assignment-day-14

February 8, 2024

#Performing regression using KNN and SVR on Toyota dataset

#Importing libraries

```python
[1]: import numpy as np
     import pandas as pd
     from sklearn.preprocessing import StandardScaler
     from sklearn.svm import SVR
     from sklearn.feature_selection import SelectFromModel
     from sklearn.ensemble import RandomForestRegressor
     import matplotlib.pyplot as plt
     import seaborn as sns
     from sklearn.metrics import accuracy_score
     from sklearn.model_selection import train_test_split, GridSearchCV
     from sklearn.preprocessing import StandardScaler
     from sklearn.neighbors import KNeighborsRegressor
     from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

     import warnings
     warnings.simplefilter(action='ignore')
```

```python
[2]: df = pd.read_csv('D:/Chools/Day_13/Toyoto_Corrola.csv')
```

#Preprocessing

```python
[3]: # Check for missingness
     missing_values = df.isnull().sum()
     print("Missing Values:\n", missing_values)
```
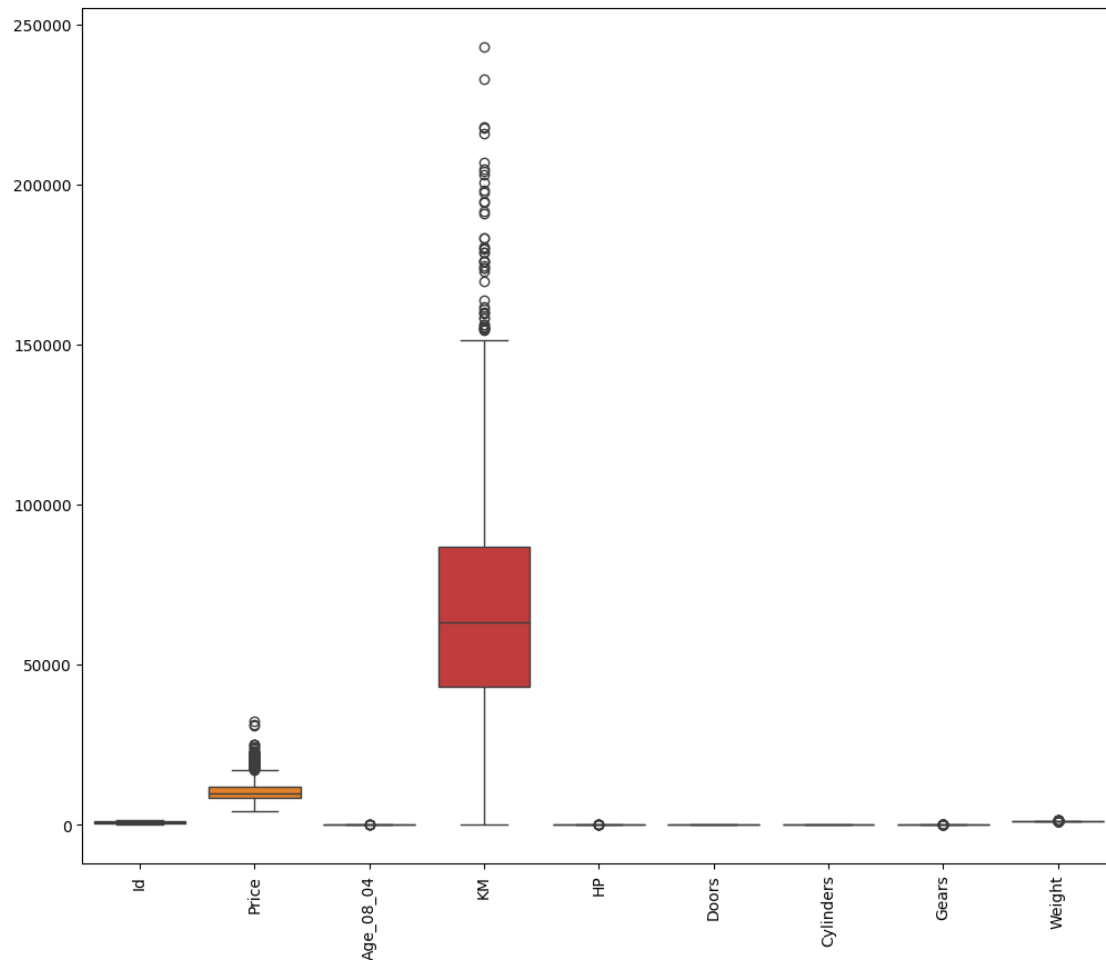
```
Missing Values:
 Id          0
Model        0
Price        0
Age_08_04    0
KM           0
HP           0
Doors        0
Cylinders    0
Gears        0
```

```
Weight        0
dtype: int64
```

[4]:
```python
# Check for outliers
plt.figure(figsize=(12, 10))
sns.boxplot(data=df)
plt.xticks(rotation=90)
plt.show()
```


[5]:
```python
# Check for typo errors and find unique values for car model
print("Unique Car Models:", df['Model'].unique())
```

```
Unique Car Models: ['TOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors'
 'ÊTOYOTA Corolla 2.0 D4D HATCHB TERRA 2/3-Doors'
 'TOYOTA Corolla 2.0 D4D HATCHB SOL 2/3-Doors'
 'ÊTOYOTA Corolla 2.0 D4D 90 3DR TERRA 2/3-Doors'
 'TOYOTA Corolla 2.0 D4D 90 3DR TERRA 2/3-Doors'
 'ÊTOYOTA Corolla 1800 T SPORT VVT I 2/3-Doors'
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'ÊTOYOTA Corolla 1.9 D HATCHB TERRA 2/3-Doors'
'TOYOTA Corolla 1.8 VVTL-i T-Sport 3-Drs 2/3-Doors'
'TOYOTA Corolla 1.8 16V VVTLI 3DR T SPORT BNS 2/3-Doors'
'TOYOTA Corolla 1.8 16V VVTLI 3DR T SPORT 2/3-Doors'
'ÊTOYOTA Corolla 1.8 16V VVTLI 3DR T SPORT 2/3-Doors'
'ÊTOYOTA Corolla 1.6 VVTI Linea Terra Comfort 2/3-Doors'
'TOYOTA Corolla 1.6 16v L.SOL 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I 3DR TERRA 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 3DR TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I 3DR SOL AUT4 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I 3DR SOL 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 3DR SOL 2/3-Doors'
'ÊTOYOTA Corolla 1.4 VVTI Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.4 16V VVT I 3DR TERRA COMFORT 2/3-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 3DR TERRA COMFORT 2/3-Doors'
'TOYOTA Corolla 1.4 16V VVT I 3DR TERRA 2/3-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 3DR 2/3-Doors'
'TOYOTA Corolla 1.4 16V VVT I 3DR 2/3-Doors'
'TOYOTA Corolla 2.0 D4D 90 5DR TERRA COMFORT 4/5-Doors'
'ÊTOYOTA Corolla 2.0 D4D 90 5DR SOL 4/5-Doors'
'TOYOTA Corolla 2.0 D4D 90 5DR TERRA 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I 5DR TERRA COMFORT 4/5-Doors'
'ÊTOYOTA Corolla 2.0 D4D 90 5DR TERRA COMFORT 4/5-Doors'
'TOYOTA Corolla 1.8 16V VVTLI 5DR T SPORT 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 5DR TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR SOL AUT4 4/5-Doors'
'TOYOTA Corolla 1.8 VVTL-i T-Sport 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR TERRA AUT4 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I LIFTB LUNA 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I 5DR TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR SOL AUT4 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR SOL 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR SOL 4/5-Doors'
'TOYOTA Corolla 1.6 VVT-I 5DR LINEA SOL 4/5-Doors'
'TOYOTA Corolla 2.0 D4D 110 5DR SOL 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I LIFTB TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 5DR 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR TERRA COMFORT 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 5drs 1 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 5DR TERRA COMFORT 4/5-Doors'
'ÊTOYOTA Corolla 1.4 VVTI (Nw type) 4/5-Doors'
'TOYOTA Corolla 2.0 D4D 90 3DR TERRA COMF BNS 2/3-Doors'
'TOYOTA Corolla 2.0 D4D 110 3DR SOL 2/3-Doors'
'ÊTOYOTA Corolla 2.0 D4D 90 3DR SOL BNS 2/3-Doors'
'TOYOTA Corolla 2.0 D 4D Linea Sol 3 Doors 2/3-Doors'
'TOYOTA Corolla 1.6 16v VVT-i Linea Sol 2/3-Doors'
'TOYOTA Corolla 2.0 D4D Linea Sol 3 Doors 2/3-Doors'

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'TOYOTA Corolla 1.4 VVT-i Sol 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I 3DR TERRA COMFORT 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I 3DR TERRA COMF AUT 2/3-Doors'
'ÊTOYOTA Corolla 1.6 VVT-i Linea Terra Comfort 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 3DR TERRA COMFORT 2/3-Doors'
'ÊTOYOTA Corolla VERSO 2.0 D4D SOL (7) BNS MPV'
'TOYOTA Corolla VERSO 2.0 D4D SOL (7) MPV'
'ÊTOYOTA Corolla VERSO 2.0 D4D LINEA SOL MPV'
'TOYOTA Corolla VERSO 2.0 D4D LINEA SOL MPV'
'TOYOTA Corolla 2.0 D4D 116 5DR LUNA 4/5-Doors'
'TOYOTA Corolla 2.0 D4D 90 WAGON SOL Stationwagen'
'TOYOTA Corolla 2.0 D4D 110 5DR EXEC BNS 4/5-Doors'
'ÊTOYOTA Corolla 2.0 D4D Linea Terra Comfort 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR EXEC 4/5-Doors'
'TOYOTA Corolla 1.6 VVT-i Linea Sol 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I 5DR SOL 4/5-Doors'
'TOYOTA Corolla 1.6 vvt-i nw model comfort airco 5drs 4/5-Doors'
'TOYOTA Corolla 1 6-16v VVT-i Linea Terra Comfort Airco 5drs 4/5-Doors'
'ÊTOYOTA Corolla 1.6 terra comfort 5drs airco 4/5-Doors'
'TOYOTA Corolla Luna 5drs D4D116 PK 4/5-Doors'
'TOYOTA Corolla 1.6i 16V VVT I SOL + Navigatie 4/5-Doors'
'ÊTOYOT Corolla 1.8 VVTL-i T-Sport 3-Drs 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN TERRA COMF 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR TERRA COMF AUT 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR EXEC BNS 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN SOL AUT4 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I 5DR SOL BNS 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I 5DR LUNA BNS 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I 5DR TERRA COMFORT 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I SEDAN TERRA COMF 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN SOL 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16v VVTi Linea Sol 4/5-Doors'
'TOYOTA Corolla 1.6 16v VVTi Terra Comfort 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN SOL BNS AUT4 4/5-Doors'
'TOYOTA Corolla 1.4-16v VVT-i Linea Terra Comfort NIEUW AIRCO 4/5-Doors'
'TOYOTA Corolla 1.6-16v VVT-i Linea Terra Comfort AIRCO NIEUW 5DRS 4/5-Doors'
'TOYOTA Corolla 1.6-16v VVT-i Executive B.edition 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I 5DR LUNA 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I 5DR LUNA 4/5-Doors'
'TOYOTA Corolla 1.6 VVT-I 5DR LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.4 16V 5DR TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.4-16v VVT-i Linea Terra Comfort NIEUW AIRCO 4/5-Doors'
'TOYOTA Corolla 1.6-16v VVT-i Linea Terra Comfort NIEUW AIRCO 5drs 4/5-Doors'
'TOYOTA Corolla 1.9 D HATCHB SOL 2/3-Doors'
'TOYOTA Corolla 2.0 D4D SEDAN SOL 4/5-Doors'
'TOYOTA Corolla 2.0 D4D LIFTB SOL 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB TERRA 2/3-Doors'
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'TOYOTA Corolla 1.9 D HATCHB TERRA 2/3-Doors'
'TOYOTA Corolla 1.8D Stationwagen' 'TOYOTA Corolla 1.8D 4/5-Doors'
'TOYOTA Corolla 1.9 D LIFTB TERRA 4/5-Doors'
'TOYOTA Corolla 1.9 D WAGON TERRA Stationwagen'
'TOYOTA Corolla 1.6 16V VVT I LIFTB LUNA 4/5-Doors'
'TOYOTA Corolla 1.9 D Sedan 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I HATCHB TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I LIFTB TERRA 4/5-Doors'
'TOYOTA Corolla 1.4 VVTI Linea Terra 2/3-Doors'
'TOYOTA Corolla 19D LB Linea Terra 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB SOL 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I LIFTB SOL 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I LIFTB LUNA AUT4 4/5-Doors'
'TOYOTA Corolla 1.6 Terra LB 4/5-Doors'
'TOYOTA Corolla 1.6 HB LINEA SOL 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I WAGON BLUE Stationwagen'
'TOYOTA Corolla 1.4 16V VVT I LIFTB LUNA 4/5-Doors'
'TOYOTA Corolla LIFTBACK 1.6-16v Linea Luna 4/5-Doors'
'TOYOTA Corolla 1.4 16V VVT I HATCHB SOL 2/3-Doors'
'TOYOTA Corolla 1.6 VVTI Linea Terra liftback 4/5-Doors'
'TOYOTA Corolla 1.9 D HB SOL 2/3-Doors'
'TOYOTA Corolla 1.6 16V VVT I LIFTB SOL AUT4 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB G6 2/3-Doors'
'TOYOTA Corolla 1.6 16V HATCHB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 16V WAGON LINEA TERRA Stationwagen'
'TOYOTA Corolla 1.6 GL LB 4/5-Doors'
'TOYOTA Corolla 1.6 Terra 5-Doors Liftback 4/5-Doors'
'TOYOTA Corolla 1.6-16v Linea Terra LB 4/5-Doors'
'TOYOTA Corolla 1.6I Luna liftback 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I WAGON TERRA Stationwagen'
'TOYOTA Corolla 1.6 Linea Terra Sedan 4/5-Doors'
'TOYOTA Corolla 1.4 VVTI L.Terra HB 4/5-Doors'
'TOYOTA Corolla 1.4 LB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16v VVTi Terra Comfort 2/3-Doors'
'TOYOTA Corolla 1.6 SDN LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB G6 4/5-Doors'
'TOYOTA Corolla 1.6 VVTi Linea terra 4/5-Doors'
'TOYOTA Corolla 1.6v VVT-i Linea Sol 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I LIFTB SOL 4/5-Doors'
'TOYOTA Corolla 1.6I LIFTBACK 4/5-Doors'
'TOYOTA Corolla Liftback 1.6 VVTI 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB TERRA AUT4 2/3-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I LIFTB LUNA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I HATCHB G6 4/5-Doors'
'ÊTOYOTA Corolla 1.6 Terra LB Comf. 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I LIFTB TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I SEDAN TERRA AUT4 4/5-Doors'

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'ÊTOYOTA Corolla 1.6 VVTi Terra Comfort 4/5-Doors'
'TOYOTA Corolla 1.3 16V LIFTB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 VVTI Linea Terra Comfort 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Terra LB 4/5-Doors'
'TOYOTA Corolla 1.4 VVTI LB 4/5-Doors'
'ÊTOYOTA Corolla 1.9 D HATCHB SOL 2/3-Doors'
'TOYOTA Corolla 1.9 D SEDAN TERRA 4/5-Doors'
'TOYOTA Corolla 2.0 DSL SEDAN LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 VVTi Linea terra 2/3-Doors'
'TOYOTA Corolla 2.0 DSL LIFTB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.9 D LIFTB LUNA 4/5-Doors'
'TOYOTA Corolla 1.9 D WGN LINEA TERRA Stationwagen'
'ÊTOYOTA Corolla 1.9 D SEDAN TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I HATCHB G6 2/3-Doors'
'TOYOTA Corolla 1.9 D LB LINEA SOL 4/5-Doors'
'TOYOTA Corolla 2.0D 4/5-Doors'
'TOYOTA Corolla 1.6 16V LIFTB LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.6 16v TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I WAGON TERRA Stationwagen'
'TOYOTA Corolla 1.6 HB SOL 2/3-Doors'
'ÊTOYOTA Corolla 2.0 DSL HATCHB LINEA TERRA 2/3-Doors'
'ÊTOYOTA Corolla 1.3 16V HATCHB LINEA TERRA 2/3-Doors'
'ÊTOYOTA Corolla LIFTBACK 1.4 VVT-i LINEA TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I HATCHB TERRA 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I HATCHB SOL 2/3-Doors'
'TOYOTA Corolla 1.6 VVT-i L. Sol Wagon Stationwagen'
'ÊTOYOTA Corolla 1.6 LB LINEA SOL 4/5-Doors'
'TOYOTA Corolla 1.4 VVT-i Linea Sol HB 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I LIFTB TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I SEDAN TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 G6 HB 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I SEDAN TERRA AUT4 4/5-Doors'
'TOYOTA Corolla 1.6 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I HATCHB SOL 2/3-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I HATCHB TERRA 2/3-Doors'
'TOYOTA Corolla 1.9 D Linea Terra 2/3-Doors'
'ÊTOYOTA Corolla 1.3 16V HATCHB G6 2/3-Doors'
'TOYOTA Corolla 1.4 16V VVT I LIFTB SOL 4/5-Doors'
'ÊTOYOTA Corolla 1.9 D LIFTB TERRA 4/5-Doors'
'TOYOTA Corolla 2.0 DSL HATCHB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 16V WAGON LINEA LUNA Stationwagen'
'TOYOTA Corolla 1.6 sol lb 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V HATCHB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 SDN LINEA SOL 4/5-Doors'
'TOYOTA Corolla 1.9 D Wagon Stationwagen'
'ÊTOYOTA Corolla 1.6 VVTI Linea Terra liftback 4/5-Doors'
'TOYOTA Corolla LIFTBACK 1.9 D Linea Terra 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V HATCHB S 2/3-Doors'
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'TOYOTA Corolla ! 1.6-16v vvt-i sol airco sedan 4/5-Doors'
'TOYOTA Corolla 1.4 VVT-i Linea Luna liftback 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V LIFTB LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.6 16V HATCHB S 2/3-Doors'
'ÊTOYOTA Corolla 1.6 SDN LINEA SOL 4/5-Doors'
'TOYOTA Corolla 1.6 VVTI Linea Sol Sedan 4/5-Doors'
'TOYOTA Corolla 1.6 16v Liftback Linea So 4/5-Doors'
'TOYOTA Corolla 1.4 HB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 16V LIFTB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.3 G6 liftback 4/5-Doors'
'ÊTOYOTA Corolla 1.6 HB LINEA TERRA 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16V LIFTB LINEA TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.3 Linea Terra liftback 4/5-Doors'
'ÊTOYOTA Corolla LIFTBACK 1.6 Linea terra 4/5-Doors'
'TOYOTA Corolla 1.3 16V HATCHB G6 2/3-Doors'
'TOYOTA Corolla 1.6 Hatchback 2/3-Doors'
'ÊTOYOTA Corolla 1.6 VVT-i Linea Sol 4/5-Doors'
'TOYOTA Corolla 1.6 16V VVT I HATCHB SOL AUT4 2/3-Doors'
'TOYOTA Corolla 1.3 16V LIFTB G6 4/5-Doors'
'ÊTOYOTA Corolla 1.6 16V VVT I HATCHB TERRA AUT4 2/3-Doors'
'TOYOTA Corolla 1.6 16V HATCHB LINEA LUNA 2/3-Doors'
'TOYOTA Corolla 1.6 16v Liftback Linea Sol 4/5-Doors'
'TOYOTA Corolla 1.4 HB Terra 2/3-Doors'
'ÊTOYOTA Corolla 1.3 16V WAGON LINEA TERRA Stationwagen'
'TOYOTA Corolla LIFTBACK 1.4 16V VVTI TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.6 SDN LINEA TERRA 4/5-Doors'
'ÊTOYOTA Corolla 1.4 16V VVT I LIFTB SOL 4/5-Doors'
'TOYOTA Corolla 2.0 d HB Diesel 2/3-Doors'
'TOYOTA Corolla 1.4 VVT-i Terra 2/3-Doors'
'TOYOTA Corolla 1.3 16V SEDAN LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 2.0 DSL LIFTB LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.3 16V HATCHB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 Linea Terra Comfort 4/5-Doors'
'TOYOTA Corolla 2.0 DSL HATCHB LINEA LUNA 2/3-Doors'
'TOYOTA Corolla 1.6 16V HATCHB G6 2/3-Doors'
'TOYOTA Corolla 2.0diesel Stationwagen'
'TOYOTA Corolla 2.0D TERRA LIFTBACK 4/5-Doors'
'TOYOTA Corolla 1.6 16V G6 2/3-Doors'
'TOYOTA Corolla 2.0D XL Sedan 4/5-Doors'
'TOYOTA Corolla Sw 20D Linea Terra Stationwagen'
'TOYOTA Corolla 1.3 16V WAGON LINEA TERRA Stationwagen'
'TOYOTA Corolla 1.6 VVT-i Linea Terra Comfort 4/5-Doors'
'TOYOTA Corolla 1.6 16V SEDAN LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 2.0 DSL WAGON LINEA TERRA Stationwagen'
'TOYOTA Corolla 1.6 16V SEDAN LINEA TERRA AUT4 4/5-Doors'
'TOYOTA Corolla 1.6 G6-R 2/3-Doors'
'TOYOTA Corolla 2.0 D Linea Terra 3d 2/3-Doors'
'TOYOTA Corolla 1.6 16v Liftback Linea Terra 4/5-Doors'
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'TOYOTA Corolla 1.3 16V HATCHB LINEA LUNA 2/3-Doors'
'TOYOTA Corolla 1.3 16V LIFTB LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.6 16V HATCHB G6 R 2/3-Doors'
'TOYOTA Corolla 2.0 SDN LINEA TERRA DSL 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Luna 2/3-Doors'
'TOYOTA Corolla 1.6 HB LINEA LUNA AUT 2/3-Doors'
'TOYOTA Corolla 1.3 16V Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.3 LIN. Terra 2/3-Doors'
'TOYOTA Corolla 1.3 16V WAGON LINEA LUNA Stationwagen'
'TOYOTA Corolla 2.0 LB LINEA TERRA D 4/5-Doors'
'TOYOTA Corolla 1.3 Linea Terra sedan Comf. 4/5-Doors'
'TOYOTA Corolla 1.6 HB Linea Luna 2/3-Doors'
'TOYOTA Corolla 1.6-16v Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.6 G6R HB 2/3-Doors'
'TOYOTA Corolla 1.6 Linea Luna Wagon Stationwagen'
'TOYOTA Corolla 1.6 16V SEDAN LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.3 16V LIFTB LINEA TERRA AUT3 4/5-Doors'
'TOYOTA Corolla 1.6 Terra HB 2/3-Doors'
'ÊTOYOTA Corolla 1.6 16v Linea Luna Stationwagen'
'TOYOTA Corolla 1.6 16V LIFTB LINEA TERRA AUT4 4/5-Doors'
'TOYOTA Corolla Linea Luna 1.6i 16V 2/3-Doors'
'TOYOTA Corolla 1.6 HB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.6 VVTi Linea Luna 4/5-Doors'
'TOYOTA Corolla 1.3 LB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.3 HB LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 2.0 D Linea luna Wagon Stationwagen'
'TOYOTA Corolla 1.6 16V HATCHB LINEA LUNA AUT4 2/3-Doors'
'TOYOTA Corolla 1.6 LB LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Terra HB 2/3-Doors'
'TOYOTA Corolla 1.3 16V 2/3-Doors'
'TOYOTA Corolla 1.6 16v Linea Luna 2/3-Doors'
'TOYOTA Corolla 1.3 16V L. TERRA COMFORT 2/3-Doors'
'TOYOTA Corolla 1.6 Luna Liftback 4/5-Doors'
'TOYOTA Corolla 1.3 16V HATCHB LINEA TERRA AUT3 2/3-Doors'
'TOYOTA Corolla 3drs 13i-16V 2/3-Doors'
'TOYOTA Corolla 1.3 16V HATCHB S 2/3-Doors'
'TOYOTA Corolla 1.6 16V SEDAN LINEA LUNA AUT4 4/5-Doors'
'TOYOTA Corolla 1.3-16V Luna 2/3-Doors'
'TOYOTA Corolla LIFTBACK 1.6 Linea Sol 4/5-Doors'
'TOYOTA Corolla 1.3 16V HATCHB LINEA LUNA AUT3 2/3-Doors'
'TOYOTA Corolla 1.6i Linea Terra HB 2/3-Doors'
'TOYOTA Corolla 1.6 HB Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.3 16V SEDAN LINEA TERRA AUT3 4/5-Doors'
'TOYOTA Corolla LIFTBACK 1.3i Linea Luna Liftback 4/5-Doors'
'TOYOTA Corolla 1.6 VVTi Linea Luna Lift 4/5-Doors'
'TOYOTA Corolla 1.6 16V WAGON LINEA TERRA AUT4 Stationwagen'
'TOYOTA Corolla 1.6 16V HATCHB LINEA TERRA AUT4 2/3-Doors'
'TOYOTA Corolla 1.6 16V LIFTB LINEA LUNA AUT4 4/5-Doors'
```

'TOYOTA Corolla 1.3 Hatchback 2/3-Doors'
'TOYOTA Corolla 1.6 I lb luna 4/5-Doors' 'TOYOTA Corolla 2/3-Doors'
'TOYOTA Corolla LIFTBACK 1.6-16v Linea Luna 2/3-Doors'
'TOYOTA Corolla 1.6 linea terra 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Luna Aut. 4/5-Doors'
'TOYOTA Corolla 1.3I LINEATERRA 2/3-Doors' 'TOYOTA Corolla '
'TOYOTA Corolla 1.6 LL HB 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Terra Comfort HB 2/3-Doors'
'TOYOTA Corolla 1.3 HB Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.6 GTSi HB 4/5-Doors'
'TOYOTA Corolla 1.6 GTSi HB 2/3-Doors'
'TOYOTA Corolla 1.6 Lin.Terra Aut. 4/5-Doors'
'TOYOTA Corolla 1.6 SD TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 16v Liftback Linea Luna 4/5-Doors'
'TOYOTA Corolla 1.6 LB Linea Terra 4/5-Doors'
'TOYOTA Corolla 1.3 Linea Terra Comfort 4/5-Doors'
'TOYOTA Corolla 1.6 Luna LB 4/5-Doors'
'TOYOTA Corolla 2.0 DSL WAGON LINEA TERRA COMM Anders'
'TOYOTA Corolla 1.6 LB *G3* AIRCO 4/5-Doors'
'TOYOTA Corolla 2.0D LINEA TERRA+airco 2/3-Doors'
'TOYOTA Corolla 2.0 ST WGN LINEA TERRA DSL Stationwagen'
'TOYOTA Corolla 1.6 3D Terra/Comf. 2/3-Doors'
'TOYOTA Corolla 1.6 16v Linea Terra 4/5-Doors'
'TOYOTA Corolla 2.0D Linea Terra 2/3-Doors' 'TOYOTA Corolla 2.0 DSL'
'TOYOTA Corolla 2.0 D Linea Terra Liftback 4/5-Doors'
'TOYOTA Corolla 1.6 HB Terra 4/5-Doors'
'TOYOTA Corolla 1.6i-16 SPORTS TC 2/3-Doors'
'TOYOTA Corolla 2.0 LB LINEA TERRA DSL 4/5-Doors'
'TOYOTA Corolla 1.6 HATCHBACK 2/3-Doors'
'TOYOTA Corolla 1.6 Linea Terra / Keuze uit 700 occasions 2/3-Doors'
'TOYOTA Corolla 1.3 16V HATCHB 2/3-Doors'
'TOYOTA Corolla 1.3 Linea Terra 3 drs 2/3-Doors'
'TOYOTA Corolla 1.6 16V S-uitvoering 2/3-Doors'
'TOYOTA Corolla 1.6 LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.6 Terra Stationwagen'
'TOYOTA Corolla 1.6 16V HATCHB GTSI 2/3-Doors'
'TOYOTA Corolla 1.3 Linea Luna Hatchback 2/3-Doors'
'TOYOTA Corolla 1.3i-16v Linea Terra 5d 4/5-Doors'
'TOYOTA Corolla 1.6 LB LINEA TERRA 4/5-Doors'
'TOYOTA Corolla 1.3 3D Linea Terra 2/3-Doors'
'TOYOTA Corolla 1.3 16V LB Linea Luna 4/5-Doors'
'TOYOTA Corolla 1.6 HB LINEA LUNA 2/3-Doors'
'TOYOTA Corolla LIFTBACK 1.6 Linea Terra Liftback 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Luna 4/5-Doors'
'TOYOTA Corolla 1.6 Linea Terra Comfort H 2/3-Doors'
'TOYOTA Corolla 1.3 Linea Terra wagon Stationwagen'
'TOYOTA Corolla 1.6 station 1 Stationwagen'
'TOYOTA Corolla 1.6 Linea Terra Sd 4/5-Doors'

```
'TOYOTA Corolla 1.3 16V Linea Terra 4/5-Doors'
'TOYOTA Corolla LIFTBACK 1.6 Linea Luna Liftback 4/5-Doors'
'TOYOTA Corolla 1.3i LINEA TERRA 2/3-Doors'
'TOYOTA Corolla 1.3 SDN LINEA TERRA AUT 4/5-Doors'
'TOYOTA Corolla 1.3 16v linea terra'
'TOYOTA Corolla 1.3 Linea Terra Hatchback 2/3-Doors'
'TOYOTA Corolla 1.6 lb aut 4/5-Doors'
'TOYOTA Corolla 1.6 WGN LINEA TERRA Stationwagen'
'TOYOTA Corolla 1.6 16V LIFTBACK LINEA LUNA 4/5-Doors'
'TOYOTA Corolla 1.6HB 2/3-Doors'
'TOYOTA Corolla Hatchback 1.6 Terra Comfort 2/3-Doors'
'TOYOTA Corolla 1.3 16V Linea Terra Liftb 4/5-Doors'
'TOYOTA Corolla 1.3 I LUNA 2/3-Doors'
'TOYOTA Corolla 1.6 Linea Terra Comfort 2/3-Doors'
'TOYOTA Corolla 1.6 16V HATCHBACK LINEA LUNA 2/3-Doors'
'TOYOTA Corolla LIFTBACK 1.6 Linea terra 4/5-Doors'
'TOYOTA Corolla 1.6 VVTi Linea Luna 2/3-Doors'
'TOYOTA Corolla 1.3 16V Linea Terra Liftb 2/3-Doors'
'TOYOTA Corolla 1.3 HB LINEA TERRA AUT Anders'
'TOYOTA Corolla LIFTBACK 1.3i Linea Terra Liftback 4/5-Doors'
'TOYOTA Corolla 1.6 LB 4/5-Doors'
'TOYOTA Corolla 1.6 SDN LINEA TERRA AUT 4/5-Doors'
'TOYOTA Corolla 1.3 HB LINEA TERRA AUT 2/3-Doors'
'TOYOTA Corolla 1.3 Linea Terra sedan 4/5-Doors'
'TOYOTA Corolla 1.6 Lin.Terra Aut. 2/3-Doors'
'TOYOTA Corolla 1.3 Linea Terra 4/5-Doors']
```

#Feature Selection

```
[6]: # Feature selection and importance using Random Forest
     X = df.drop(['Id', 'Model', 'Price'], axis=1)
     y = df['Price']
     X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
      ↪random_state=42)
```

```
[7]: scaler = StandardScaler()
     X_train_scaled = scaler.fit_transform(X_train)
     X_test_scaled = scaler.transform(X_test)
```

Feature selection using randomforest regressor

```
[8]: rf = RandomForestRegressor(n_estimators=120, random_state=42)
     rf.fit(X_train_scaled, y_train)
```

```
[8]: RandomForestRegressor(n_estimators=120, random_state=42)
```

#Feature Importance

```
[9]: feature_importances = rf.feature_importances_
     feature_names = X.columns
     feature_importance_df = pd.DataFrame({'Feature': feature_names, 'Importance':␣
       ↪feature_importances})
     print("Feature Importance:\n", feature_importance_df.
       ↪sort_values(by='Importance', ascending=False))
```

```
Feature Importance:
        Feature  Importance
0     Age_08_04    0.841171
6        Weight    0.068179
1            KM    0.066293
2            HP    0.018042
3         Doors    0.005497
5         Gears    0.000818
4     Cylinders    0.000000
```

"Age_08_04" feature is the most important for predicting the target variable (presumably "Price"), with an importance score of approximately 0.841. This indicates that the age of the Toyota Corolla (in months) at the time of sale is the most significant factor in determining its price of the model.

The other features have much lower importance scores, indicating their relative impact on the target variable is lower compared to "Age_08_04":

"Weight" has an importance score of about 0.068, suggesting it has some influence on the price prediction, but less than "Age_08_04".

"KM" (kilometers driven) and "HP" (horsepower) have importance scores of approximately 0.066 and 0.018, respectively, indicating they also contribute to the prediction, but to a lesser extent than "Weight" and "Age_08_04".

"Doors", "Gears", and "Cylinders" have very low or zero importance scores, suggesting they have minimal impact on the price prediction

```
[10]: # Feature selection
      model = SelectFromModel(rf, prefit=True)
      X_train_selected = model.transform(X_train_scaled)
      X_test_selected = model.transform(X_test_scaled)
```

```
[11]: # Build SVM model
      svm = SVR()
      svm.fit(X_train_selected, y_train)
      svm_score = svm.score(X_test_selected, y_test)
      print("SVM Score:", svm_score)

      # Build KNN model
      knn = KNeighborsRegressor()
      knn.fit(X_train_selected, y_train)
      knn_score = knn.score(X_test_selected, y_test)
      print("KNN Score:", knn_score)
```

```
SVM Score: 0.03287137433191134
KNN Score: 0.8190538854022031
```

[12]:
```python
# SVM model
svm_model = SVR()
svm_params = {'kernel': ['linear', 'rbf'], 'C': [0.1, 1, 10], 'gamma':
 ↪['scale', 'auto']}
svm_grid = GridSearchCV(svm_model, svm_params,
 ↪scoring='neg_mean_squared_error', cv=5)
svm_grid.fit(X_train_scaled, y_train)
svm_best_model = svm_grid.best_estimator_
```

[13]:
```python
# KNN model
knn_model = KNeighborsRegressor()
knn_params = {'n_neighbors': [3, 5, 7], 'weights': ['uniform', 'distance']}
knn_grid = GridSearchCV(knn_model, knn_params,
 ↪scoring='neg_mean_squared_error', cv=5)
knn_grid.fit(X_train_scaled, y_train)
knn_best_model = knn_grid.best_estimator_
```

[14]:
```python
# Evaluating the models
def evaluate_model(model, X_test, y_test):
    y_pred = model.predict(X_test)
    mae = mean_absolute_error(y_test, y_pred)
    mse = mean_squared_error(y_test, y_pred)
    r2 = r2_score(y_test, y_pred)
    return mae, mse, r2
```

[15]:
```python
svm_mae, svm_mse, svm_r2 = evaluate_model(svm_best_model, X_test_scaled, y_test)
knn_mae, knn_mse, knn_r2 = evaluate_model(knn_best_model, X_test_scaled, y_test)

# Calculating accuracy scores
svm_train_accuracy = svm_best_model.score(X_train_scaled, y_train)
svm_test_accuracy = svm_best_model.score(X_test_scaled, y_test)

knn_train_accuracy = knn_best_model.score(X_train_scaled, y_train)
knn_test_accuracy = knn_best_model.score(X_test_scaled, y_test)

print("SVM Train Accuracy:", svm_train_accuracy)
print("SVM Test Accuracy:", svm_test_accuracy)

print("\nKNN Train Accuracy:", knn_train_accuracy)
print("KNN Test Accuracy:", knn_test_accuracy)
```

```
SVM Train Accuracy: 0.8469872577189992
SVM Test Accuracy: 0.8331525167989715
```

```
KNN Train Accuracy: 1.0
KNN Test Accuracy: 0.8773109428757436
```

[16]:
```python
print("SVM:")
print("MAE:", svm_mae)
print("MSE:", svm_mse)
print("R-squared:", svm_r2)

print("\nKNN:")
print("MAE:", knn_mae)
print("MSE:", knn_mse)
print("R-squared:", knn_r2)

# Selecting the best model
best_model = svm_best_model if svm_r2 > knn_r2 else knn_best_model
```

```
SVM:
MAE: 1011.6843053019937
MSE: 2226210.7374544013
R-squared: 0.8331525167989715


KNN:
MAE: 880.054212189236
MSE: 1637014.182641818
R-squared: 0.8773109428757436
```

[17]:
```python
from tabulate import tabulate

table = [
    ["Model", "Train Accuracy", "Test Accuracy", "MAE", "MSE", "R-squared"],
    ["SVM", svm_train_accuracy, svm_test_accuracy, svm_mae, svm_mse, svm_r2],
    ["KNN", knn_train_accuracy, knn_test_accuracy, knn_mae, knn_mse, knn_r2]
]

print(tabulate(table, headers="firstrow", floatfmt=".4f"))
```
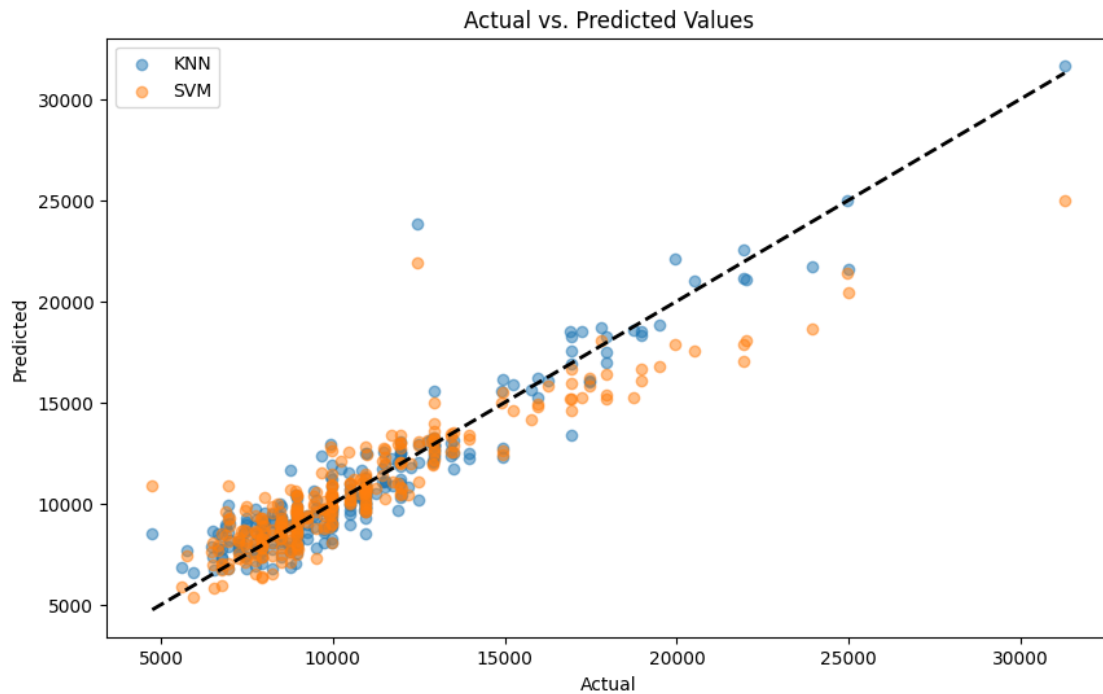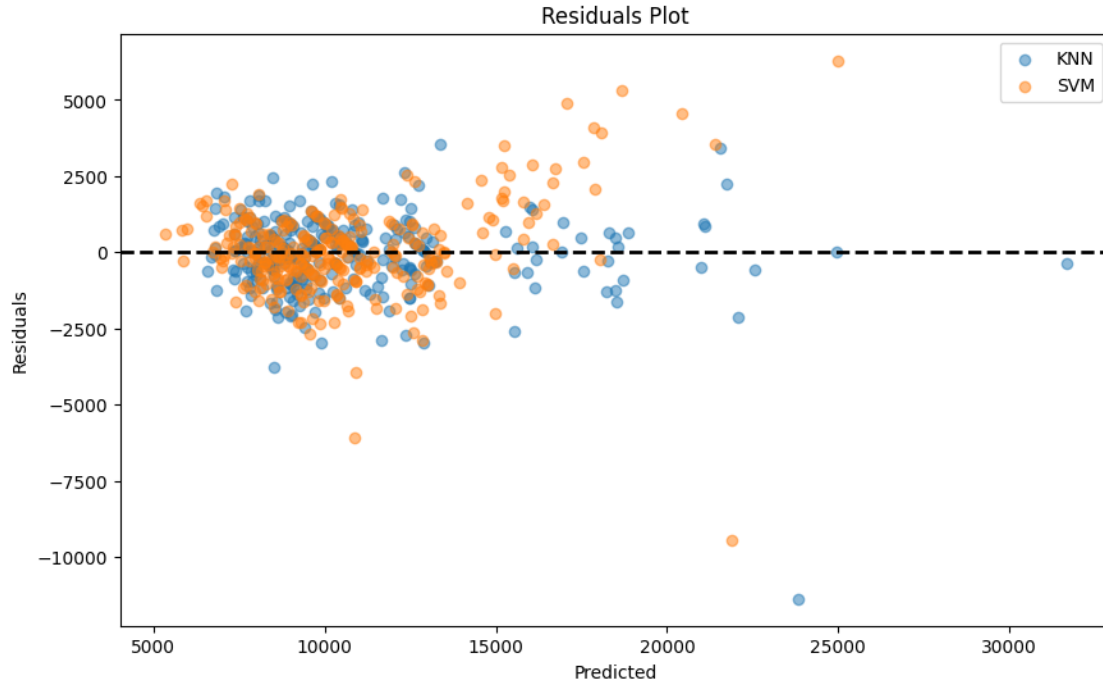
```
Model      Train Accuracy    Test Accuracy        MAE           MSE    R-squared
-------    --------------    -------------    ---------    -----------    -----------
SVM                0.8470           0.8332    1011.6843    2226210.7375       0.8332
KNN                1.0000           0.8773     880.0542    1637014.1826       0.8773
```

[18]:
```python
# Actual vs. Predicted Values Plot
plt.figure(figsize=(10, 6))
plt.scatter(y_test, knn_best_model.predict(X_test_scaled), label='KNN', alpha=0.
↪5)
plt.scatter(y_test, svm_best_model.predict(X_test_scaled), label='SVM', alpha=0.
↪5)
```

```
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'k--',␣
 ↪lw=2)
plt.xlabel('Actual')
plt.ylabel('Predicted')
plt.title('Actual vs. Predicted Values')
plt.legend()
plt.show()
```


[19]:
```
# Residuals Plot
plt.figure(figsize=(10, 6))
plt.scatter(knn_best_model.predict(X_test_scaled), y_test - knn_best_model.
 ↪predict(X_test_scaled), label='KNN', alpha=0.5)
plt.scatter(svm_best_model.predict(X_test_scaled), y_test - svm_best_model.
 ↪predict(X_test_scaled), label='SVM', alpha=0.5)
plt.axhline(y=0, color='k', linestyle='--', lw=2)
plt.xlabel('Predicted')
plt.ylabel('Residuals')
plt.title('Residuals Plot')
plt.legend()
plt.show()
```

14

Residuals Plot

The results indicate that both models perform reasonably well in predicting car prices, but with some differences:

- **SVM** achieved a train accuracy of approximately 84.7% and a test accuracy of about 83.3%. It also yielded a mean absolute error (MAE) of around 1011.68, a mean squared error (MSE) of about 2,226,210.74, and an R-squared value of approximately 0.833.

- **KNN** achieved a train accuracy of 100% and a test accuracy of about 87.7%. It also yielded a lower MAE of approximately 880.05, a lower MSE of about 1,637,014.18, and a higher R-squared value of approximately 0.877.

Based on these results, it can be conclude that the KNN model out-performs the SVM model for this dataset. **The KNN model demonstrates higher accuracy on both training and test sets, as well as lower error metrics (MAE and MSE) and a higher R-squared value, indicating better overall performance in predicting Toyota Corolla prices. Therefore, we recommend using the KNN model for this dataset to achieve the best predictions.**