advertising_and_sales_clean

August 7, 2022

1 Adveriting and Sales Data (LinearRegression)

This data is about the relation between Sales and Marketing at different Media (TVs , Radio and Social Media).

Here we will make a linear Regressor and Correlation to show the relation between Data

[2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

[3]:
```
df = pd.read_csv('advertising_and_sales_clean.csv')
df.head(20)
```

[3]:

	tv	radio	social_media	influencer	sales
0	16000.0	6566.23	2907.98	Mega	54732.76
1	13000.0	9237.76	2409.57	Mega	46677.90
2	41000.0	15886.45	2913.41	Mega	150177.83
3	83000.0	30020.03	6922.30	Mega	298246.34
4	15000.0	8437.41	1406.00	Micro	56594.18
5	29000.0	9614.38	1027.16	Mega	105889.15
6	55000.0	24893.81	4273.60	Micro	198679.82
7	31000.0	17355.04	2289.85	Nano	108733.93
8	76000.0	24648.90	7130.12	Macro	270189.40
9	13000.0	431.13	2229.42	Mega	48280.58
10	62000.0	24345.19	5151.48	Nano	224961.02
11	42000.0	15807.34	3194.92	Mega	145543.99
12	64000.0	20240.42	3921.15	Micro	229632.38
13	34000.0	226.33	2372.71	Nano	121336.42
14	36000.0	3900.20	60.40	Nano	123526.11
15	60000.0	22353.72	940.80	Mega	212764.40
16	25000.0	9905.84	1853.22	Micro	89819.92
17	100000.0	36116.09	3674.30	Macro	353804.64
18	92000.0	40736.99	4636.56	Nano	329350.54
19	46000.0	12695.09	3884.58	Macro	162191.33

1.1 EDA

[4]:
```
df.describe()
```

[4]:

	tv	radio	social_media	sales
count	4546.000000	4546.000000	4546.000000	4546.000000
mean	54062.912451	18157.533110	3323.472829	192413.332112
std	26104.941838	9663.259642	2211.253915	93019.873216
min	10000.000000	0.680000	0.030000	31199.410000
25%	32000.000000	10555.355000	1530.822500	112434.610000
50%	53000.000000	17859.515000	3055.565000	188963.680000
75%	77000.000000	25640.605000	4804.922500	272324.240000
max	100000.000000	48871.160000	13981.660000	364079.750000

[5]:
```
df.info()
```

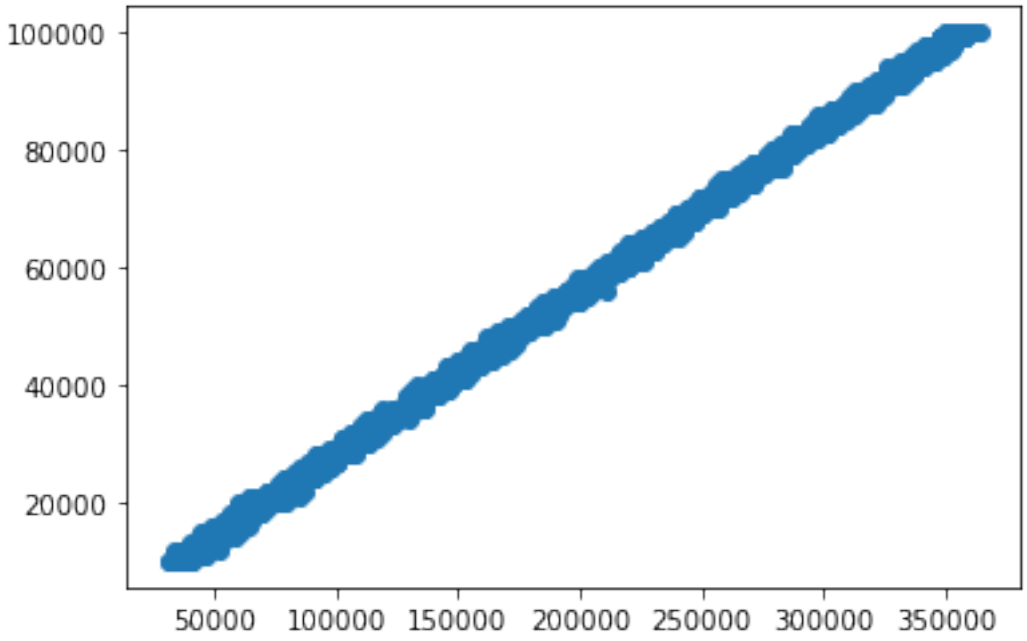
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4546 entries, 0 to 4545
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   tv            4546 non-null   float64
 1   radio         4546 non-null   float64
 2   social_media  4546 non-null   float64
 3   influencer    4546 non-null   object
 4   sales         4546 non-null   float64
dtypes: float64(4), object(1)
memory usage: 177.7+ KB
```

[6]:
```
groupping=df.groupby('influencer').count()
print(groupping)
```

```
              tv  radio  social_media  sales
influencer
Macro       1112   1112          1112   1112
Mega        1152   1152          1152   1152
Micro       1148   1148          1148   1148
Nano        1134   1134          1134   1134
```

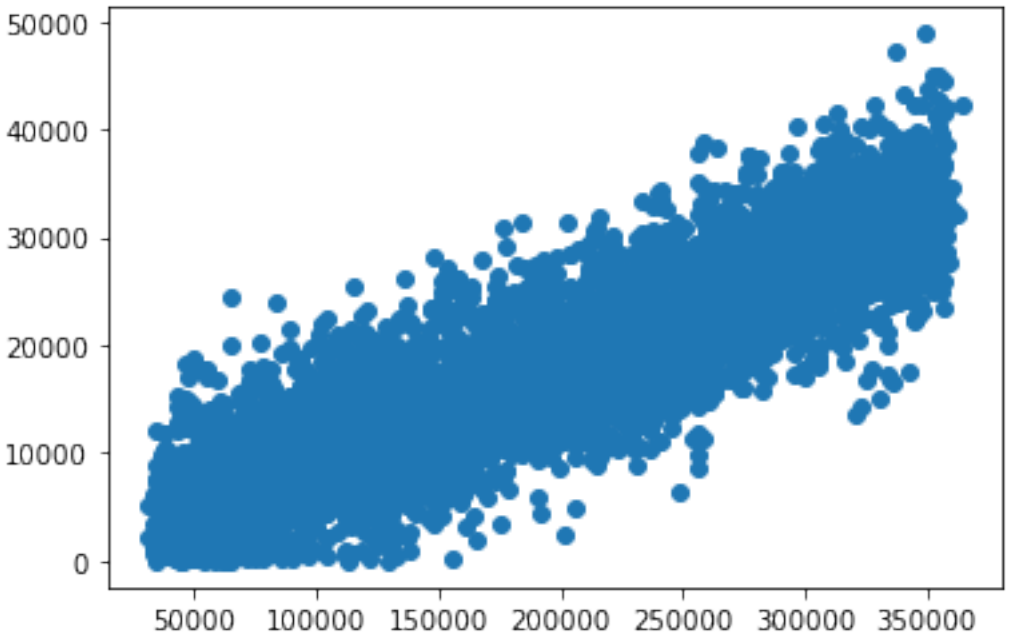
[7]:
```
plt.scatter(df['sales'],df['tv'])
```

[7]:
```
<matplotlib.collections.PathCollection at 0x1ffd022dd90>
```



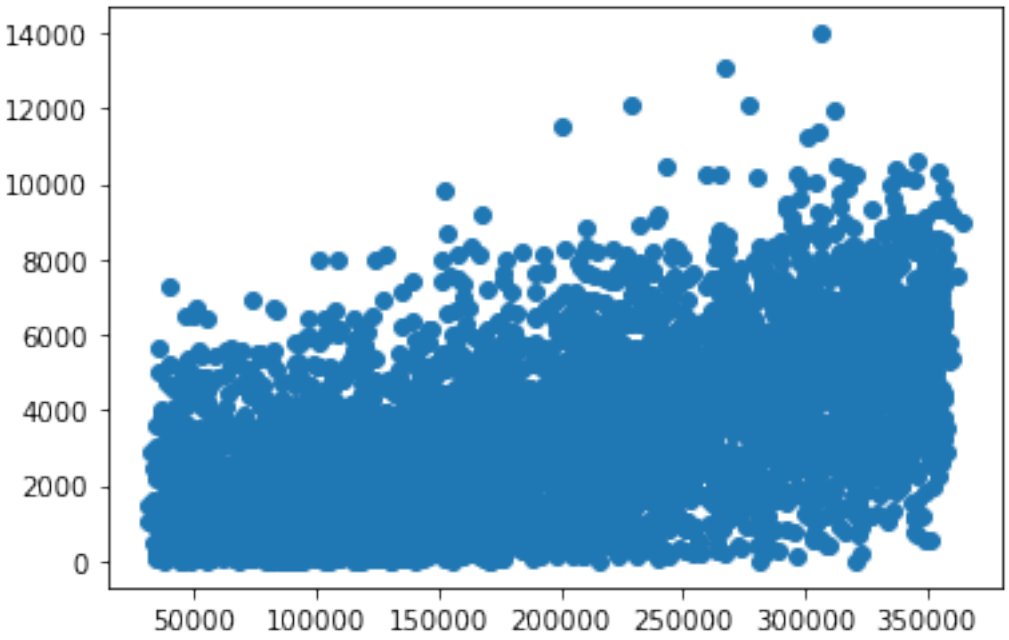
[8]:
```
plt.scatter(df['sales'],df['radio'] )
```

[8]: <matplotlib.collections.PathCollection at 0x1ffd09b5670>



[9]:
```
plt.scatter(df['sales'] , df['social_media'])
```

[9]: <matplotlib.collections.PathCollection at 0x1ffd0a13c40>



2 Linear Regression

[10]:
```
X = df.drop('sales',axis=1).values
y = df['sales'].values
print(type(X),type(y))
```

<class 'numpy.ndarray'> <class 'numpy.ndarray'>

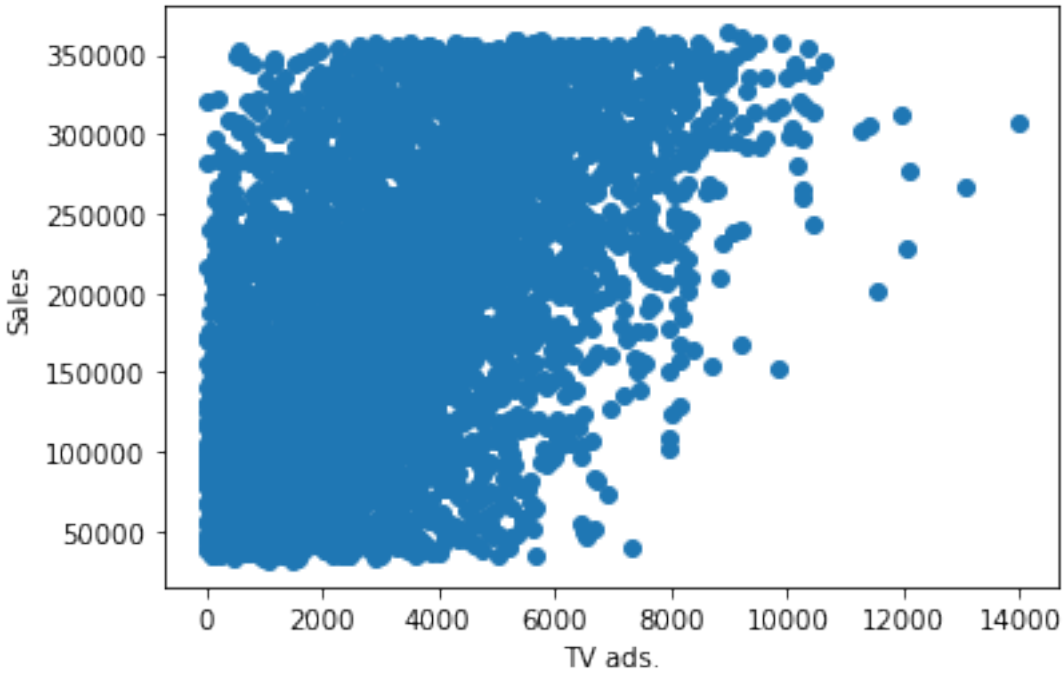
[11]:
```
X_sm = X[:,2]
print(X_sm.shape,y.shape)
```

(4546,) (4546,)

[12]:
```
X_sm= X_sm.reshape(-1,1)
print(X_sm.shape)
```

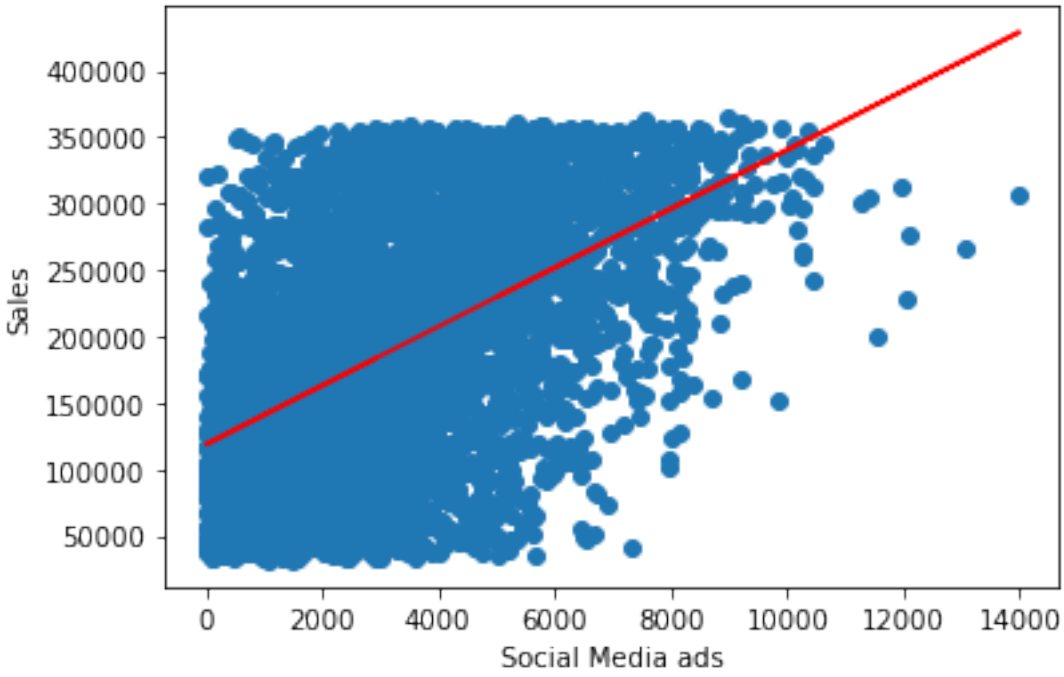
(4546, 1)

[13]:
```
plt.scatter(X_sm,y)
plt.xlabel("TV ads.")
plt.ylabel("Sales")
plt.show()
```



2.0.1 Fitteing a regression model

[14]:
```
from sklearn.linear_model import LinearRegression
lreg = LinearRegression()
lreg.fit(X_sm,y)
predictions = lreg.predict(X_sm)
plt.scatter(X_sm,y)
plt.plot(X_sm,predictions,color = 'r')
plt.xlabel("Social Media ads")
plt.ylabel("Sales")
plt.show()
```



Correlation factor for pearsonr , spearmanr and kendalltau

[20]:
```
import scipy.stats
X_sm = X_sm.reshape(4546,)
(corr_pear_fitted , p_value_pear_fitted) = scipy.stats.
 ↪pearsonr(X_sm,predictions)
(corr_spear_fitted ,p_value_spear_fitted) = scipy.stats.
 ↪spearmanr(X_sm,predictions)
(corr_kendal_fitted ,p_value_kendal_fitted) = scipy.stats.
 ↪kendalltau(X_sm,predictions)
```

[28]:
```
print('Correlation of pearson social media with the fitted data : {}'.
 ↪format(corr_pear_fitted))
print('correlation of spearman social media with the fitted data : {}'.
 ↪format(corr_spear_fitted))
print('correlation of kendall social media with the fitted data : {}'.
 ↪format(corr_kendal_fitted))
```

```
Correlation of pearson social media with the fitted data : 1.0
correlation of spearman social media with the fitted data : 1.0
correlation of kendall social media with the fitted data : 1.0
```

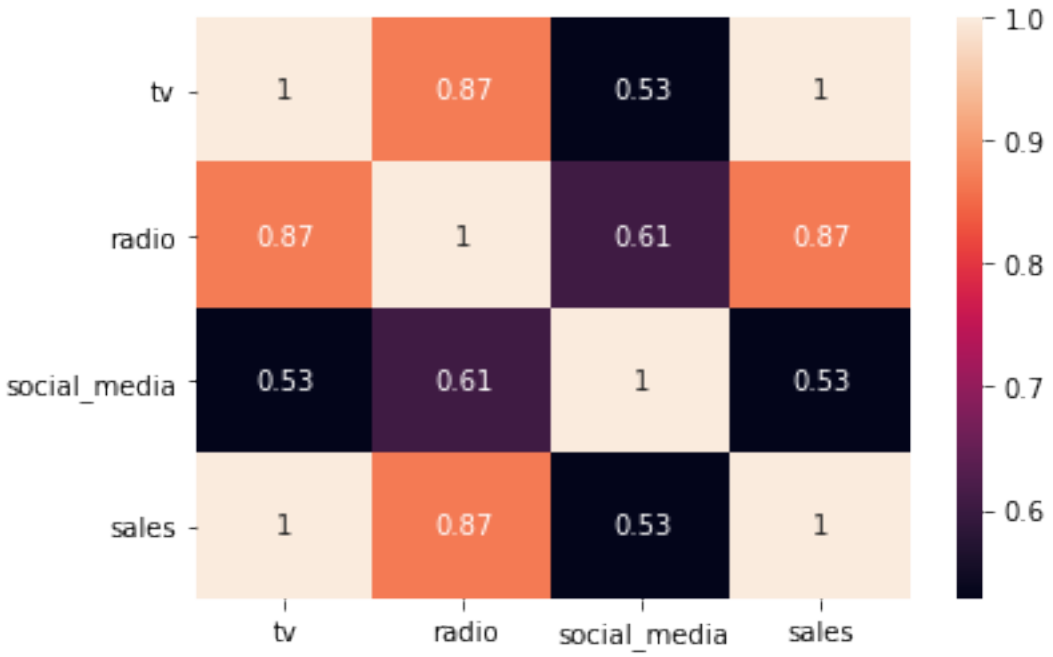
[29]:
```
print('p-value for pearson social media with the fitted data : {}'.
 ↪format(p_value_pear_fitted))
```

```
print('p-value for spearman social media with the fitted data : {}'.
 ↪format(p_value_spear_fitted))
print('p-value for kendall social media with the fitted data : {}'.
 ↪format(p_value_kendal_fitted))
```

```
p-value for pearson social media with the fitted data : 0.0
p-value for spearman social media with the fitted data : 0.0
p-value for kendall social media with the fitted data : 0.0
```

[23]:
```
import seaborn as sns
sns.heatmap(df.corr(),annot =True)
```

[23]:
```
<AxesSubplot:>
```



[27]:
```
X_tv = X[:,0]
X_rad = X[:,1]
```

[25]:
```
(corr_pear_tv,p_value_tv)=scipy.stats.pearsonr(X_sm,X_tv)
(corr_spear_tv,p_value_tv) = scipy.stats.spearmanr(X_sm,X_tv)
(corr_kendal_tv,p_value_tv) = scipy.stats.kendalltau(X_sm,X_tv)
```

[26]:
```
print('pearson correlation between social media and tv : {}'.
 ↪format(corr_pear_tv))
print('spearman correlation between social media and tv : {}'.
 ↪format(corr_spear_tv))
```

```
print('Kendall tau correlation between social media and tv : {}'.
 ↪format(corr_kendal_tv))
```

```
pearson correlation between social media and tv : 0.527687429313132
spearman correlation between social media and tv : 0.5283872233222907
Kendall tau correlation between social media and tv : 0.3644053913094565
```

Note : It seems that kendall tau correlation is far from the correlation we got from heat map

2.1 Now we will make colleration between sales with TVs , Radio , Social Media

[31]:
```
(corr_pear_sales_tv,p_value_sales_tv)=scipy.stats.pearsonr(y,X_tv)
(corr_spear_sales_tv,p_value_sales_tv) = scipy.stats.spearmanr(y,X_tv)
(corr_kendal_sales_tv,p_value_sales_tv) = scipy.stats.kendalltau(y,X_tv)
print('pearson correlation between Sales and tv : {}'.
 ↪format(corr_pear_sales_tv))
print('spearman correlation between Sales and tv : {}'.
 ↪format(corr_spear_sales_tv))
print('Kendall tau correlation between Sales and tv : {}'.
 ↪format(corr_kendal_sales_tv))
```

```
pearson correlation between Sales and tv : 0.999497365941497
spearman correlation between Sales and tv : 0.9994958189860506
Kendall tau correlation between Sales and tv : 0.9837033941521164
```

[33]:
```
(corr_pear_sales_radio,p_value_sales_radio)=scipy.stats.pearsonr(y,X_rad)
(corr_spear_sales_radio,p_value_sales_radio) = scipy.stats.spearmanr(y,X_rad)
(corr_kendal_sales_radio,p_value_sales_radio) = scipy.stats.kendalltau(y,X_rad)
print('pearson correlation between Sales and Radio : {}'.
 ↪format(corr_pear_sales_radio))
print('spearman correlation between Sales and Radio : {}'.
 ↪format(corr_spear_sales_radio))
print('Kendall tau correlation between Sales and Radio : {}'.
 ↪format(corr_kendal_sales_radio))
```

```
pearson correlation between Sales and Radio : 0.8686378136021529
spearman correlation between Sales and Radio : 0.8733903567887087
Kendall tau correlation between Sales and Radio : 0.6776141094422263
```

[34]:
```
(corr_pear_sales_sm,p_value_sales_sm)=scipy.stats.pearsonr(y,X_sm)
(corr_spear_sales_sm,p_value_sales_sm) = scipy.stats.spearmanr(y,X_sm)
(corr_kendal_sales_sm,p_value_sales_sm) = scipy.stats.kendalltau(y,X_sm)
print('pearson correlation between Sales and Social media : {}'.
 ↪format(corr_pear_sales_sm))
print('spearman correlation between Sales and Social media : {}'.
 ↪format(corr_spear_sales_sm))
print('Kendall tau correlation between Sales and Social media : {}'.
 ↪format(corr_kendal_sales_sm))
```

```
pearson correlation between Sales and Social media : 0.52744642201645
spearman correlation between Sales and Social media : 0.5280717993064484
Kendall tau correlation between Sales and Social media : 0.362235465820529
```