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Objectives

- Use scikit-learn
- Use real_estate.csv
- Perform linear regression and predict price based on the features
- Using combinations of data try multiple regression

In [ ]:
```
import numpy as np
import pandas as pd
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import MinMaxScaler, StandardScaler, LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score
import matplotlib.pyplot as plt
```

In [ ]:
```
df = pd.read_csv('real_estate.csv')

df['UniqueNum'] = [_ for _ in range(len(df))]
df = df.drop("Address", axis = 1)
```

Cleaning the dataset

In [ ]:
```
def assign_year_category(year) -> int:
    if year < 1800:
        return 8
    elif 1800 <= year < 1850:
        return 7
    elif 1850 <= year < 1900:
        return 6
    elif 1900 <= year < 1920:
        return 5
    elif 1920 <= year < 1950:
        return 4
    elif 1950 <= year < 1980:
        return 3
    elif 1980 <= year < 2000:
        return 2
    elif 2000 <= year < 2023:
        return 1
    else:
        return 0

df['YearBuilt2'] = df['YearBuilt'].apply(assign_year_category)
```

```
df = df.drop('YearBuilt', axis = 1)

scaler = MinMaxScaler()
df[['price_norm', 'land_size_norm']] = scaler.fit_transform(df[['Price', 'Landsi

scaler = StandardScaler()
df[['price_norm', 'land_size_norm']] = scaler.fit_transform(df[['Price', 'Landsi
```

In [ ]:

```
l_encoder = LabelEncoder()
df['EncodedUniqueNum'] = l_encoder.fit_transform(df['UniqueNum'])
df['EncodedRegionname'] = l_encoder.fit_transform(df['Regionname'])
df['EncodedSuburb'] = l_encoder.fit_transform(df['Suburb'])
df['EncodedType'] = l_encoder.fit_transform(df['Type'])
df = df.drop('UniqueNum', axis = 1)
df = df.drop('Regionname', axis = 1)
df = df.drop('Suburb', axis = 1)
df = df.drop('Type', axis = 1)
df = df.dropna()

features = df.to_numpy()
covar = np.cov(features)
print(covar)

print(df)
```

```
[[1.82528638e+11 1.27646467e+11 1.80679311e+11 ... 1.44137412e+11
  3.08163751e+11 1.58321244e+11]
 [1.27646467e+11 8.92661044e+10 1.26353190e+11 ... 1.00798600e+11
  2.15505984e+11 1.10717679e+11]
 [1.80679311e+11 1.26353190e+11 1.78848722e+11 ... 1.42677061e+11
  3.05041532e+11 1.56717187e+11]
 ...
 [1.44137412e+11 1.00798600e+11 1.42677061e+11 ... 1.13836122e+11
  2.43362800e+11 1.25036680e+11]
 [3.08163751e+11 2.15505984e+11 3.05041532e+11 ... 2.43362800e+11
  5.20289036e+11 2.67309421e+11]
 [1.58321244e+11 1.10717679e+11 1.56717187e+11 ... 1.25036680e+11
  2.67309421e+11 1.37339427e+11]]
```

	Rooms	Price	Bedroom2	Bathroom	Landsize	YearBuilt2	price_norm	land_size_norm	EncodedUniqueNum	EncodedRegionname	EncodedSuburb	EncodedType
0	2	1480000	2	1	202	0	0.632448	-0.089316	0	2	0	0
1	2	1035000	2	1	156	5	-0.063640	-0.100843	1	2	0	0
2	3	1465000	3	2	134	5	0.608984	-0.106356	2	2	0	0
3	3	850000	3	2	94	0	-0.353025	-0.116380	3	2	0	0
4	4	1600000	3	1	120	1	0.820157	-0.109864	4	2	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...
13575	4	1245000	4	2	652	2	0.264851	0.023452	13575	4	302	0
13576	3	1031000	3	2	333	2	-0.069897	-0.056488	13576	6	305	0
13577	3	1170000	3	2	436	2	0.147533	-0.030677	13577	6	305	0
13578	4	2500000	4	1	866	4	2.227975	0.077079	13578	6	305	0
13579	4	1285000	4	1	362	4	0.327421	-0.049221	13579	6	313	0

```
[13580 rows x 12 columns]
```

	Rooms	Price	Bedroom2	Bathroom	Landsize	YearBuilt2	price_norm	land_size_norm	EncodedUniqueNum	EncodedRegionname	EncodedSuburb	EncodedType
0	2	1480000	2	1	202	0	0.632448	-0.089316	0	2	0	0
1	2	1035000	2	1	156	5	-0.063640	-0.100843	1	2	0	0
2	3	1465000	3	2	134	5	0.608984	-0.106356	2	2	0	0
3	3	850000	3	2	94	0	-0.353025	-0.116380	3	2	0	0
4	4	1600000	3	1	120	1	0.820157	-0.109864	4	2	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...

```
13575      4  1245000         4         2       652           2    0.264851
13576      3  1031000         3         2       333           2   -0.069897
13577      3  1170000         3         2       436           2    0.147533
13578      4  2500000         4         1       866           4    2.227975
13579      4  1285000         4         1       362           4    0.327421

       land_size_norm  EncodedUniqueNum  EncodedRegionname  EncodedSuburb  \
0           -0.089316                 0                  2              0
1           -0.100843                 1                  2              0
2           -0.106356                 2                  2              0
3           -0.116380                 3                  2              0
4           -0.109864                 4                  2              0
...               ...               ...                ...            ...
13575        0.023452             13575                  4            302
13576       -0.056488             13576                  6            305
13577       -0.030677             13577                  6            305
13578        0.077079             13578                  6            305
13579       -0.049221             13579                  6            313

       EncodedType
0                0
1                0
2                0
3                0
4                0
...            ...
13575            0
13576            0
13577            0
13578            0
13579            0

[13580 rows x 12 columns]
```

Simple linear regression

- Trying to predict the landsize of the house based on its price

In [ ]:
```
X = np.array(df["Price"]).reshape(-1, 1) # can also use price_norm to use the no
print(X)
y = np.array(df["Landsize"]) # can also use land_size_norm to use the normalized
print(y)

model = LinearRegression()
model.fit(X, y)
```

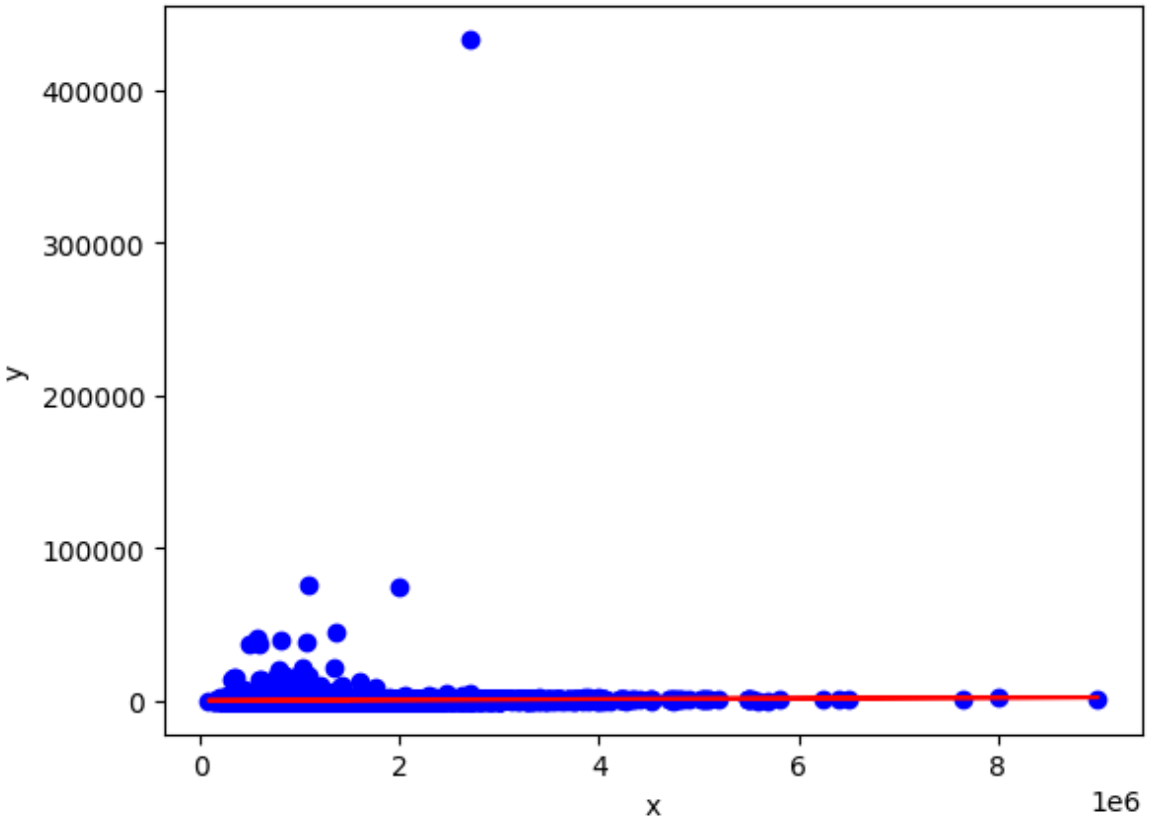
```
[[1480000]
 [1035000]
 [1465000]
 ...
 [1170000]
 [2500000]
 [1285000]]
[202 156 134 ... 436 866 362]
```

Out[ ]:
```
▾ LinearRegression
LinearRegression()
```

In [ ]:
```
X_new = np.array([2000000]).reshape(-1, 1)
y_pred = model.predict(X_new)
print("Prediction of new price for X_new = {} is {}".format(X_new, y_pred))
```

```
Prediction of new price for X_new = [[2000000]] is [774.82333246]
```

In [ ]:
```
plt.scatter(X, y, color = "blue")
plt.plot(X, model.predict(X), color = "red")
plt.xlabel("x")
plt.ylabel("y")
plt.show()
```



Multiple linear regression

- Trying to predict landsize of the house using price and the number of bedrooms it has.

In [ ]:
```
X = np.array(df.loc[:, ['price_norm', 'Bedroom2']].values) # can also use price_
y = np.array(df["Landsize"]) # can also use land_size_norm to use the normalized

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3, rando
model = LinearRegression()
model.fit(X_train, y_train)

y_pred = model.predict(X_test)

print(y_pred)
```

```
[596.38488847 426.31253231 529.11591957 ... 526.71946255 414.75067828
 639.06663477]
```

- Calculating the mean squared error and R2 score

In [ ]:
```
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean squared error =", mse)
print("R2 score =", r2)
```

```
Mean squared error = 48548904.28521491
R2 score = 0.0003085798410912277
```