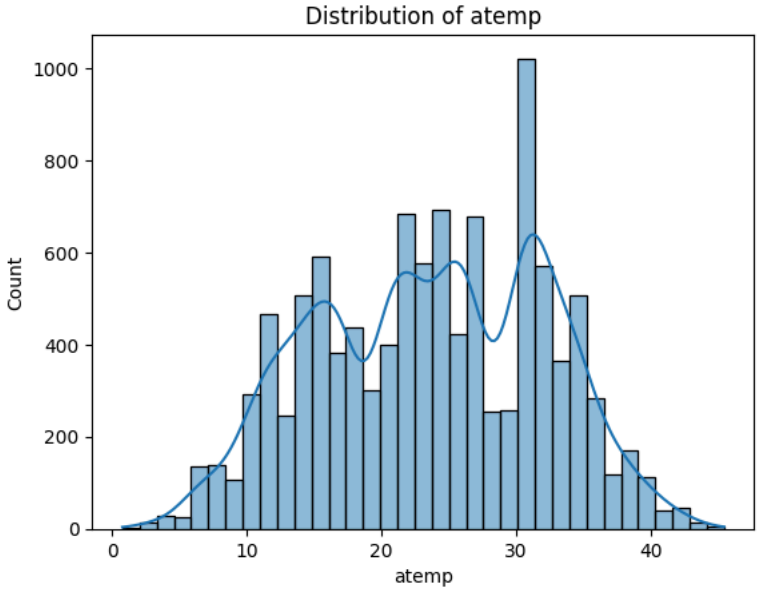
```
df.describe()
```

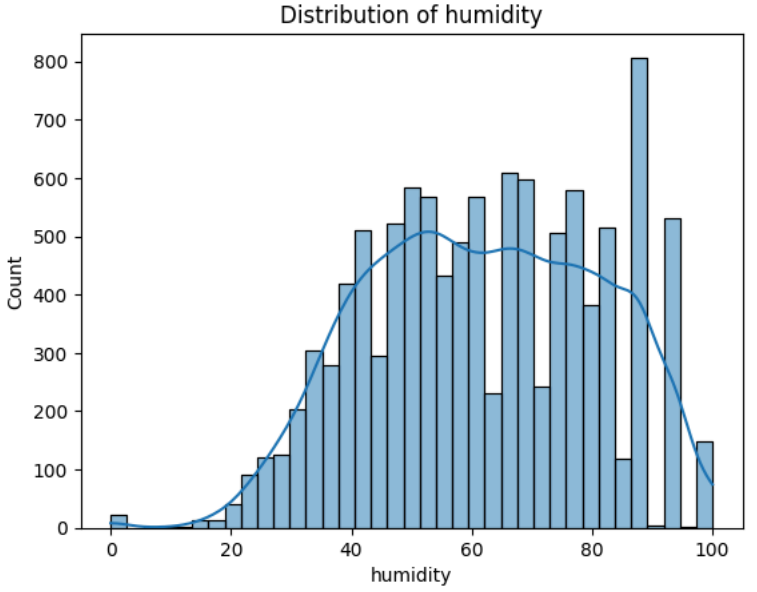
	temp	atemp	humidity	windspeed	casual	registere
count	10886.00000	10886.000000	10886.000000	10886.000000	10886.000000	10886.00000
mean	20.23086	23.655084	61.886460	12.799395	36.021955	155.55217
std	7.79159	8.474601	19.245033	8.164537	49.960477	151.03903
min	0.82000	0.760000	0.000000	0.000000	0.000000	0.00000
25%	13.94000	16.665000	47.000000	7.001500	4.000000	36.00000
50%	20.50000	24.240000	62.000000	12.998000	17.000000	118.00000
75%	26.24000	31.060000	77.000000	16.997900	49.000000	222.00000
max	41.00000	45.455000	100.000000	56.996900	367.000000	886.00000

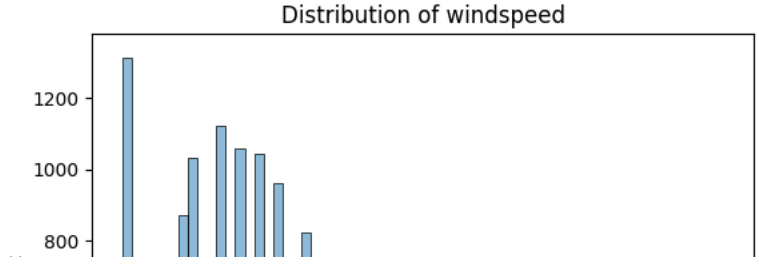
Univariate Analysis:

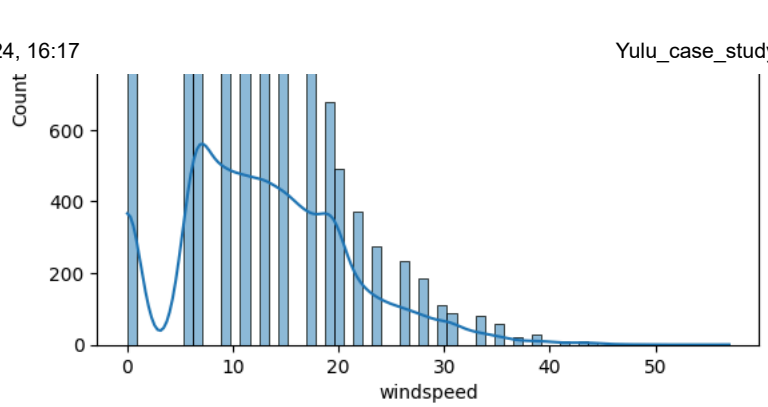
```
continuous_vars = ['temp', 'atemp', 'humidity', 'windspeed', 'casual', 'registered', 'count']
categorical_vars = ['season', 'holiday', 'workingday', 'weather']

# Distribution plots for continuous variables
for var in continuous_vars:
    sns.histplot(df[var], kde=True)
    plt.title(f'Distribution of {var}')
    plt.show()

# Count plots for categorical variables
for var in categorical_vars:
    sns.countplot(x=var, data=df)
    plt.title(f'Count plot of {var}')
    plt.show()
```

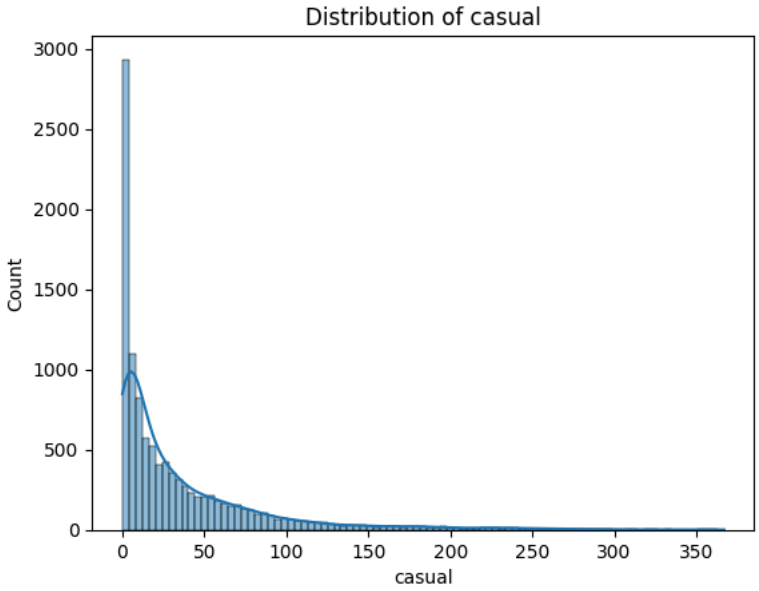

Distribution of temp
Count
temp
0
200
400
600
800
0
5
10
15
20
25
30
35
40

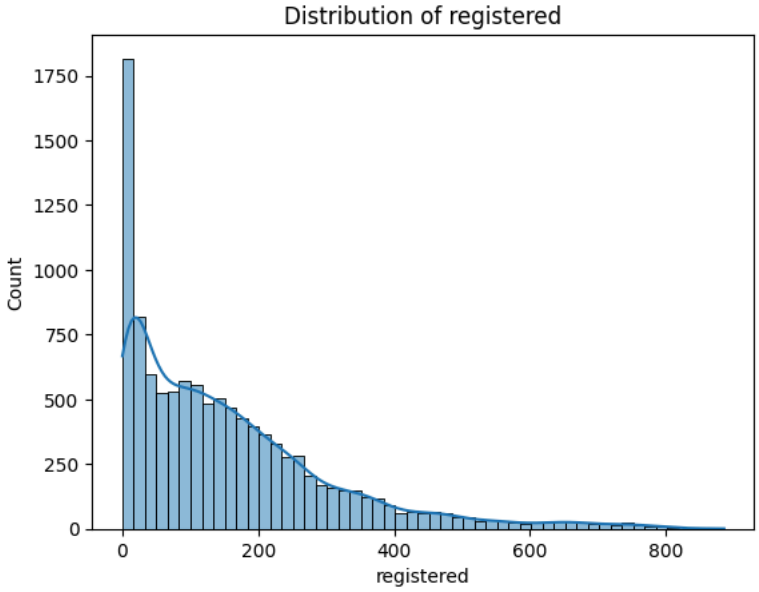

Distribution of atemp
Count
atemp
0
200
400
600
800
1000
0
10
20
30
40

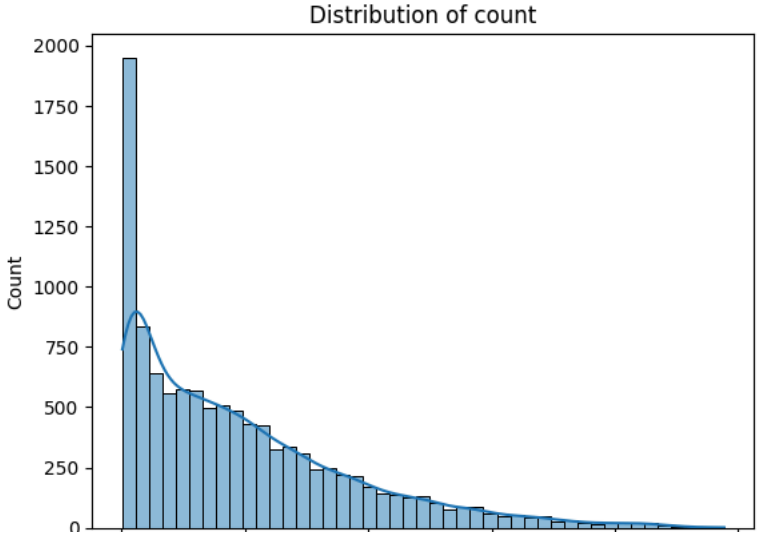

Distribution of humidity
Count
humidity
0
100
200
300
400
500
600
700
800
0
20
40
60
80
100

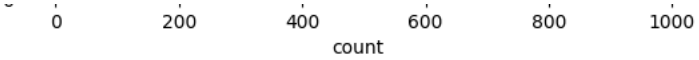

Distribution of windspeed
800
1000
1200

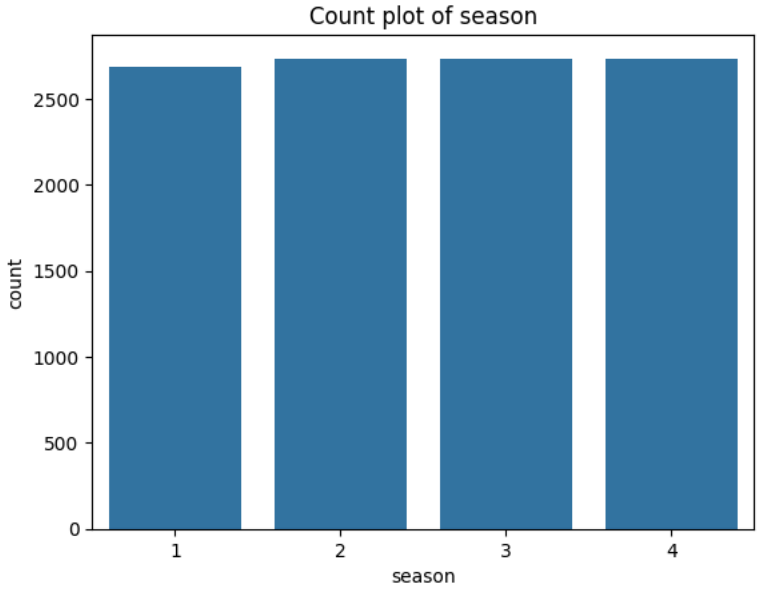

Count
600
400
200
0
0
10
20
30
40
50
windspeed

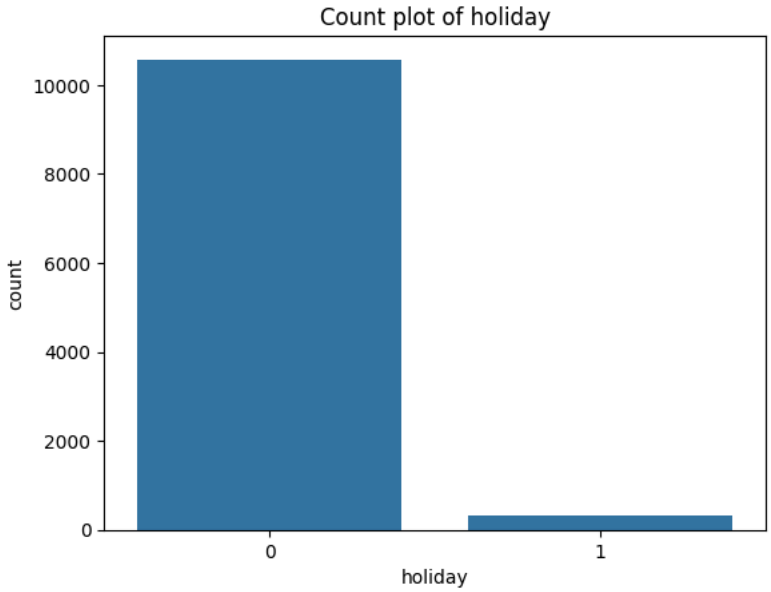

Distribution of casual
Count
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
casual

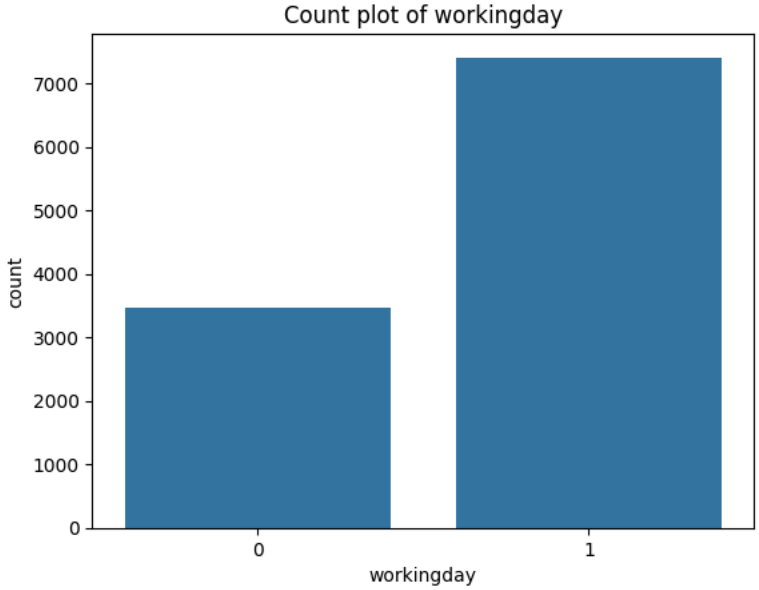

Distribution of registered
Count
1750
1500
1250
1000
750
500
250
0
0
200
400
600
800
registered

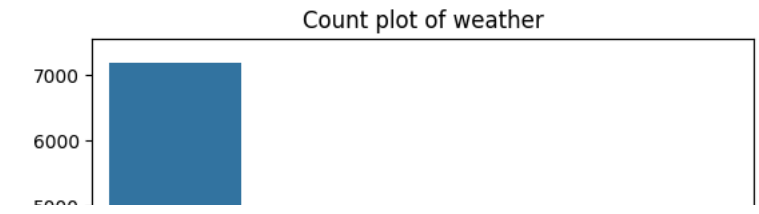

Distribution of count
Count
2000
1750
1500
1250
1000
750
500
250
0

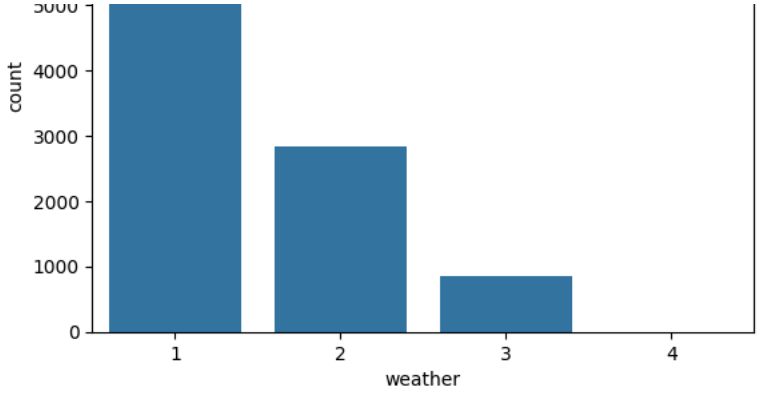

0
200
400
600
800
1000
count


Count plot of season
2500
2000
1500
1000
500
0
count
1
2
3
4
season


Count plot of holiday
10000
8000
6000
4000
2000
0
count
0
1
holiday


Count plot of workingday
7000
6000
5000
4000
3000
2000
1000
0
count
0
1
workingday

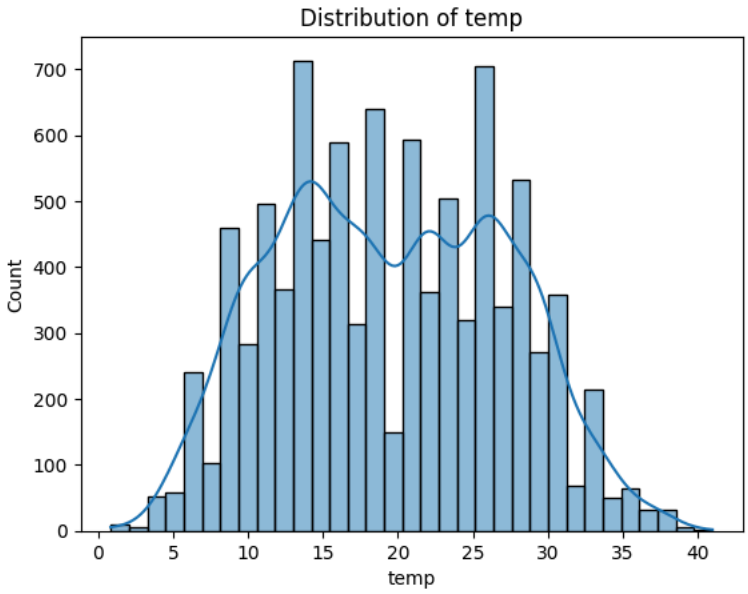

Count plot of weather
7000
6000

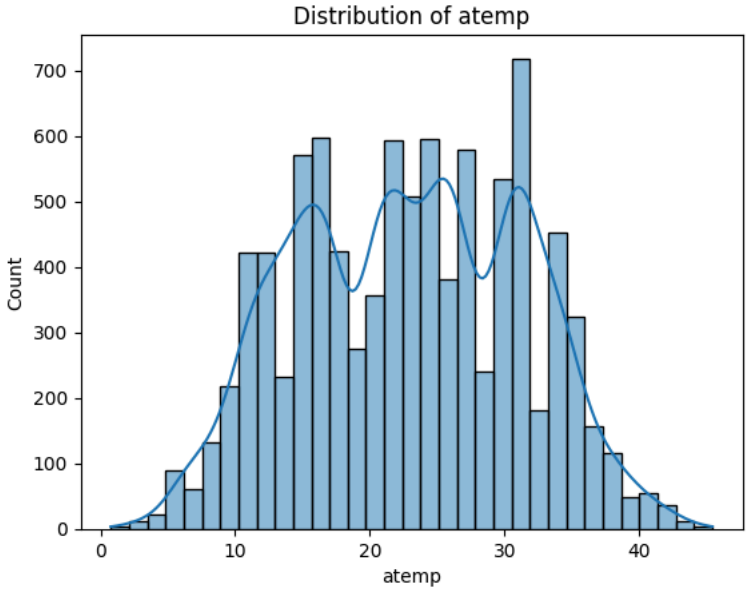


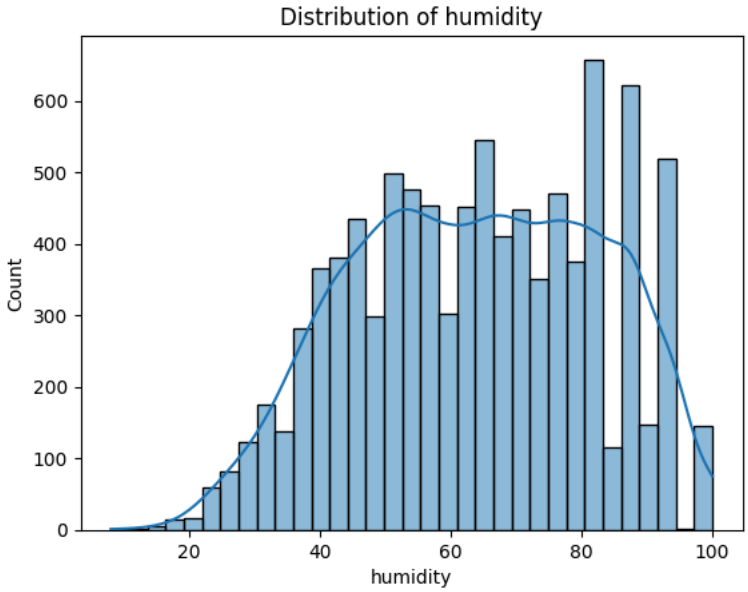

```
def remove_outliers_iqr(df, column):

    Q1 = df[column].quantile(0.25)
    Q3 = df[column].quantile(0.75)
    IQR = Q3 - Q1

    lower_bound = Q1 - 1.5 * IQR
    upper_bound = Q3 + 1.5 * IQR

    # Filter the DataFrame

    filtered_df = df[(df[column] >= lower_bound) & (df[column] <= upper_bound)]
    return filtered_df
```

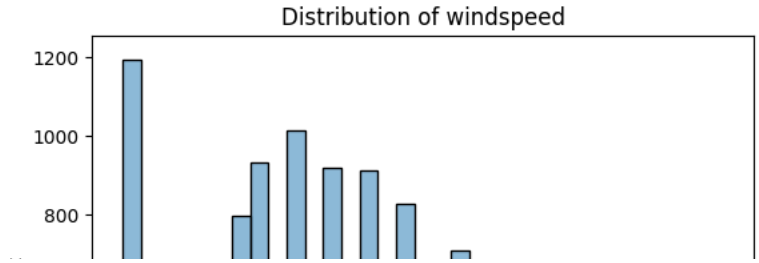
```
for column in continuous_vars:
    df = remove_outliers_iqr(df, column)
```

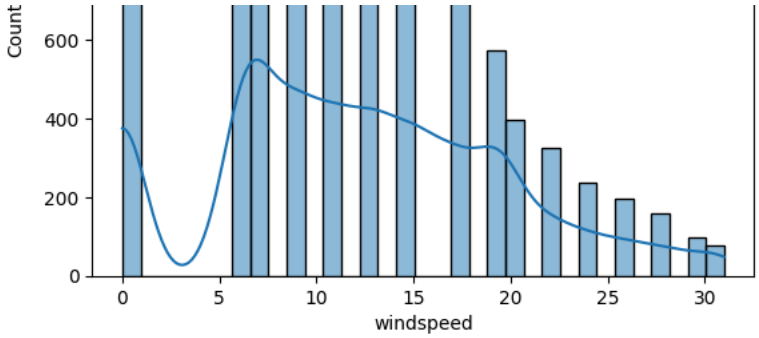
```
# Distribution plots for continuous variables
for var in continuous_vars:
    sns.histplot(df[var], kde=True)
    plt.title(f'Distribution of {var}')
    plt.show()
```

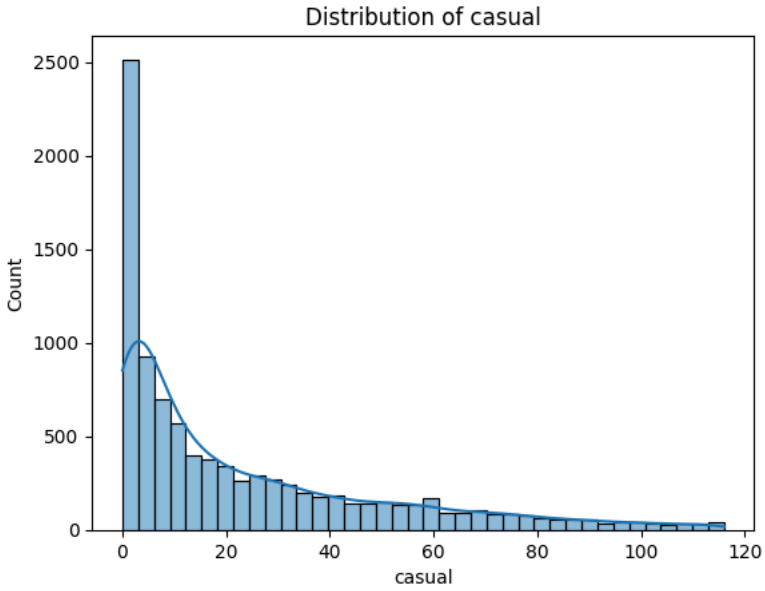

Distribution of temp
Count
temp
0
100
200
300
400
500
600
700
0
5
10
15
20
25
30
35
40

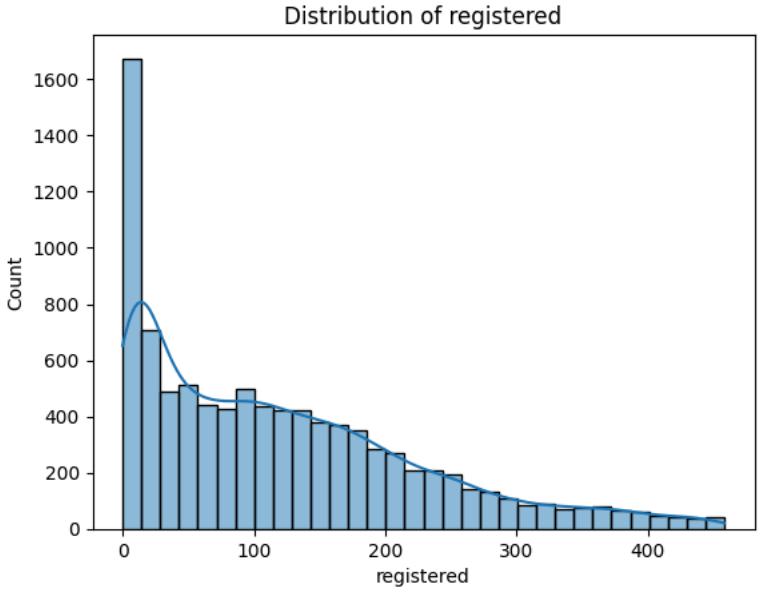

Distribution of atemp
Count
atemp
0
100
200
300
400
500
600
700
0
10
20
30
40

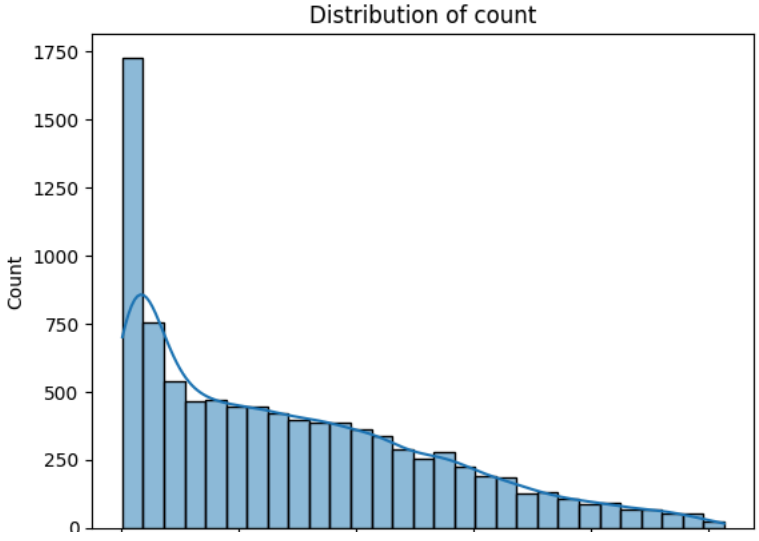

Distribution of humidity
Count
humidity
0
100
200
300
400
500
600
20
40
60
80
100

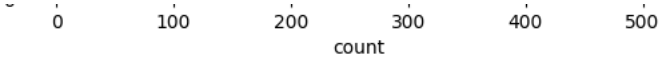

Distribution of windspeed
800
1000
1200


Count
600
400
200
0
0
5
10
15
20
25
30
windspeed


Distribution of casual
Count
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
casual

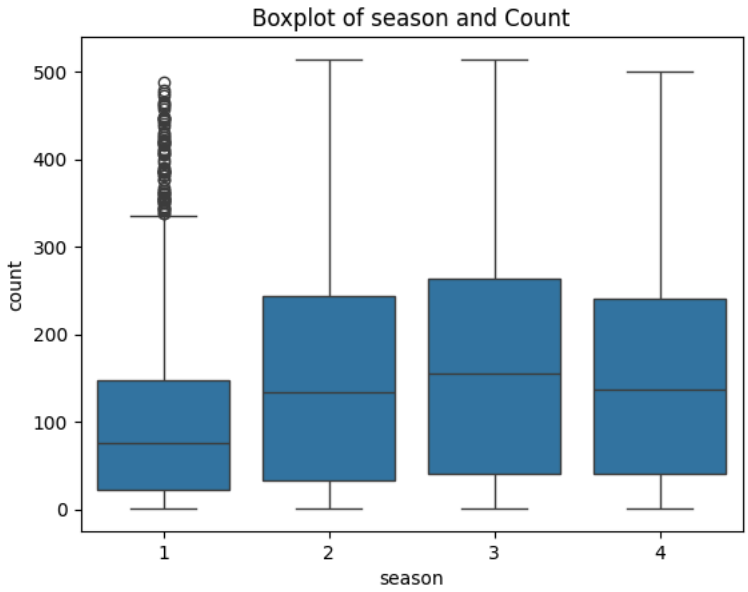

Distribution of registered
Count
1600
1400
1200
1000
800
600
400
200
0
0
100
200
300
400
registered

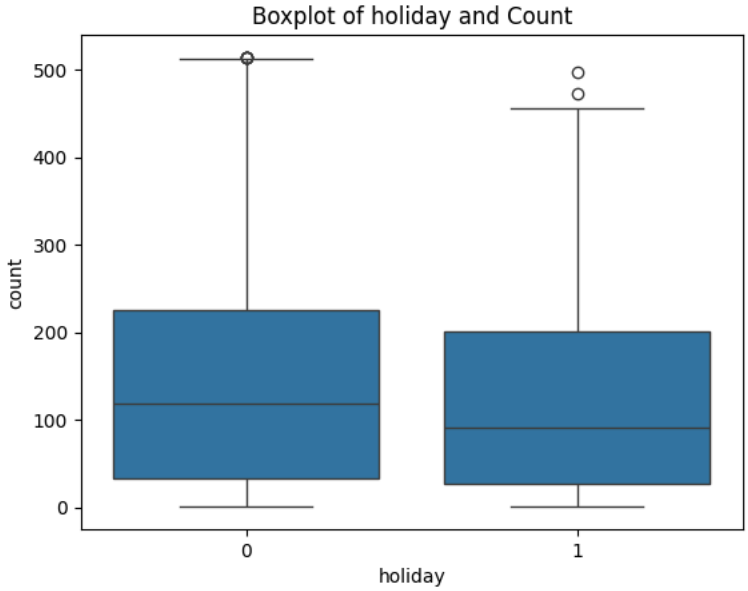

Distribution of count
Count
1750
1500
1250
1000
750
500
250
0

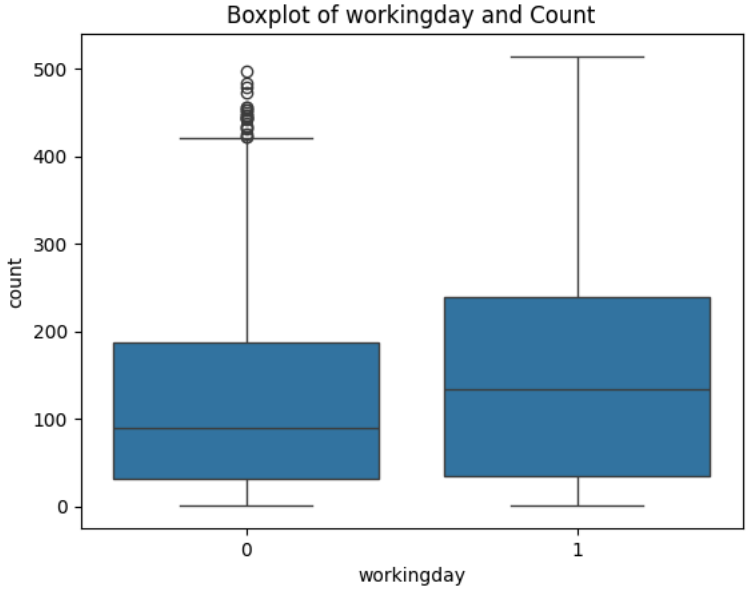


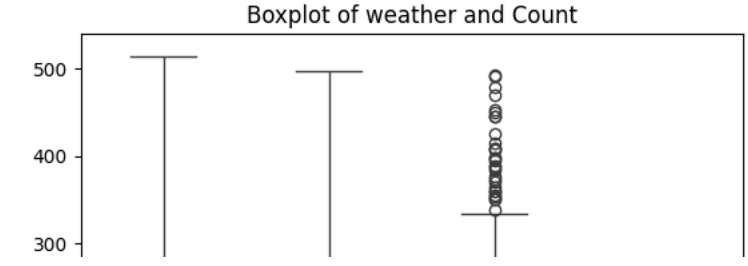
Bivariate Analysis:

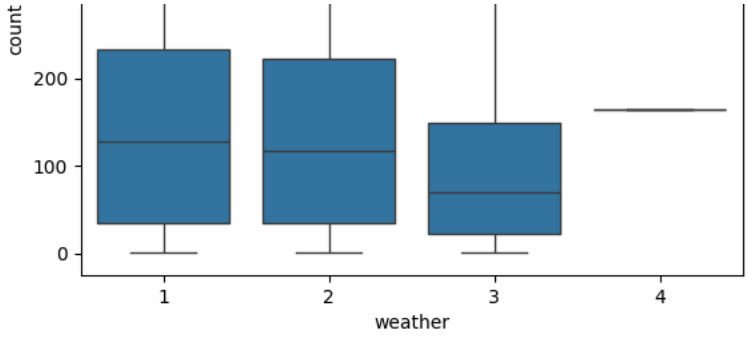
```
for var in categorical_vars :
  sns.boxplot(x=var, y='count', data=df)
  plt.title(f'Boxplot of {var} and Count')
  plt.show()
```


Boxplot of season and Count
count
season
0
100
200
300
400
500
1
2
3
4


Boxplot of holiday and Count
count
holiday
0
100
200
300
400
500
0
1


Boxplot of workingday and Count
count
workingday
0
100
200
300
400
500
0
1


Boxplot of weather and Count
500
400
300



Step 2: Hypothesis Testing

2 Sample T-Test:

Null Hypothesis (H0): Working Day has no effect on the number of electric cycles rented.
Alternate Hypothesis (H1): Working Day has an effect on the number of electric cycles rented
Significance level at 5%

```
working_day_count = df[df['workingday'] == 1]['count']
non_working_day_count = df[df['workingday'] == 0]['count']

t_stat, p_val = ttest_ind(working_day_count, non_working_day_count)

print(f'T-Statistic: {t_stat}, P-Value: {p_val}')

alpha = 0.05

if p_val < alpha :
  print( 'Reject Null Hypothesis , Working Day has an effect on the number of electric cycles rented ')
else:
  print("Fail to Reject Null Hypothesis  , Working Day has no effect on the number of electric cycles rented ")
```

```
T-Statistic: 12.084616332054733, P-Value: 2.2552148137228035e-33
Reject Null Hypothesis , Working Day has an effect on the number of electric cycles rented
```

one way Annova Test

```
from scipy.stats import f_oneway,levene,kruskal,shapiro

season1 = df[df['season'] == 1]['count']

season2 = df[df['season'] == 2]['count']

season3 = df[df['season'] == 3]['count']

season4 = df[df['season'] == 4]['count']

stats1,pvalue1 = shapiro(season1)
stats2,pvalue2 = shapiro(season2)
stats3,pvalue3 = shapiro(season3)
stats4,pvalue4 = shapiro(season4)

alpha = 0.05

print("not normally distributed" if pvalue1 <= alpha else "normally distributed")
print("not normally distributed" if pvalue2 <= alpha else "normally distributed")
print("not normally distributed" if pvalue3 <= alpha else "normally distributed")
print("not normally distributed" if pvalue4 <= alpha else "normally distributed")



# H0: Variances are equal
# Ha: Variances are not equal

# Levene test
statistic, pvalue_levene = levene(season1, season2, season3,season4 )
```

one way Annova Test

```
from scipy.stats import f_oneway,levene,kruskal,shapiro

season1 = df[df['season'] == 1]['count']

season2 = df[df['season'] == 2]['count']

season3 = df[df['season'] == 3]['count']

season4 = df[df['season'] == 4]['count']

stats1,pvalue1 = shapiro(season1)
stats2,pvalue2 = shapiro(season2)
stats3,pvalue3 = shapiro(season3)
stats4,pvalue4 = shapiro(season4)

alpha = 0.05

print("not normally distributed" if pvalue1 <= alpha else "normally distributed")
print("not normally distributed" if pvalue2 <= alpha else "normally distributed")
print("not normally distributed" if pvalue3 <= alpha else "normally distributed")
print("not normally distributed" if pvalue4 <= alpha else "normally distributed")



# H0: Variances are equal
# Ha: Variances are not equal

# Levene test
statistic, pvalue_levene = levene(season1, season2, season3,season4 )
print('Levene test p-value:',pvalue_levene)

if pvalue_levene < alpha:
 print("Variances are not equal")
else:
 print("Variances are equal")
```

```
not normally distributed
not normally distributed
not normally distributed
not normally distributed
Levene test p-value: 1.4156739715299946e-85
Variances are not equal
```

We can see in the above output our Seasons rent counts are not normally distributed so we cannot go with doing annova test . we will need to perform Kruskal-Wallis test in order to make conclusions

```
from scipy.stats import kruskal
# Null Hypothesis (H0): The medians of the seasons are the same for all three algorithms.
# Alternative Hypothesis (H1): At least one of the medians of the seasons is different among the four .

stat, p_value = kruskal(season1, season2, season3,season4)

print("test statistic:",stat)
print("p_value:",p_value)

if p_value < 0.05:
   print("Reject H0")
   print("At least one of the medians of the rented counts is different among the four seasons")
else:
   print("Fail to reject H0")
   print("The medians of the rented counts are the same for all four seasons .")
```

```
test statistic: 402.42037461467095
p_value: 6.62035386503286e-87
Reject H0
At least one of the medians of the rented counts is different among the four seasons
```

```
import statsmodels.api as sm
from statsmodels.formula.api import ols

model = ols('count ~ C(season) * C(holiday)',data = df).fit()

sm.stats.anova_lm(model,type=2)
```

index	df	sum_sq	mean_sq	F	PR(>F)
C(season)	3.0	6453569.886784438	2151189.9622614793	148.3526000515924	6.34189741449558e-94
C(holiday)	1.0	55927.06133929639	55927.06133929639	3.8569001847736466	0.04957134374895196
C(season):C(holiday)	3.0	268324.9899541374	89441.6633180458	6.168169031535479	0.0003489435219567815 6
Residual	9356.0	135666872.57196045	14500.520796490002	NaN	NaN

At 5% significant level (0.05) p value is high on Holiday and Interaction so we fail to reject null there is no significant difference acrros them But P value is low for seasons so we reject null and we conclude there is a significant difference in seasons

Final: there is a significant difference in seasons

```
import statsmodels.api as sm
from statsmodels.formula.api import ols

model = ols('count ~ C(weather) * C(season)',data = df).fit()

sm.stats.anova_lm(model,type=2)
```

index	df	sum_sq	mean_sq	F	PR(>F)
C(weather)	3.0	1682685.509050064	560895.1696833547	39.1144268524813 65	4.1250696589626025e-25
C(season)	3.0	6504400.898047293	2168133.632682431	151.19635355361908	1.0956704764672059e-95
C(weather):C(season)	9.0	173986.5215242941	19331.835724921566	1.348119426333278	0.20609321409703638
Residual	9351.0	134091974.59265131	14339.8539827453	NaN	NaN

At 5% significant level (0.05)

P value is low for seasons,weather and their interactions so we reject null and we conclude there is a significant difference in seasons

Final: there is a significant difference in seasons and weather

Chi-Square Test

```
from scipy.stats import chi2_contingency
# Create contingency table

contingency_table = pd.crosstab(df['season'], df['weather'])
print('Contingency Table:')
print(contingency_table)

# Perform Chi-square test
chi2, p, dof, expected = chi2_contingency(contingency_table)

# Display results
print(f'\nChi-square Statistic: {chi2}')
print(f'p-value: {p}')
print(f'Degrees of Freedom: {dof}')
print('Expected Frequencies:')
print(expected)

# Interpret the results
alpha = 0.05  # significance level
if p < alpha:
    print("\nReject the null hypothesis: Weather is dependent on the season.")
else:
    print("\nFail to reject the null hypothesis: Weather is independent of the season.")
```

Contingency Table:
weather 1 2 3 4
season
1 1583 680 184 1
2 1436 610 203 0
3 1557 500 173 0
4 1483 743 211 0\

Chi-square Statistic: 50.87276261778956
p-value: 7.378995767129 81e-08
Degrees of Freedom: 9
Expected Frequencies:
[[1.58398462e+03 6.62193934e+02 2.01560017e+02 2.61426741e-01]
[1.45522117e+03 6.08363627e+02 1.85175032e+02 2.40175139e-01]
[1.44292717e+03 6.03224050e+02 1.83610636e+02 2.38146091e-01]
[1.57686704e+03 6.59218390e+02 2.00654314e+02 2.60252029e-01]]

Reject the null hypothesis: Weather is dependent on the season.

```
Start coding or generate with AI.
```