In [ ]:
```
# importere modulerne vi bruger i pogrammet
from sklearn.model_selection import train_test_split
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import PolynomialFeatures
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import LabelEncoder, OneHotEncoder
import pandas as pd
import matplotlib.pyplot as plt
import pickle as pkl
```

In [ ]:
```
# definere preprocessoren

features = ["model", "year", "transmission", "mileage", "fuelType", "mpg", "engi

cat_features = ["model", "transmission", "fuelType", "brand"]
cont_features = ["year", "mileage", "mpg", "engineSize"]

# laver en preprocesser med to forskellige transformere
preprocessor = ColumnTransformer(
    transformers=[
        # onehot til kategoriske features
        ("cat", OneHotEncoder(), cat_features),
        # standardscaler til "continuous features"(tal)
        ("cont", StandardScaler(), cont_features)
    ])
```

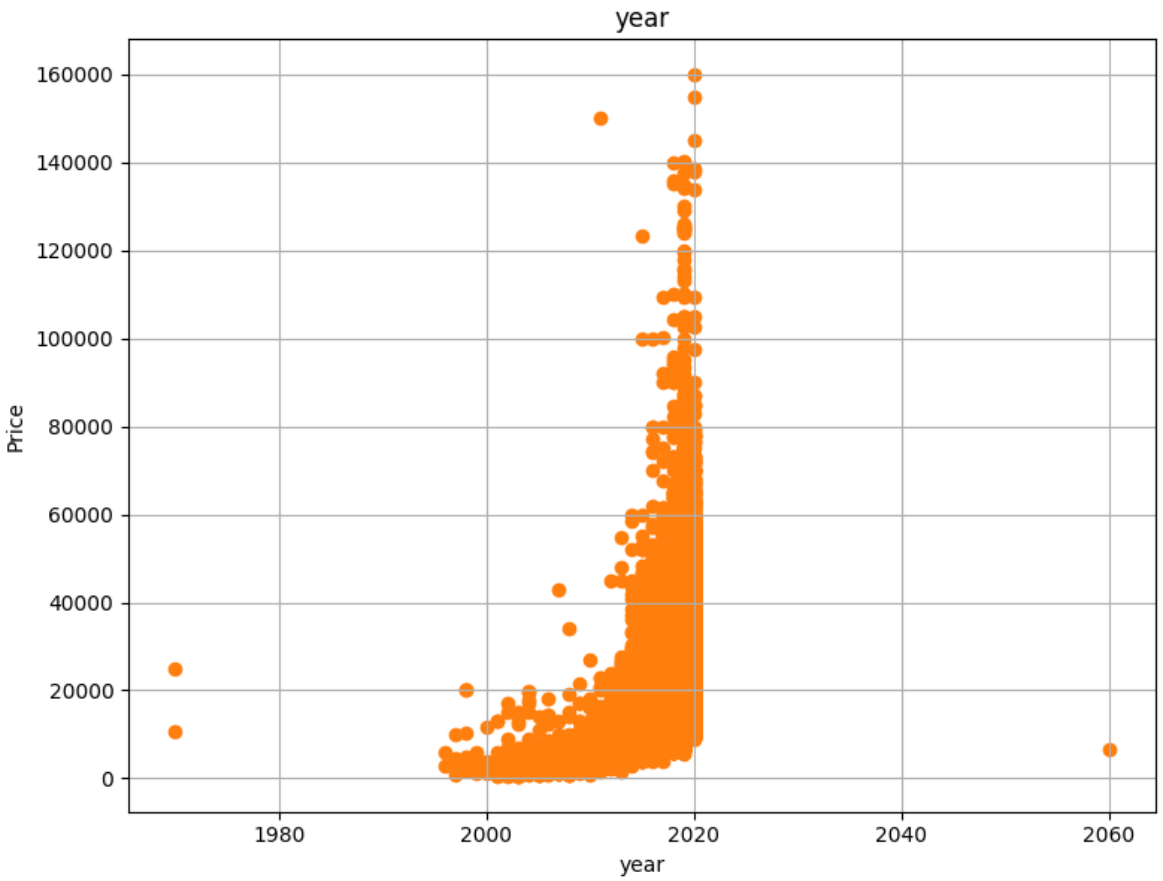
In [ ]:
```
# indlæser datasættet og transformere med prepocessor
data = pd.read_csv("./samletdata.csv", sep=";", decimal=",")
data = data.loc[:, ~data.columns.str.contains('^Unnamed')]
data["model"] = data["model"].str.strip()

X = preprocessor.fit_transform(data.drop(["price", "tax"], axis=1))
# pickler prepocessoren til brug i hjemmesiden
with(open("preprocessor.pkl", "wb")) as f:
    pkl.dump(preprocessor, f)

y = data['price']
```

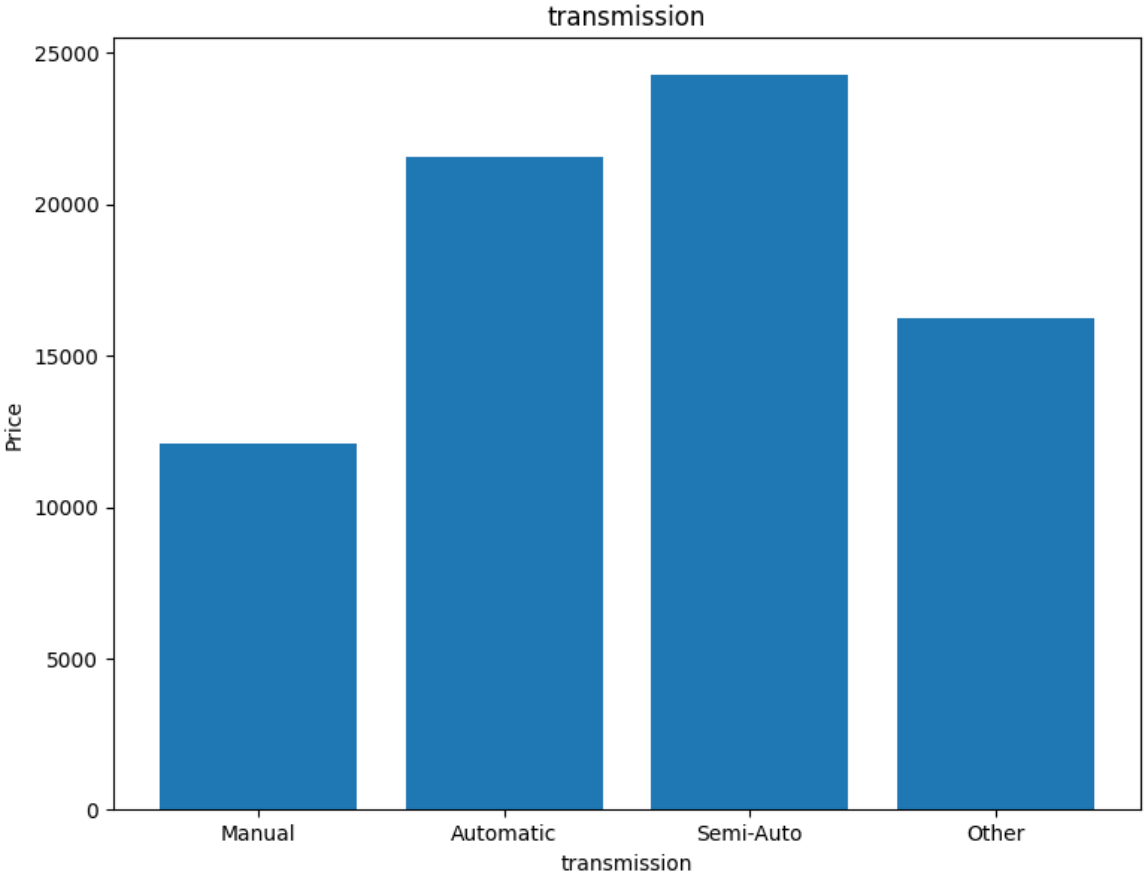
In [ ]:
```
# laver dictionaries til at kunne laver søjlediagrammer
from statistics import mean

X_plot = data.drop(["price", "tax", "model"], axis=1)

brand_dict = {}
for brand in X_plot["brand"].unique():
    brand_dict[brand] = mean([y[i] for i, row in X_plot.iterrows() if row["brand
print(brand_dict)
trans_dict = {}
for trans in X_plot["transmission"].unique():
    trans_dict[trans] = mean([y[i] for i, row in X_plot.iterrows() if row["trans
print(trans_dict)
fuel_dict = {}
for fuel in X_plot["fuelType"].unique():
    fuel_dict[fuel] = mean([y[i] for i, row in X_plot.iterrows() if row["fuelTyp
print(fuel_dict)
```

```
{'audi': 22896, 'bmw': 22733, 'ford': 12279, 'hyundai': 12750, 'mercedes': 24698,
'skoda': 14275, 'toyota': 12522, 'vauxhall': 10406, 'vw': 16838}
{'Manual': 12112, 'Automatic': 21558, 'Semi-Auto': 24284, 'Other': 16219}
{'Petrol': 14775, 'Diesel': 19339, 'Hybrid': 19289, 'Other': 17443, 'Electric': 1
6645}
```

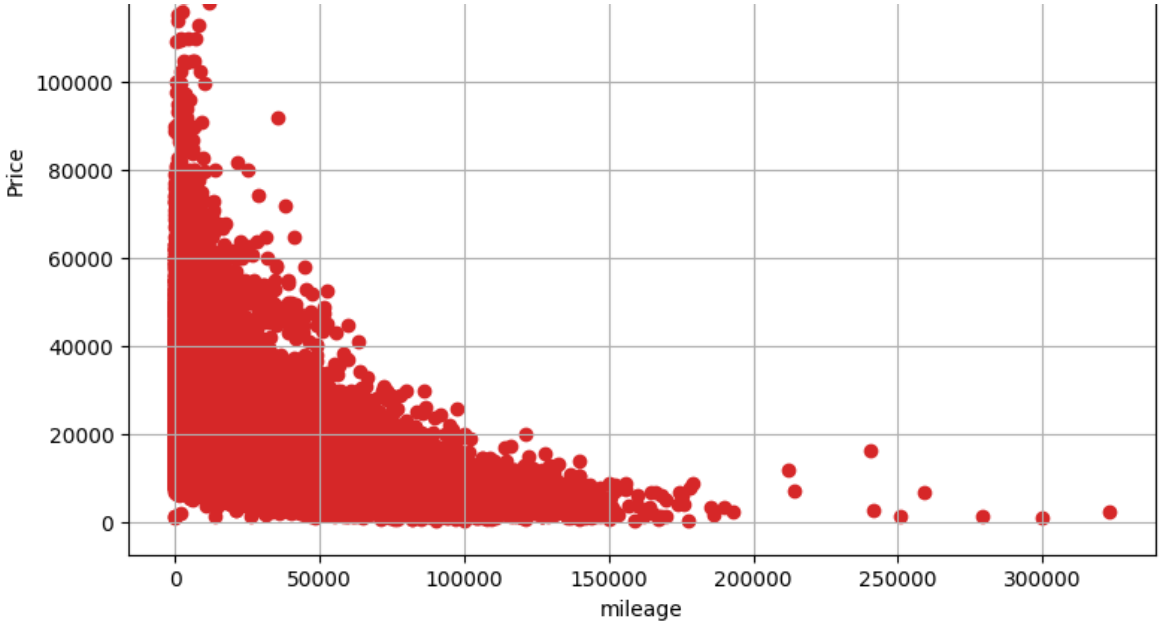
In [ ]:

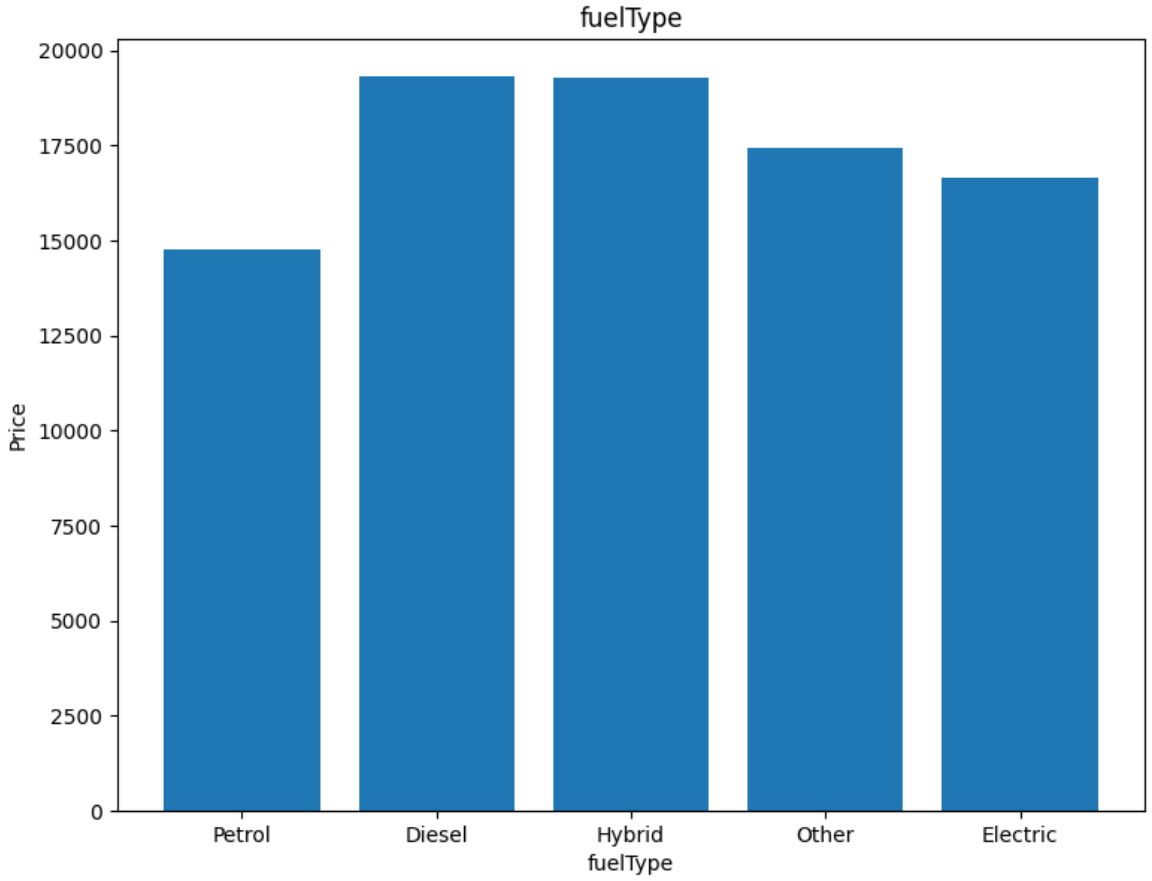
```python
# plotter vores data med matplotlib
colors = {"year": "tab:orange", "transmission": "tab:green", "mileage": "tab:red
plot_features = [feature for feature in features if feature != "model"]
fig, axs = plt.subplots(nrows=len(plot_features), ncols=1, figsize=(8, 6 * len(p

# Iterate over each feature and create scatterplot
for i, col in enumerate(plot_features):
    if col in cont_features:
        axs[i].scatter(X_plot.iloc[:, i], y, c=colors[col])
        axs[i].set_title(col)
        axs[i].set_xlabel(col)
        axs[i].set_ylabel('Price')
        axs[i].grid(True)
    elif col == "brand":
        axs[i].bar(brand_dict.keys(), brand_dict.values())
        axs[i].set_title(col)
        axs[i].set_xlabel(col)
        axs[i].set_ylabel('Price')
    elif col == "transmission":
        axs[i].bar(trans_dict.keys(), trans_dict.values())
        axs[i].set_title(col)
        axs[i].set_xlabel(col)
        axs[i].set_ylabel('Price')
    elif col == "fuelType":
        axs[i].bar(fuel_dict.keys(), fuel_dict.values())
        axs[i].set_title(col)
        axs[i].set_xlabel(col)
        axs[i].set_ylabel('Price')

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

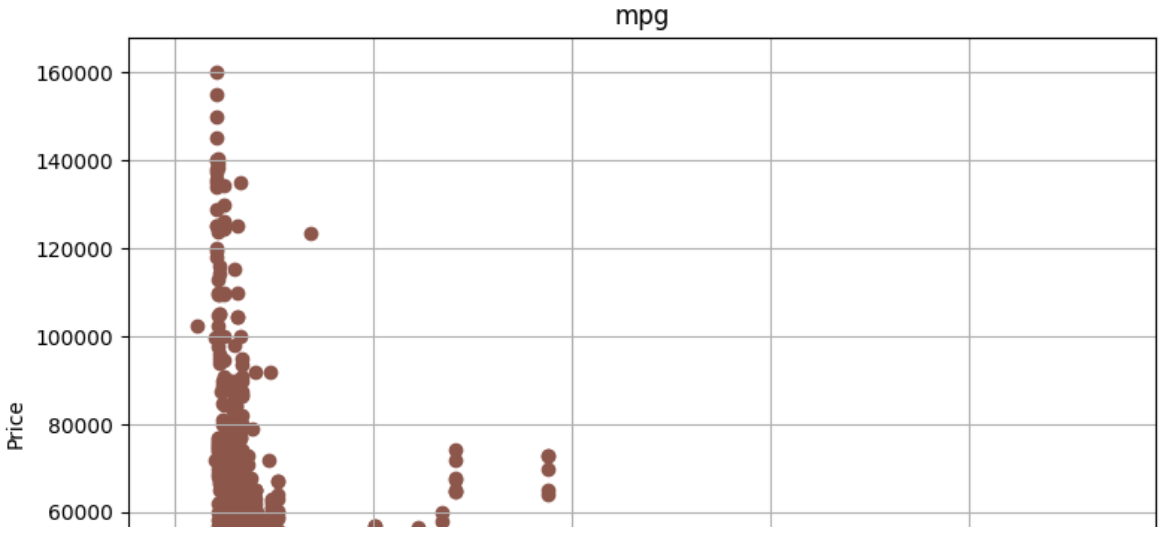

year
160000
140000
120000
100000
80000
60000
40000
20000
0
Price
1980
2000
2020
2040
2060
year

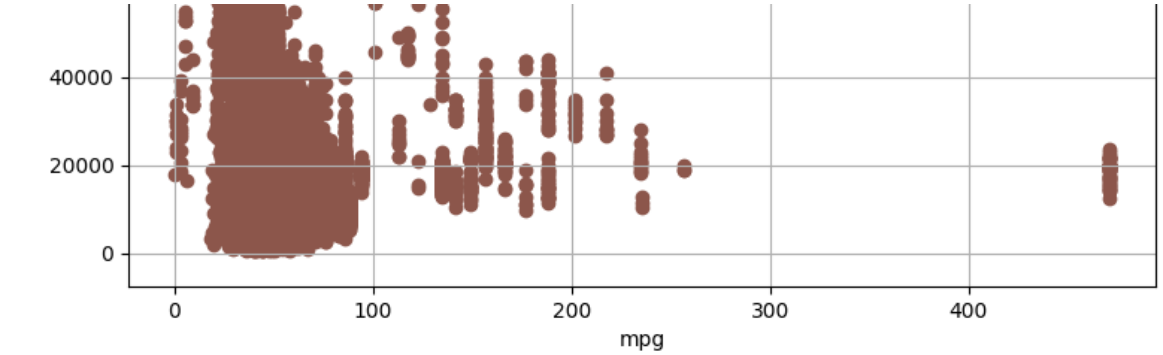

transmission
25000
20000
15000
10000
5000
0
Price
Manual
Automatic
Semi-Auto
Other
transmission

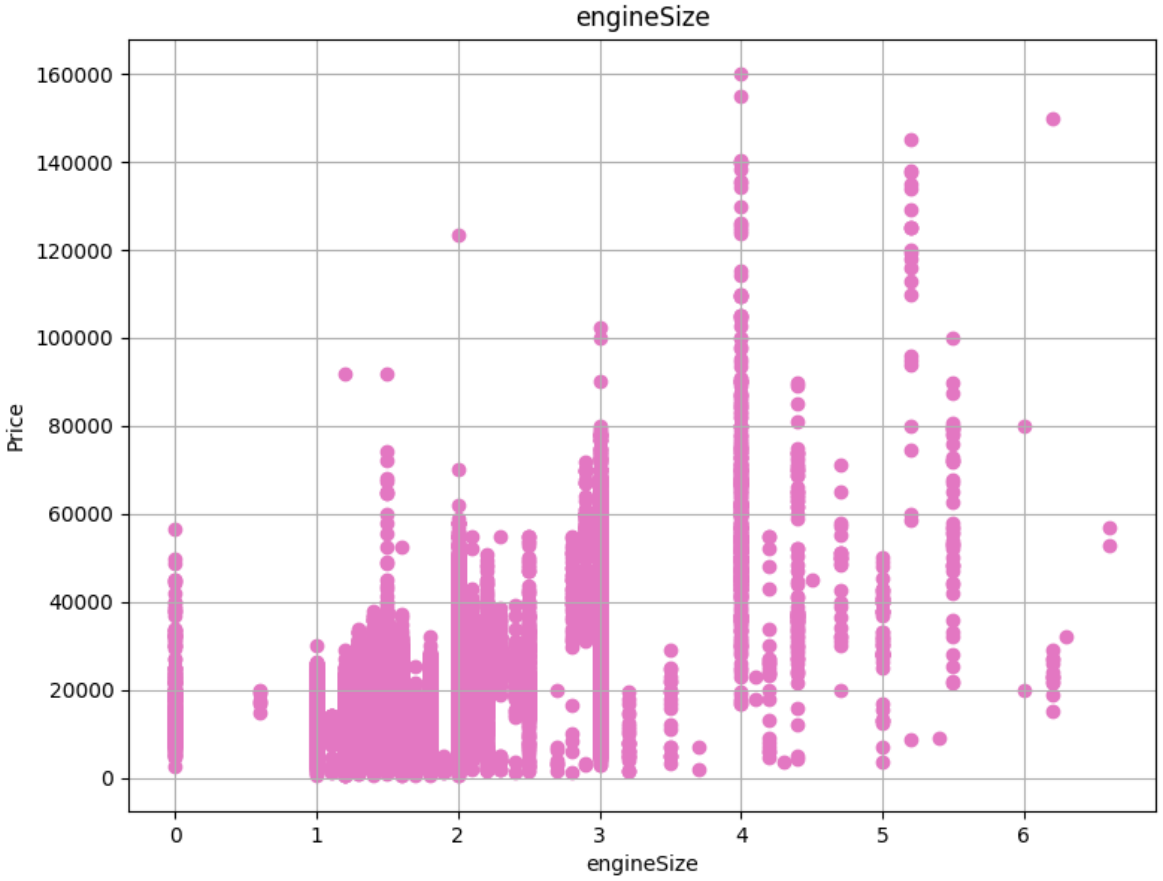

mileage
160000
140000
120000

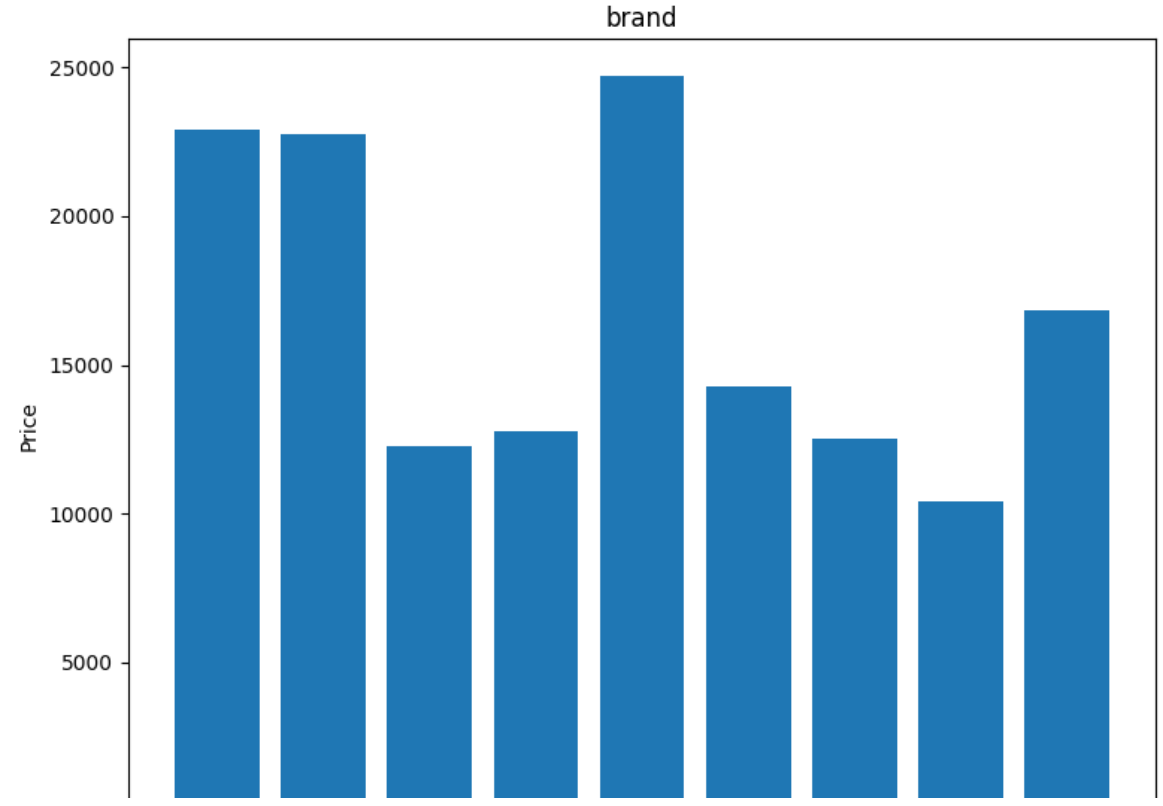

Price
100000
80000
60000
40000
20000
0
0
50000
100000
150000
200000
250000
300000
mileage


fuelType
Price
20000
17500
15000
12500
10000
7500
5000
2500
0
Petrol
Diesel
Hybrid
Other
Electric
fuelType


mpg
Price
160000
140000
120000
100000
80000
60000


40000
20000
0
0
100
200
300
400
mpg


engineSize
160000
140000
120000
100000
80000
60000
40000
20000
0
Price
0
1
2
3
4
5
6
engineSize


brand
25000
20000
15000
10000
5000
Price

In [ ]:
```
# lav "pipeline" og fitter den til dataen
model = Pipeline(steps=[
    ('poly', PolynomialFeatures(degree=3)), # polynomiske features så modellen p
    ('regressor', LinearRegression()) # lineær regression pågrund af god perfoma
], verbose=True)

model.fit(X, y)
pkl.dump(model, open("model.pkl", "wb"))
```

```
[Pipeline] ............... (step 1 of 2) Processing poly, total=   6.4s
[Pipeline] ......... (step 2 of 2) Processing regressor, total= 7.6min
```

In [ ]:
```
# test prediction
test_data = {col: [data] for col, data in zip(features, ["Octavia", 2010, "Manua

test_data = pd.DataFrame(test_data)
test_data = preprocessor.transform(test_data)
print(model.predict(test_data))
```

```
[5499.47831473]
```

In [ ]:
```
# test R2 værdi ved at splitte X i test og træning og fitter modellen igen
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_
model.fit(X_train, y_train)
score = model.score(X_test, y_test)

print("Model R-squared (R2) Score:", score)
```

```
[Pipeline] ............... (step 1 of 2) Processing poly, total=   3.5s
[Pipeline] ......... (step 2 of 2) Processing regressor, total= 6.9min
Model R-squared (R2) Score: 0.9521675295667276
```