Lab-Assignment - 4

In [1]:
```
# import all the necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, mean_squared_log_error
```

In [2]:
```
# Load the dataset
df= pd.read_csv(r"C:\Users\raval\Downloads\bike+sharing+dataset\day.csv")
df.head()
```

Out[2]:

	instant	dteday	season	yr	mnth	holiday	weekday	workingday	weathersit	temp	atemp	hum
0	1	2011-01-01	1	0	1	0	6	0	2	0.344167	0.363625	0.805833
1	2	2011-01-02	1	0	1	0	0	0	2	0.363478	0.353739	0.696087
2	3	2011-01-03	1	0	1	0	1	1	1	0.196364	0.189405	0.437273
3	4	2011-01-04	1	0	1	0	2	1	1	0.200000	0.212122	0.590435
4	5	2011-01-05	1	0	1	0	3	1	1	0.226957	0.229270	0.436957

In [3]:
```
X = df[["weekday","temp","weathersit","atemp","hum","windspeed"]]
y= df["cnt"]
```

In [4]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.2, random_state=42)
```

In [11]:
```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

In [5]:
```
from sklearn.linear_model import Lasso, Ridge, ElasticNet
```

In [12]:
```python
# Lasso Regression
alpha_lasso = 1.0  # Regularization strength for Lasso
lasso_model = Lasso(alpha=alpha_lasso)
lasso_model.fit(X_train, y_train)

y_pred_lasso = lasso_model.predict(X_test)

mse_lasso = mean_squared_error(y_test, y_pred_lasso)
print(f'Lasso Mean Squared Error (MSE): {mse_lasso}')

# Ridge Regression
alpha_ridge = 1.0  # Regularization strength for Ridge
ridge_model = Ridge(alpha=alpha_ridge)
ridge_model.fit(X_train, y_train)

y_pred_ridge = ridge_model.predict(X_test)

mse_ridge = mean_squared_error(y_test, y_pred_ridge)
print(f'Ridge Mean Squared Error (MSE): {mse_ridge}')

# Elastic Net
alpha_elastic = 1.0  # Regularization strength for Elastic Net
l1_ratio = 0.5  # Mixing parameter for Elastic Net (0.0 for L2, 1.0 for L1)
elastic_net_model = ElasticNet(alpha=alpha_elastic, l1_ratio=l1_ratio)
elastic_net_model.fit(X_train, y_train)

y_pred_elastic = elastic_net_model.predict(X_test)

mse_elastic = mean_squared_error(y_test, y_pred_elastic)
print(f'Elastic Net Mean Squared Error (MSE): {mse_elastic}')
```

```
Lasso Mean Squared Error (MSE): 1966826.4243399801
Ridge Mean Squared Error (MSE): 1966601.4264985875
Elastic Net Mean Squared Error (MSE): 2117213.884175252
```

In [32]:
```python
reg = LinearRegression().fit(X_train, y_train)
```

In [33]:
```python
reg.score(X_test, y_test)
```

Out[33]:
```
0.5096989557230602
```

In [34]:
```python
reg.score(X_train, y_train)
```

Out[34]:
```
0.4664063098127508
```

In [35]:
```python
from sklearn import linear_model
lasso_reg = linear_model.Lasso(alpha = 10)
lasso_reg.fit(X_train, y_train)
```

Out[35]:
```
Lasso(alpha=10)
```

**In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.**

In [36]:
```python
lasso_reg.score(X_test, y_test)
```

Out[36]:
```
0.5077465419959204
```

In [37]:
```python
lasso_reg.score(X_train, y_train)
```

Out[37]:
```
0.46628542789501115
```

In [38]:
```
ridge_reg = Ridge(alpha = 10)
ridge_reg.fit(X_train, y_train)
```

Out[38]:
```
Ridge(alpha=10)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [39]:
```
ridge_reg.score(X_test, y_test)
```

Out[39]:
```
0.5085742314214189
```

In [40]:
```
ridge_reg.score(X_train, y_train)
```

Out[40]:
```
0.46633568986780494
```

In [42]:
```
# Train the linear regression model
model = LinearRegression()
reg1 = model.fit(X_train, y_train)

# Predict bike rentals
y_pred = model.predict(X_test)
```

In [43]:
```
reg1.score(X_test,y_test)
```

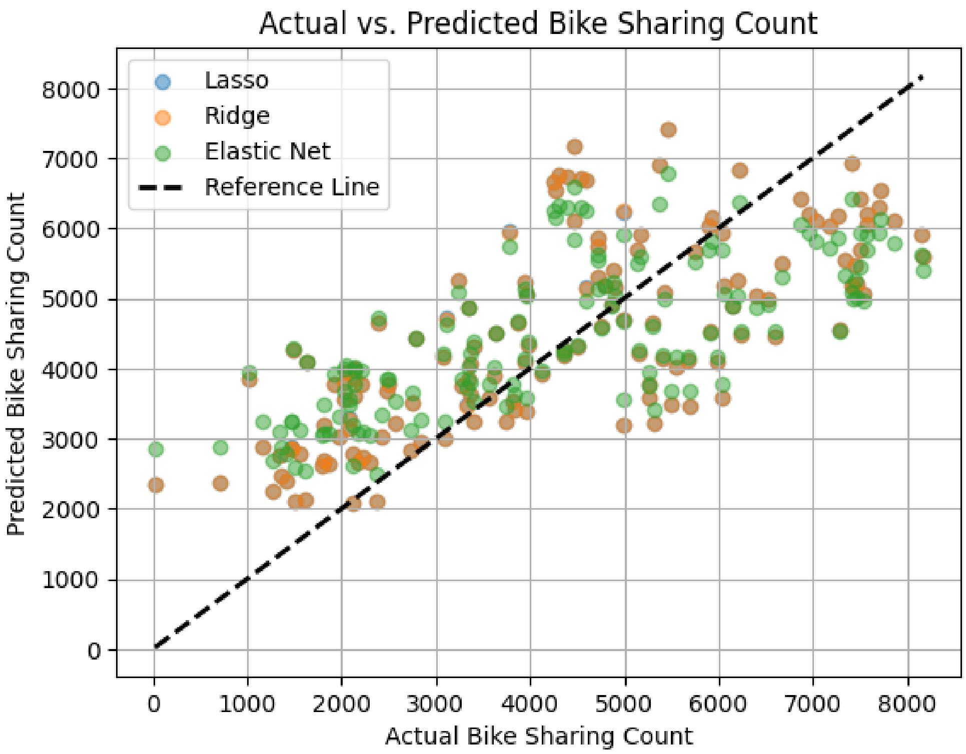
Out[43]:
```
0.5096989557230602
```

In [44]:
```
reg1.score(X_train,y_train)
```

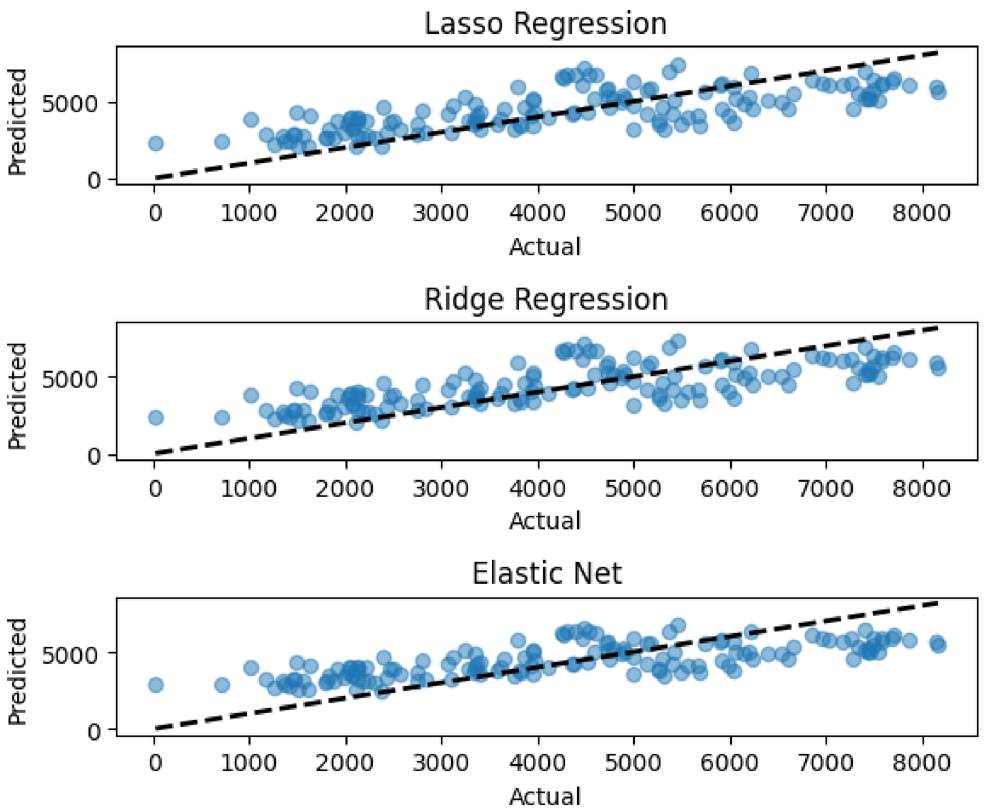
Out[44]:
```
0.4664063098127508
```

In [ ]:
```

```

In [45]:
```
import matplotlib.pyplot as plt

# Create a scatter plot of the actual data points
plt.scatter(y_test, y_pred_lasso, label="Lasso", alpha=0.5)
plt.scatter(y_test, y_pred_ridge, label="Ridge", alpha=0.5)
plt.scatter(y_test, y_pred_elastic, label="Elastic Net", alpha=0.5)

# Add a reference line (y = x) for comparison
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], 'k--', lw=2, label="Refere

plt.xlabel("Actual Bike Sharing Count")
plt.ylabel("Predicted Bike Sharing Count")
plt.title("Actual vs. Predicted Bike Sharing Count")
plt.legend()
plt.grid(True)
plt.show()
```



In [52]:
```python
import matplotlib.pyplot as plt

# Create separate scatter plots for each regularization method
plt.figure(figsize=(6, 5))

# Lasso Regression
plt.subplot(3,1, 1)
plt.scatter(y_test, y_pred_lasso, alpha=0.5)
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], 'k--', lw=2)
plt.xlabel("Actual")
plt.ylabel("Predicted")
plt.title("Lasso Regression")

# Ridge Regression
plt.subplot(3,1, 2)
plt.scatter(y_test, y_pred_ridge, alpha=0.5)
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], 'k--', lw=2)
plt.xlabel("Actual")
plt.ylabel("Predicted")
plt.title("Ridge Regression")

# Elastic Net
plt.subplot(3,1, 3)
plt.scatter(y_test, y_pred_elastic, alpha=0.5)
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], 'k--', lw=2)
plt.xlabel("Actual")
plt.ylabel("Predicted")
plt.title("Elastic Net")

plt.tight_layout()
plt.show()
```



In [57]:
```python
# Define the Lasso regression function
def lasso_regression(X, y, alpha, num_iterations, learning_rate):
    m, n = X.shape
    theta = np.zeros(n)
    for iteration in range(num_iterations):
        y_pred = X.dot(theta)
        error = y_pred - y
        gradient = X.T.dot(error) / m + alpha * np.sign(theta) / m
        theta -= learning_rate * gradient
    return theta
```

In [65]:
```python
lasso_regression(X, y, alpha=0.1, num_iterations=100, learning_rate=0.1)
```

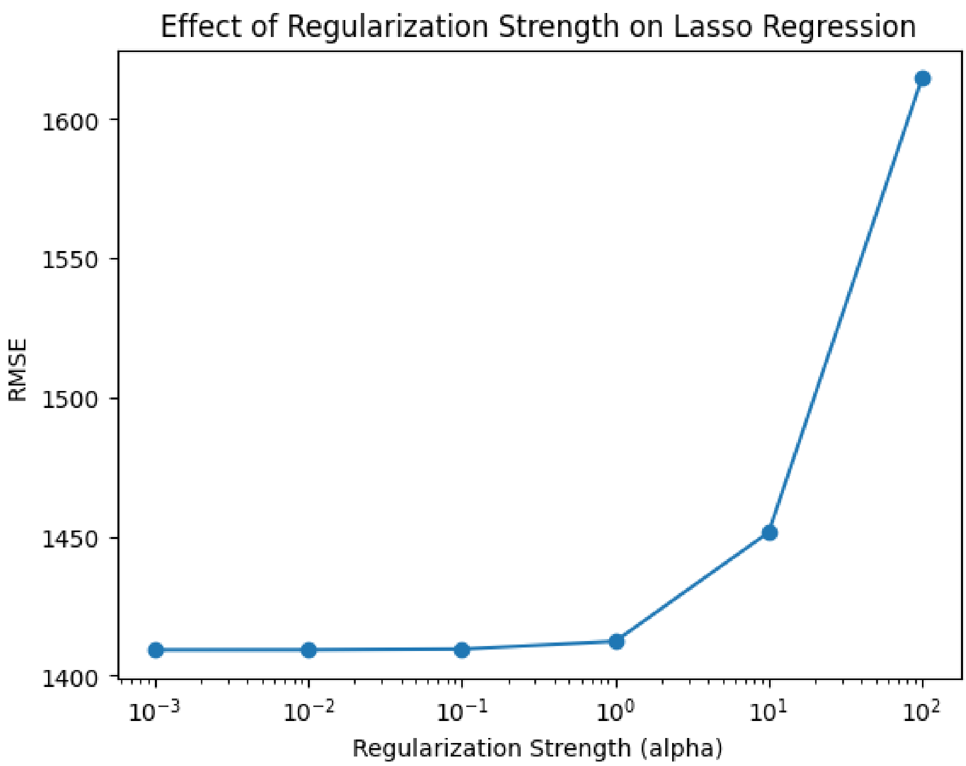
Out[65]:
```
weekday        206.092592
temp          2881.229471
weathersit      23.656667
atemp         2700.630830
hum           1421.308725
windspeed      396.650138
dtype: float64
```

In [66]:
```python
lasso_regression(X, y, alpha=10, num_iterations=100, learning_rate=0.1)
```

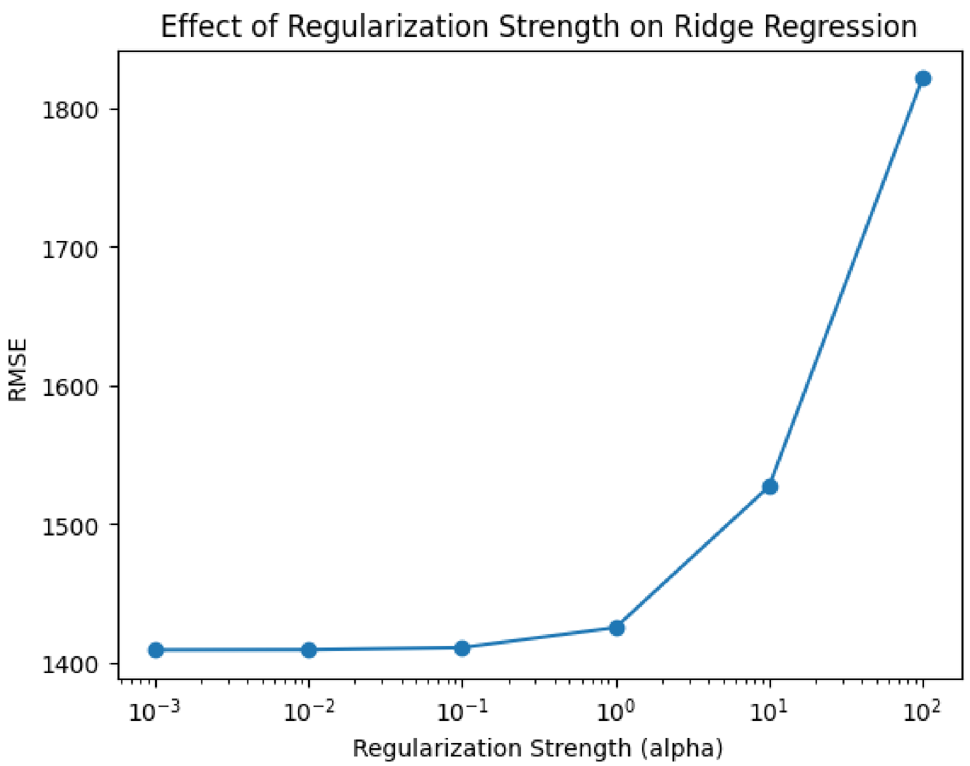
Out[66]:
```
weekday        206.102218
temp          2881.186220
weathersit      23.688560
atemp         2700.582506
hum           1421.265882
windspeed      396.544411
dtype: float64
```

In [67]:

```
from sklearn.linear_model import Lasso
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
import numpy as np

# Prepare data
X = df[['temp', 'weathersit', 'hum', 'windspeed']]
y = df['cnt']

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Define a list of regularization strengths (alpha values)
alphas = [0.001, 0.01, 0.1, 1, 10, 100]

# Create a dictionary to store RMSE scores for each alpha
rmse_scores = {}

# Iterate through regularization strengths
for alpha in alphas:
    model = Lasso(alpha=alpha)
    model.fit(X_train, y_train)
    y_pred = model.predict(X_test)

    rmse = np.sqrt(mean_squared_error(y_test, y_pred))
    rmse_scores[alpha] = rmse

# Plot the RMSE curve
plt.plot(alphas, list(rmse_scores.values()), marker='o')
plt.xscale('log')
plt.xlabel('Regularization Strength (alpha)')
plt.ylabel('RMSE')
plt.title('Effect of Regularization Strength on Lasso Regression')
plt.show()
```

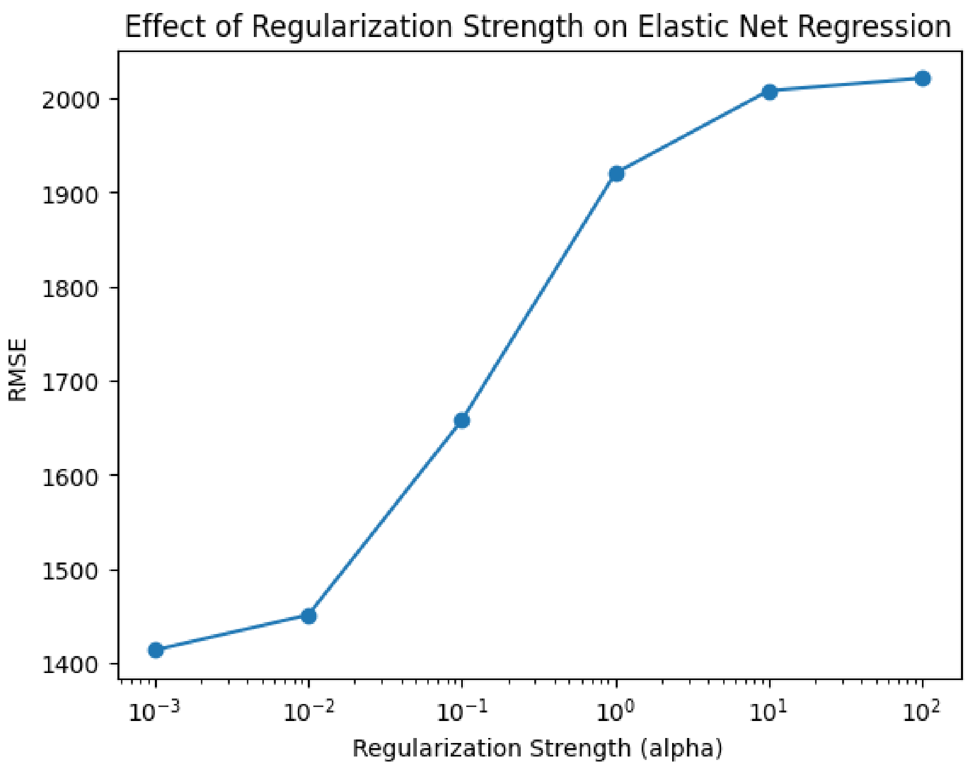


In [68]:
```
from sklearn.linear_model import Ridge
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
import numpy as np

# Prepare data
X = df[['temp', 'weathersit', 'hum', 'windspeed']]
y = df['cnt']

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Define a list of regularization strengths (alpha values)
alphas = [0.001, 0.01, 0.1, 1, 10, 100]

# Create a dictionary to store RMSE scores for each alpha
rmse_scores = {}

# Iterate through regularization strengths
for alpha in alphas:
    model = Ridge(alpha=alpha)
    model.fit(X_train, y_train)
    y_pred = model.predict(X_test)

    rmse = np.sqrt(mean_squared_error(y_test, y_pred))
    rmse_scores[alpha] = rmse

# Plot the RMSE curve
plt.plot(alphas, list(rmse_scores.values()), marker='o')
plt.xscale('log')
plt.xlabel('Regularization Strength (alpha)')
plt.ylabel('RMSE')
plt.title('Effect of Regularization Strength on Ridge Regression')
plt.show()
```



In [69]:

```
from sklearn.linear_model import ElasticNet
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
import numpy as np

# Prepare data
X = df[['temp', 'weathersit', 'hum', 'windspeed']]
y = df['cnt']

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Define a list of regularization strengths (alpha values)
alphas = [0.001, 0.01, 0.1, 1, 10, 100]

# Create a dictionary to store RMSE scores for each alpha
rmse_scores = {}

# Iterate through regularization strengths
for alpha in alphas:
    model = ElasticNet(alpha=alpha, l1_ratio=0.5)  # l1_ratio=0.5 means equal combination c
    model.fit(X_train, y_train)
    y_pred = model.predict(X_test)

    rmse = np.sqrt(mean_squared_error(y_test, y_pred))
    rmse_scores[alpha] = rmse

# Plot the RMSE curve
plt.plot(alphas, list(rmse_scores.values()), marker='o')
plt.xscale('log')
plt.xlabel('Regularization Strength (alpha)')
plt.ylabel('RMSE')
plt.title('Effect of Regularization Strength on Elastic Net Regression')
plt.show()
```



In [ ]: