

```
In [140]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")
```

```
In [141]: data=pd.read_csv("/home/placement/Downloads/Advertising.csv")
```

```
In [142]: data.describe()
```

```
Out[142]:
```

	Unnamed: 0	TV	radio	newspaper	sales
count	200.000000	200.000000	200.000000	200.000000	200.000000
mean	100.500000	147.042500	23.264000	30.554000	14.022500
std	57.879185	85.854236	14.846809	21.778621	5.217457
min	1.000000	0.700000	0.000000	0.300000	1.600000
25%	50.750000	74.375000	9.975000	12.750000	10.375000
50%	100.500000	149.750000	22.900000	25.750000	12.900000
75%	150.250000	218.825000	36.525000	45.100000	17.400000
max	200.000000	296.400000	49.600000	114.000000	27.000000

```
In [143]: data.head(10)
```

```
Out[143]:
```

	Unnamed: 0	TV	radio	newspaper	sales
0	1	230.1	37.8	69.2	22.1
1	2	44.5	39.3	45.1	10.4
2	3	17.2	45.9	69.3	9.3
3	4	151.5	41.3	58.5	18.5
4	5	180.8	10.8	58.4	12.9
5	6	8.7	48.9	75.0	7.2
6	7	57.5	32.8	23.5	11.8
7	8	120.2	19.6	11.6	13.2
8	9	8.6	2.1	1.0	4.8
9	10	199.8	2.6	21.2	10.6

```
In [144]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
#   Column      Non-Null Count  Dtype  
---  -
0   Unnamed: 0   200 non-null   int64  
1   TV           200 non-null   float64
2   radio        200 non-null   float64
3   newspaper    200 non-null   float64
4   sales        200 non-null   float64
dtypes: float64(4), int64(1)
memory usage: 7.9 KB
```

```
In [145]: data.shape
```

```
Out[145]: (200, 5)
```

```
In [146]: data
```

```
Out[146]:
```

	Unnamed: 0	TV	radio	newspaper	sales
0	1	230.1	37.8	69.2	22.1
1	2	44.5	39.3	45.1	10.4
2	3	17.2	45.9	69.3	9.3
3	4	151.5	41.3	58.5	18.5
4	5	180.8	10.8	58.4	12.9
...
195	196	38.2	3.7	13.8	7.6
196	197	94.2	4.9	8.1	9.7
197	198	177.0	9.3	6.4	12.8
198	199	283.6	42.0	66.2	25.5
199	200	232.1	8.6	8.7	13.4

200 rows × 5 columns

```
In [147]: data1=data.drop(['Unnamed: 0'],axis=1)
```

```
In [148]: data1
```

```
Out[148]:
```

	TV	radio	newspaper	sales
0	230.1	37.8	69.2	22.1
1	44.5	39.3	45.1	10.4
2	17.2	45.9	69.3	9.3
3	151.5	41.3	58.5	18.5
4	180.8	10.8	58.4	12.9
...
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	9.7
197	177.0	9.3	6.4	12.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	13.4

200 rows × 4 columns

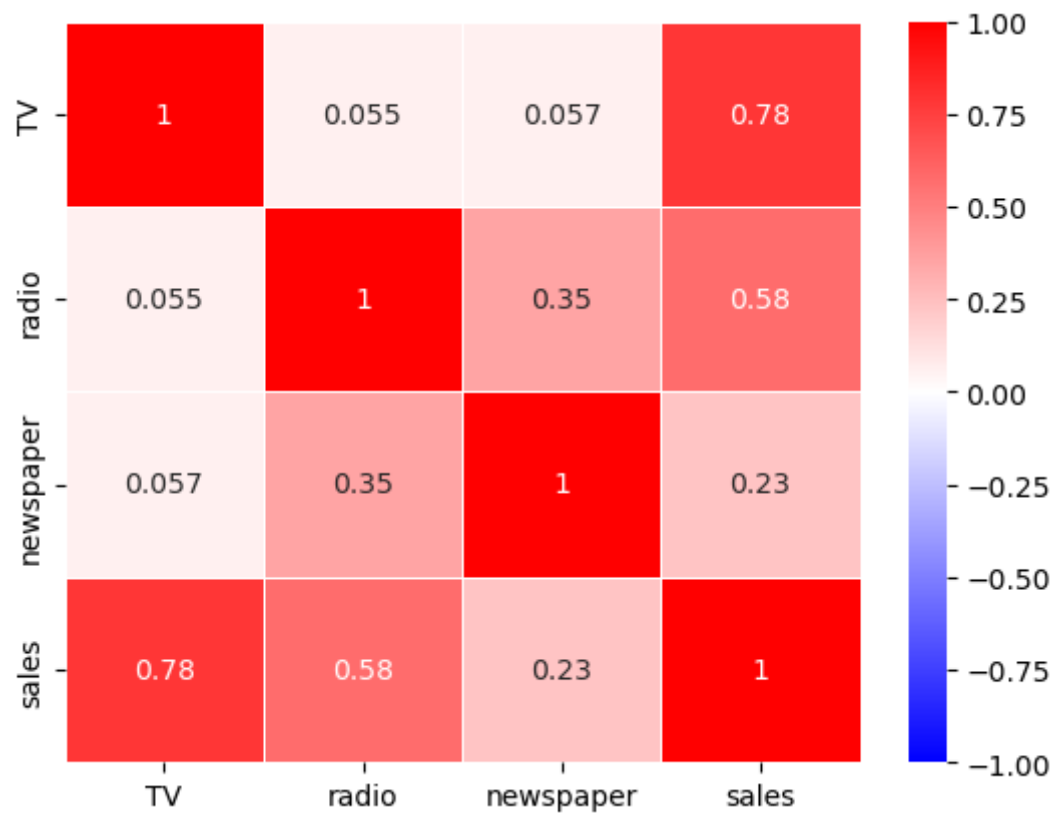
```
In [149]: cor=data1.corr()  
cor
```

```
Out[149]:
```

	TV	radio	newspaper	sales
TV	1.000000	0.054809	0.056648	0.782224
radio	0.054809	1.000000	0.354104	0.576223
newspaper	0.056648	0.354104	1.000000	0.228299
sales	0.782224	0.576223	0.228299	1.000000

```
In [150]: import seaborn as sns  
sns.heatmap(cor, vmax=1, vmin=-1, annot=True, linewidths=.5, cmap='bwr')
```

Out[150]: <Axes: >



```
In [151]: data2=data1.drop(['sales'],axis=1)
```

```
In [152]: data2
```

```
Out[152]:
```

	TV	radio	newspaper
0	230.1	37.8	69.2
1	44.5	39.3	45.1
2	17.2	45.9	69.3
3	151.5	41.3	58.5
4	180.8	10.8	58.4
...
195	38.2	3.7	13.8
196	94.2	4.9	8.1
197	177.0	9.3	6.4
198	283.6	42.0	66.2
199	232.1	8.6	8.7

200 rows × 3 columns

```
In [153]: y=data1['sales']  
x=data1.drop('sales',axis=1)
```

```
In [154]: y
```

```
Out[154]: 0      22.1  
          1      10.4  
          2       9.3  
          3      18.5  
          4      12.9  
          ...  
          195     7.6  
          196     9.7  
          197     12.8  
          198     25.5  
          199     13.4  
          Name: sales, Length: 200, dtype: float64
```

```
In [155]: from sklearn.model_selection import train_test_split  
          x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33,random_state=42)
```

```
In [156]: y
```

```
Out[156]: 0      22.1  
          1      10.4  
          2       9.3  
          3      18.5  
          4      12.9  
          ...  
          195     7.6  
          196     9.7  
          197     12.8  
          198     25.5  
          199     13.4  
          Name: sales, Length: 200, dtype: float64
```

```
In [157]: list(x)
```

```
Out[157]: ['TV', 'radio', 'newspaper']
```

```
In [158]: from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33,random_state=42)
```

```
In [159]: from sklearn.linear_model import LinearRegression
reg=LinearRegression()#creating object of linearRegression
reg.fit(x_train,y_train)#training and fitting LR object using training data
```

Out[159]: LinearRegression()

**In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.**

```
In [160]: ypred=reg.predict(x_test)
```

```
In [161]: ypred
```

Out[161]: array([16.58673085, 21.18622524, 21.66752973, 10.81086512, 22.25210881,
13.31459455, 21.23875284, 7.38400509, 13.43971113, 15.19445383,
9.01548612, 6.56945204, 14.4156926 , 8.93560138, 9.56335776,
12.10760805, 8.86091137, 16.25163621, 10.31036304, 18.83571624,
19.81058732, 13.67550716, 12.45182294, 21.58072583, 7.67409148,
5.67090757, 20.95448184, 11.89301758, 9.13043149, 8.49435255,
12.32217788, 9.99097553, 21.71995241, 12.64869606, 18.25348116,
20.17390876, 14.20864218, 21.02816483, 10.91608737, 4.42671034,
9.59359543, 12.53133363, 10.14637196, 8.1294087 , 13.32973122,
5.27563699, 9.30534511, 14.15272317, 8.75979349, 11.67053724,
15.66273733, 11.75350353, 13.21744723, 11.06273296, 6.41769181,
9.84865789, 9.45756213, 24.32601732, 7.68903682, 12.30794356,
17.57952015, 15.27952025, 11.45659815, 11.12311877, 16.60003773,
6.90611478])

```
In [162]: from sklearn.metrics import r2_score
r2_score(y_test,ypred)
```

Out[162]: 0.8555568430680086


```
In [163]: from sklearn.metrics import mean_squared_error  
l=mean_squared_error(ypred,y_test)
```

```
In [164]: l
```

```
Out[164]: 3.7279283306815105
```

```
In [165]: from sklearn.linear_model import ElasticNet  
from sklearn.model_selection import GridSearchCV  
elastic = ElasticNet()  
parameters = {'alpha':[1e-15,1e-10,1e-8,1e-4,1e-3,1e-2,1,5,10,20]}  
elastic_regressor = GridSearchCV(elastic,parameters)  
elastic_regressor.fit(x_train,y_train)
```

```
Out[165]: GridSearchCV(estimator=ElasticNet(),  
                        param_grid={'alpha': [1e-15, 1e-10, 1e-08, 0.0001, 0.001, 0.01, 1,  
                                              5, 10, 20]})
```

**In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.**

```
In [166]: elastic_regressor.best_params_
```

```
Out[166]: {'alpha': 1}
```

```
In [167]: elastic=ElasticNet(alpha=0.1)  
elastic.fit(x_train,y_train)  
y_pred_elastic=elastic.predict(x_test)
```

```
In [168]: from sklearn.metrics import r2_score  
r2_score(y_test,y_pred_elastic)
```

```
Out[168]: 0.8557548052018211
```

```
In [169]: from sklearn.metrics import mean_squared_error
elastic_Error=mean_squared_error(y_pred_elastic,y_test)
elastic_Error
```

```
Out[169]: 3.722819132968605
```

```
In [170]: x_test
```

```
Out[170]:
```

	TV	radio	newspaper
95	163.3	31.6	52.9
15	195.4	47.7	52.9
30	292.9	28.3	43.2
158	11.7	36.9	45.2
128	220.3	49.0	3.2
...
97	184.9	21.0	22.0
31	112.9	17.4	38.6
12	23.8	35.1	65.9
35	290.7	4.1	8.5
119	19.4	16.0	22.3

66 rows × 3 columns

```
In [171]: y_pred_elastic=elastic.predict(test)
test=[[110,33,21]]
y_pred_elastic
```

```
Out[171]: array([14.28599702])
```

```
In [173]: y_pred_elastic=elastic.predict(test)
          test=[[110,33,21],[220,66,13]]
          y_pred_elastic
```

```
Out[173]: array([14.28599702, 25.6314246 ])
```

```
In [ ]:
```