Performing Linear Regression on Advertising dataset

Why do you use Regression Analysis?

Regression analysis estimates the relationship between two or more variables.

```
# import libraries
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.metrics import r2_score, mean_squared_error
from math import sqrt

# this allows plots to appear directly in the notebook
%matplotlib inline


# read data into a DataFrame
data = pd.read_csv('Advertising.csv', index_col=0)
data.head()
data.columns = ['TV','Sales']


data
```

	TV	Sales
1	230.1	22.1
2	44.5	10.4
3	17.2	9.3
4	151.5	18.5
5	180.8	12.9
...	...	...
196	38.2	7.6
197	94.2	9.7
198	177.0	12.8
199	283.6	25.5
200	232.1	13.4

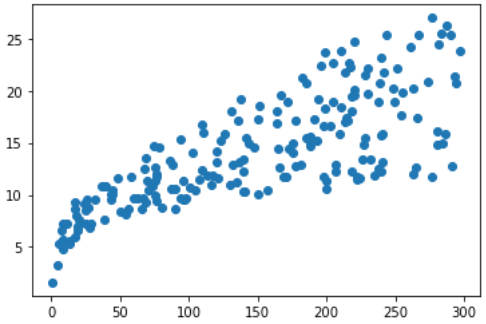
200 rows × 2 columns

```
# print the shape of the DataFrame
data.shape
```

```
(200, 2)
```

```
# visualize the relationship between the features and the response using scatterplots
#data.plot(kind='scatter', x='TV', y='Sales')
plt.scatter(data['TV'], data['Sales'])
```

```
<matplotlib.collections.PathCollection at 0x1c66a6cd850>
```




```
# create X and y
#taking only one variable for now
X = data[['TV']]
X
```

	TV
1	230.1
2	44.5
3	17.2
4	151.5
5	180.8
...	...
196	38.2
197	94.2
198	177.0
199	283.6
200	232.1

200 rows × 1 columns

```
y = data.Sales
y
```

```
1      22.1
2      10.4
3       9.3
4      18.5
5      12.9
       ...
196     7.6
197     9.7
198    12.8
199    25.5
200    13.4
Name: Sales, Length: 200, dtype: float64
```

```
# follow the usual sklearn pattern: import, instantiate, fit
from sklearn.linear_model import LinearRegression
lm = LinearRegression()
lm.fit(X, y)

# print intercept and coefficients
print(lm.intercept_)
print(lm.coef_)
```

```
7.032593549127693
[0.04753664]
```

```
# manually calculate the prediction using above slope and intercept in b0+b1*x
7.032594 + 0.047537*50
```

```
9.409444
```

```
# you have to create a DataFrame since the Statsmodels formula interface expects it
X_new = pd.DataFrame({'TV': [230.1]})
X_new.head()
```

	TV
0	230.1

```
# use the model to make predictions on a new value
lm.predict(X_new)
```

```
array([17.97077451])
```

```
data['TV'].min()
```

```
0.7
```

```
# create a DataFrame with the minimum and maximum values of TV
X_new = pd.DataFrame({'TV': [data['TV'].min(), data['TV'].max()]})
X_new.head()
```

TV

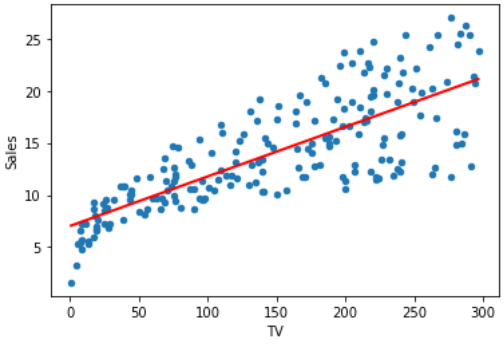
```
# make predictions for those x values and store them
preds = lm.predict(X_new)
preds
```

```
array([ 7.0658692 , 21.12245377])
```

```
# first, plot the observed data
data.plot(kind='scatter', x='TV', y='Sales')

# then, plot the least squares line
plt.plot(X_new, preds, c='red', linewidth=2)
```

```
[<matplotlib.lines.Line2D at 0x1c66cc36d30>]
```




```
predictions = lm.predict(X)
print(sqrt(mean_squared_error(y, predictions)))
```

```
3.2423221486546887
```

```
r2 = r2_score(y, predictions)
r2
```

```
0.611875050850071
```