In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import accuracy_score, recall_score, precision_score, f1_
from sklearn.metrics import classification_report, mean_absolute_error, mean_s
from sklearn.preprocessing import PolynomialFeatures
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
from sklearn.ensemble import GradientBoostingRegressor
from sklearn.neural_network import MLPRegressor
from xgboost import XGBRegressor
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
market = pd.read_csv('/content/Advertising.csv')
market.head()
```

Out[2]:

	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

In [3]:
```
market = market.drop('Unnamed: 0', axis=1)
market.head()
```

Out[3]:

	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

In [4]:
```
market.isnull().sum()
```

Out[4]:

	0
TV	0
Radio	0
Newspaper	0
Sales	0

dtype: int64

In [5]:
```
market.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   TV         200 non-null    float64
 1   Radio      200 non-null    float64
 2   Newspaper  200 non-null    float64
 3   Sales      200 non-null    float64
dtypes: float64(4)
memory usage: 6.4 KB
```

Descriptive Analysis

In [6]:
```
market.describe()
```

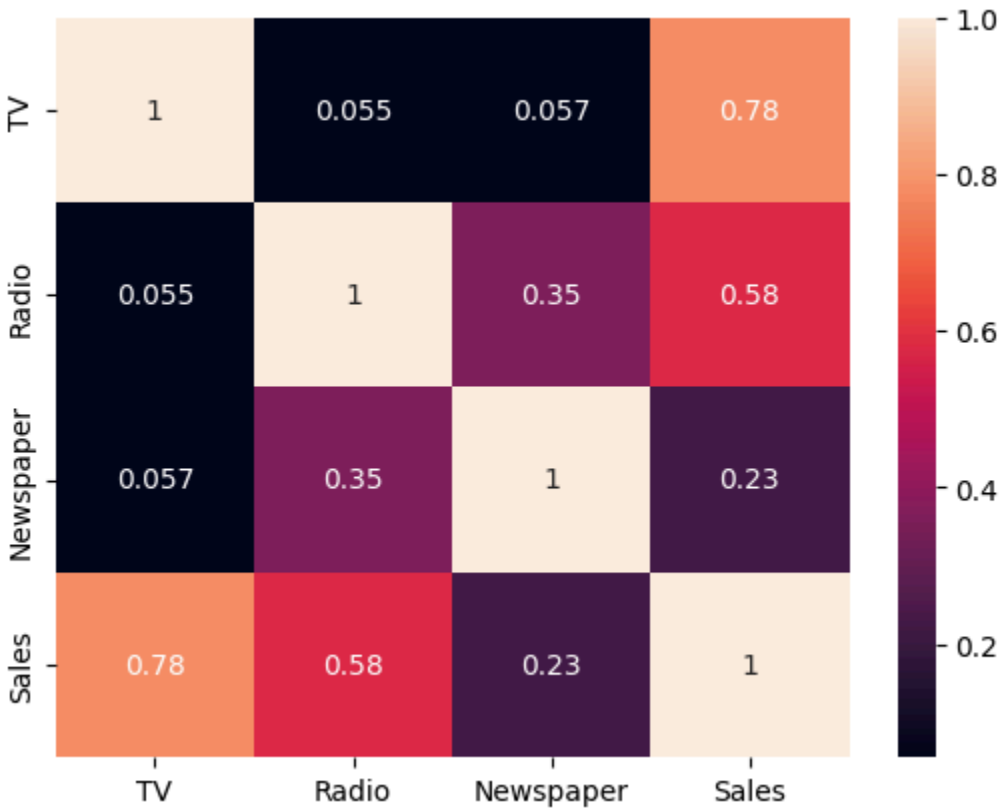
Out[6]:

	TV	Radio	Newspaper	Sales
count	200.000000	200.000000	200.000000	200.000000
mean	147.042500	23.264000	30.554000	14.022500
std	85.854236	14.846809	21.778621	5.217457
min	0.700000	0.000000	0.300000	1.600000
25%	74.375000	9.975000	12.750000	10.375000
50%	149.750000	22.900000	25.750000	12.900000
75%	218.825000	36.525000	45.100000	17.400000
max	296.400000	49.600000	114.000000	27.000000

In [7]:
```
marketcorr =  market.corr()
marketcorr

sns.heatmap(marketcorr, annot=True)
```

Out[7]: <Axes: >



In [8]:
```
X = market.drop('Sales', axis=1)
y = market['Sales']
```

In [9]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
```

Linear Regression

In [10]:
```
marketreg = LinearRegression()
marketreg.fit(X_train, y_train)
```

Out[10]:
```
▾ LinearRegression
LinearRegression()
```

In [11]:
```
y_pred = marketreg.predict(X_test)
```

In [12]:
```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 1.060100369671974
Mean Squared Error: 1.8134061110827382
R-squared: 93.37311941397313
```

In [13]:
```
marketpoly = LinearRegression()
marketpoly.fit(X_train, y_train)
```

Out[13]:
```
LinearRegression()
```

Multiple Linear Regression

In [14]:
```
X1 = market.drop(['TV','Radio','Newspaper'], axis=1)
y1 = market['Sales']
```

In [15]:
```
X1_train, X1_test, y1_train, y1_test = train_test_split(X1, y1, test_size=0.3)
```

In [16]:
```
market_mulit = LinearRegression()
market_mulit.fit(X1_train, y1_train)
```

Out[16]:
```
LinearRegression()
```

In [17]:
```
y_pred = market_mulit.predict(X1_test)
```

In [18]:
```
print('Mean Absolute Error:', mean_absolute_error(y1_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y1_test, y_pred))
print('R-squared:', r2_score(y1_test, y_pred)* 100)
```

```
Mean Absolute Error: 1.9169850891861035e-15
Mean Squared Error: 6.051220527132845e-30
R-squared: 100.0
```

In [18]:
```
```

Polynominal Regression

In [19]:
```
X_poly = PolynomialFeatures(degree=8)
X_train_poly = X_poly.fit_transform(X_train)
```

In [20]:
```
y_pred = marketpoly.predict(X_test)
```

In [21]:
```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 1.060100369671974
Mean Squared Error: 1.8134061110827382
R-squared: 93.37311941397313
```

Decision Tree Regressor

In [22]:
```
marketdecision = DecisionTreeRegressor()
marketdecision.fit(X_train, y_train)
```

Out[22]:
```
DecisionTreeRegressor()
```

In [23]:
```
y_pred = marketdecision.predict(X_test)
```

In [24]:
```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 0.7699999999999998
Mean Squared Error: 1.2414999999999998
R-squared: 95.46308342225666
```

Random Forest Regressor

In [25]:
```
marketrandom = RandomForestRegressor()
marketrandom.fit(X_train, y_train)
```

Out[25]:
```
RandomForestRegressor()
```

In [26]:
```
y_pred = marketrandom.predict(X_test)
```

In [27]:
```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 0.5335249999999997
Mean Squared Error: 0.43990812500000026
R-squared: 98.39240719694202
```

XGBoost Regressor

In [28]:
```
marketxgb = XGBRegressor(n_estimators=1000, max_depth=3, eta=0.15, subsample=0
marketxgb.fit(X_train, y_train)
```

Out[28]:

```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=0.8, device=None, early_stopping_round
s=None,
             enable_categorical=False, eta=0.15, eval_metric=None,
             feature_types=None, feature_weights=None, gamma=None,
             grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bi
n=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
```

In [29]:

```
y_pred = marketxgb.predict(X_test)
```

In [30]:

```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 0.5151723957061768
Mean Squared Error: 0.43228262636582404
R-squared: 98.42027369002857
```

Neural Network Regressor

In [31]:

```
marketneural = MLPRegressor()
marketneural.fit(X_train, y_train)
```

Out[31]:

```
MLPRegressor()
```

In [32]:

```
y_pred = marketneural.predict(X_test)
```

In [33]:

```
print('Mean Absolute Error:', mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', mean_squared_error(y_test, y_pred))
print('R-squared:', r2_score(y_test, y_pred)* 100)
```

```
Mean Absolute Error: 1.104584375554825
Mean Squared Error: 2.212773465844589
R-squared: 91.91367811519862
```

Citations

https://machinelearningmastery.com/xgboost-for-regression/

https://ujangriswanto08.medium.com/step-by-step-tutorial-on-multiple-linear-regression-with-python-e5cd2bb35398

https://scikit-learn.org/stable/modules/generated/sklearn.neural_network.MLPRegressor.html

ChatGPT