Machine Learning

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import sklearn
import warnings
warnings.filterwarnings('ignore')
```

```
df = pd.DataFrame({
    "Country" : ["France", "Spain", "Germany", "Spain", "Germany", "France", "Spain", "France", "Germany", "Franc
    "AGE" : [84.0, 27.0, 30.0, 38.0, 40.0, 35.0 , np.nan, 48.0, 50.0, 37.0, np.nan],
    "Salary" : [72000.0, 48000.0, 54000.0, 61000.0, np.nan, 58000.0, 52000.0, 79000.0, 83000.0, 67000.0, '-'],
    "Purchased" : ["No", "Yes", "No", "No", "Yes", "Yes", "No", "Yes", "No", "Yes", "No"]
})
df
```

	Country	AGE	Salary	Purchased
0	France	84.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.0	Yes
6	Spain	NaN	52000.0	No
7	France	48.0	79000.0	Yes
8	Germany	50.0	83000.0	No
9	France	37.0	67000.0	Yes
10	Spain	NaN	-	No

Data-preprocessing using matplotlib,seaborn,python,pandas

```
df.shape
```

```
(11, 4)
```

```
df.dtypes
```

	0
Country	object
AGE	float64
Salary	object
Purchased	object

dtype: object

```
df.isnull().sum()
```

	0
Country	0
AGE	2
Salary	1
Purchased	0

dtype: int64

```
for i in df.columns:
  print(df[i].unique())
```

```
['France' 'Spain' 'Germany']
[84. 27. 30. 38. 40. 35. nan 48. 50. 37.]
[72000.0 48000.0 54000.0 61000.0 nan 58000.0 52000.0 79000.0 83000.0
 67000.0 '-']
['No' 'Yes']
```

```
df.AGE.fillna(method='ffill', inplace=True)
df
```

	Country	AGE	Salary	Purchased
0	France	84.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.0	Yes
6	Spain	35.0	52000.0	No
7	France	48.0	79000.0	Yes
8	Germany	50.0	83000.0	No
9	France	37.0	67000.0	Yes
10	Spain	37.0	-	No

```
df.isnull().sum()
```

	0
Country	0
AGE	0
Salary	1
Purchased	0

dtype: int64

```
df.Salary = df.Salary.replace('-','53666.666666666664')
```

```
df[df.Country == "Spain"].Salary[0:3].mean()
```

```
np.float64(53666.666666666664)
```

```
df.Salary = df.Salary.replace('53666.666666666664',53666.666666666664)
```

```
df
```

	Country	AGE	Salary	Purchased
0	France	84.0	72000.000000	No
1	Spain	27.0	48000.000000	Yes
2	Germany	30.0	54000.000000	No
3	Spain	38.0	61000.000000	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.000000	Yes
6	Spain	35.0	52000.000000	No
7	France	48.0	79000.000000	Yes
8	Germany	50.0	83000.000000	No
9	France	37.0	67000.000000	Yes
10	Spain	37.0	53666.666667	No

```
df.Salary.fillna(df.Salary.mean(), inplace=True)
df
```

	Country	AGE	Salary	Purchased
0	France	84.0	72000.000000	No
1	Spain	27.0	48000.000000	Yes
2	Germany	30.0	54000.000000	No
3	Spain	38.0	61000.000000	No
4	Germany	40.0	62766.666667	Yes
5	France	35.0	58000.000000	Yes
6	Spain	35.0	52000.000000	No
7	France	48.0	79000.000000	Yes
8	Germany	50.0	83000.000000	No
9	France	37.0	67000.000000	Yes
10	Spain	37.0	53666.666667	No

```
df.describe()
```

	AGE	Salary
count	11.000000	11.000000
mean	41.909091	62766.666667
std	15.494867	11382.296195
min	27.000000	48000.000000
25%	35.000000	53833.333333
50%	37.000000	61000.000000
75%	44.000000	69500.000000
max	84.000000	83000.000000

```
df.dtypes
```

	0
Country	object
AGE	float64
Salary	float64
Purchased	object

dtype: object

```
df.Salary.astype('int')
```

	Salary
0	72000
1	48000
2	54000
3	61000
4	62766
5	58000
6	52000
7	79000
8	83000
9	67000
10	53666

dtype: int64

```
X = df.iloc[0:,:3]
X
```

	Country	AGE	Salary
0	France	84.0	72000.000000
1	Spain	27.0	48000.000000
2	Germany	30.0	54000.000000
3	Spain	38.0	61000.000000
4	Germany	40.0	62766.666667
5	France	35.0	58000.000000
6	Spain	35.0	52000.000000
7	France	48.0	79000.000000
8	Germany	50.0	83000.000000
9	France	37.0	67000.000000
10	Spain	37.0	53666.666667

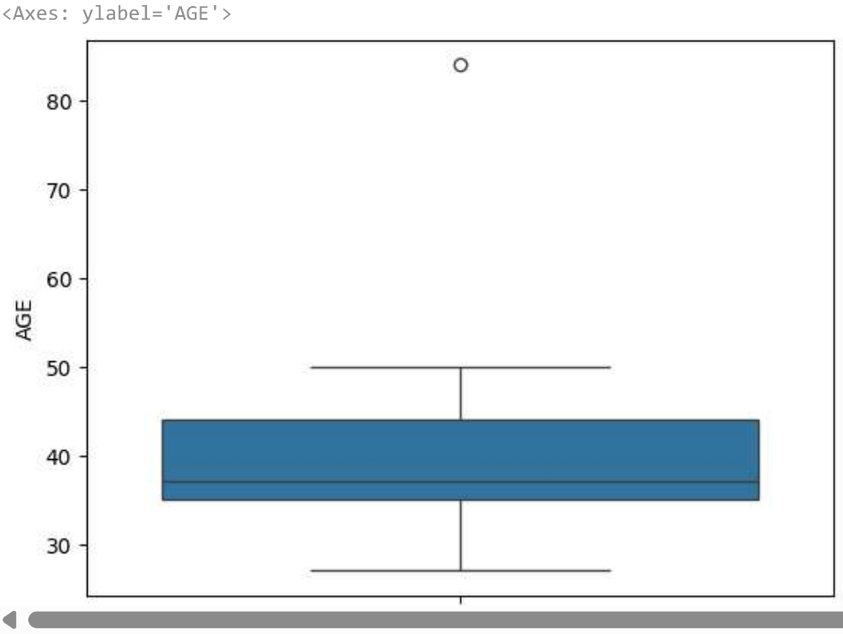
```
Y = df.Purchased
Y
```

	Purchased
0	No
1	Yes
2	No
3	No
4	Yes
5	Yes
6	No
7	Yes
8	No
9	Yes
10	No

dtype: object

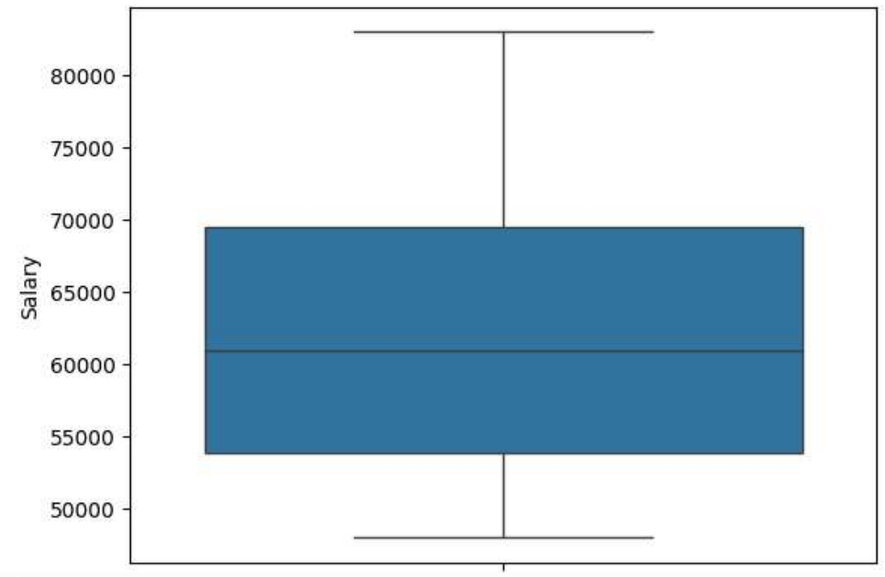
```
sns.boxplot(y='AGE', data=df)
```

```
<Axes: ylabel='AGE'>
```




```
sns.boxplot(y='Salary', data=df)
```

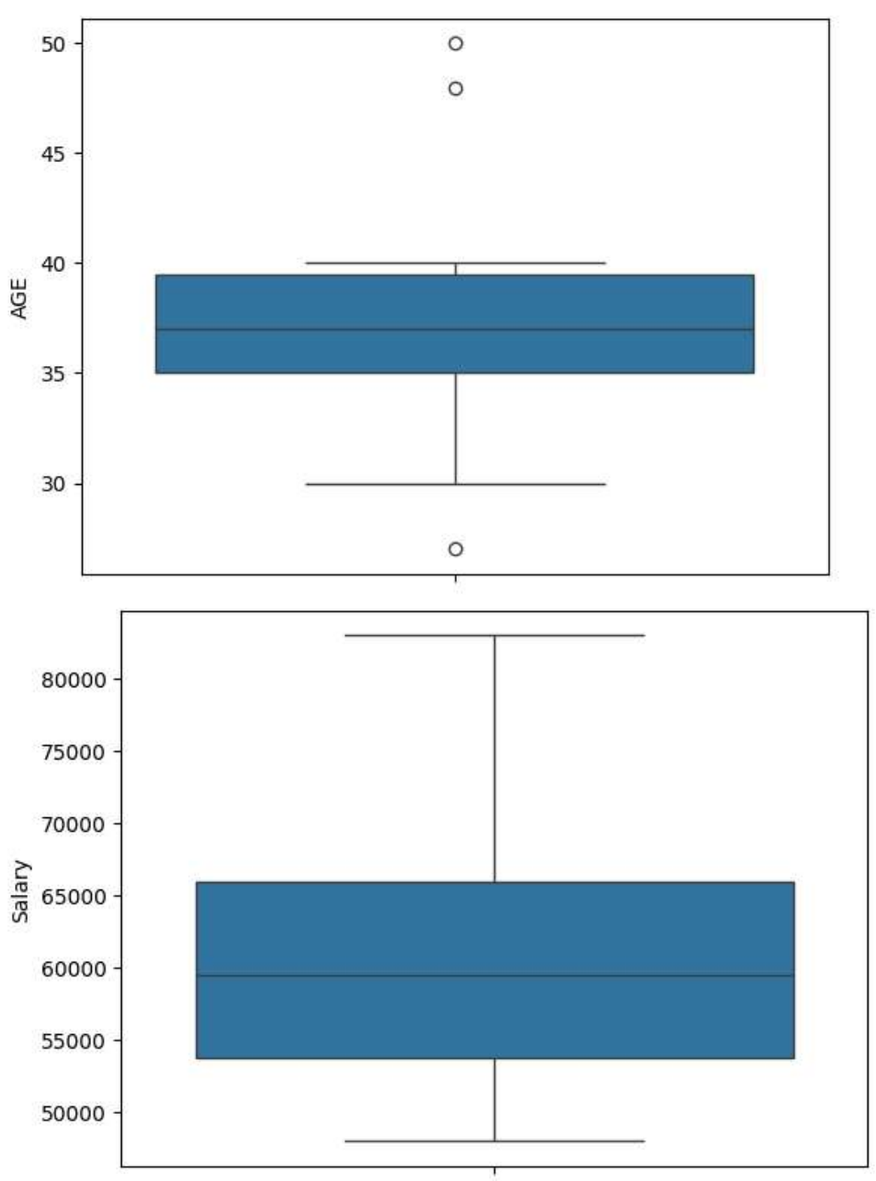
```
<Axes: ylabel='Salary'>
```




```
num_df = df[['AGE', 'Salary']]
num_df
```

	AGE	Salary
0	84.0	72000.000000
1	27.0	48000.000000
2	30.0	54000.000000
3	38.0	61000.000000
4	40.0	62766.666667
5	35.0	58000.000000
6	35.0	52000.000000
7	48.0	79000.000000
8	50.0	83000.000000
9	37.0	67000.000000
10	37.0	53666.666667

```
for c in num_df.columns:
  percentile25 = num_df[c].quantile(0.25)
  percentile75 = num_df[c].quantile(0.75)
  iqr = percentile75-percentile25
  uper_limit = percentile75 + (1.5 * iqr)
  lower_limit = percentile25 - (1.5 * iqr)
  num_df = num_df[num_df[c]<uper_limit]
  num_df = num_df[num_df[c]>lower_limit]
  plt.figure()
  sns.boxplot(y=c, data=num_df)
```




```
p_25 = num_df['AGE'].quantile(0.25)
p_25
num_df
```

	AGE	Salary
1	27.0	48000.000000
2	30.0	54000.000000
3	38.0	61000.000000
4	40.0	62766.666667
5	35.0	58000.000000
6	35.0	52000.000000
7	48.0	79000.000000
8	50.0	83000.000000
9	37.0	67000.000000
10	37.0	53666.666667

```
num_df.corr()
```

	AGE	Salary
AGE	1.000000	0.931203
Salary	0.931203	1.000000

```
sns.heatmap(num_df.corr(), annot=True, cmap='Oranges')
```

```
<Axes: >
```

Data-preprocessing using sklearn

```
my_df = pd.DataFrame({
    "Country" : ["France", "Spain", "Germany", "Spain", "Germany", "France", "Spain", "France", "Germany", "Franc
    "AGE" : [84.0, 27.0, 30.0, 38.0, 40.0, 35.0 , np.nan, 48.0, 50.0, 37.0],
    "Salary" : [72000.0, 48000.0, 54000.0, 61000.0, np.nan, 58000.0, 52000.0, 79000.0, 83000.0, 67000.0],
    "Purchased" : ["No", "Yes", "No", "No", "Yes", "Yes", "No", "Yes", "No", "Yes"]
})
my_df
```

	Country	AGE	Salary	Purchased
0	France	84.0	72000.0	No
1	Spain	27.0	48000.0	Yes
2	Germany	30.0	54000.0	No
3	Spain	38.0	61000.0	No
4	Germany	40.0	NaN	Yes
5	France	35.0	58000.0	Yes
6	Spain	NaN	52000.0	No
7	France	48.0	79000.0	Yes
8	Germany	50.0	83000.0	No
9	France	37.0	67000.0	Yes

```
x = my_df.iloc[:, :-1].values #independent
y = my_df.iloc[:, -1].values #dependent
```

```
x,y
```

```
(array([['France', 84.0, 72000.0],
        ['Spain', 27.0, 48000.0],
        ['Germany', 30.0, 54000.0],
        ['Spain', 38.0, 61000.0],
        ['Germany', 40.0, nan],
        ['France', 35.0, 58000.0],
        ['Spain', nan, 52000.0],
        ['France', 48.0, 79000.0],
        ['Germany', 50.0, 83000.0],
        ['France', 37.0, 67000.0]], dtype=object),
 array(['No', 'Yes', 'No', 'No', 'Yes', 'Yes', 'No', 'Yes', 'No', 'Yes'],
       dtype=object))
```

```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(missing_values=np.nan, strategy='mean')
imputer.fit(x[:,1:3])
x[:,1:3] = imputer.transform(x[:,1:3])
x
```

```
array([['France', 84.0, 72000.0],
       ['Spain', 27.0, 48000.0],
       ['Germany', 30.0, 54000.0],
       ['Spain', 38.0, 61000.0],
       ['Germany', 40.0, 63777.77777777778],
       ['France', 35.0, 58000.0],
       ['Spain', 43.22222222222222, 52000.0],
       ['France', 48.0, 79000.0],
       ['Germany', 50.0, 83000.0],
       ['France', 37.0, 67000.0]], dtype=object)
```

ColumnTransformer(One hot encoder)

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [0])],remainder='passthrough')
X=np.array(ct.fit_transform(x))
X
```

```
array([[1.0, 0.0, 0.0, 84.0, 72000.0],
       [0.0, 0.0, 1.0, 27.0, 48000.0],
       [0.0, 1.0, 0.0, 30.0, 54000.0],
       [0.0, 0.0, 1.0, 38.0, 61000.0],
       [0.0, 1.0, 0.0, 40.0, 63777.77777777778],
       [1.0, 0.0, 0.0, 35.0, 58000.0],
       [0.0, 0.0, 1.0, 43.22222222222222, 52000.0],
       [1.0, 0.0, 0.0, 48.0, 79000.0],
       [0.0, 1.0, 0.0, 50.0, 83000.0],
       [1.0, 0.0, 0.0, 37.0, 67000.0]], dtype=object)
```

One hot encoder using Pandas

```
pd.get_dummies(my_df.iloc[:, :-1], dtype='int')
```

	AGE	Salary	Country_France	Country_Germany	Country_Spain
0	84.0	72000.0	1	0	0
1	27.0	48000.0	0	0	1
2	30.0	54000.0	0	1	0
3	38.0	61000.0	0	0	1
4	40.0	NaN	0	1	0
5	35.0	58000.0	1	0	0
6	NaN	52000.0	0	0	1
7	48.0	79000.0	1	0	0
8	50.0	83000.0	0	1	0
9	37.0	67000.0	1	0	0

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
y = le.fit_transform(y)
y
```

```
array([0, 1, 0, 0, 1, 1, 0, 1, 0, 1])
```

Dividing values for training and testing

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X , y, test_size=0.2, random_state=1)
print(X_train)
print("-------------")
print(X)
print("-------------")
print(y_train)
print("-------------")
print(y_test)
```

```
[[0.0 0.0 1.0 43.22222222222222 52000.0]
 [0.0 1.0 0.0 40.0 63777.77777777778]
 [1.0 0.0 0.0 84.0 72000.0]
 [0.0 0.0 1.0 38.0 61000.0]
 [0.0 0.0 1.0 27.0 48000.0]
 [1.0 0.0 0.0 48.0 79000.0]
 [0.0 1.0 0.0 50.0 83000.0]
 [1.0 0.0 0.0 35.0 58000.0]]
-------------
[[1.0 0.0 0.0 84.0 72000.0]
 [0.0 0.0 1.0 27.0 48000.0]
 [0.0 1.0 0.0 30.0 54000.0]
 [0.0 0.0 1.0 38.0 61000.0]
 [0.0 1.0 0.0 40.0 63777.77777777778]
 [1.0 0.0 0.0 35.0 58000.0]
 [0.0 0.0 1.0 43.22222222222222 52000.0]
 [1.0 0.0 0.0 48.0 79000.0]
 [0.0 1.0 0.0 50.0 83000.0]
 [1.0 0.0 0.0 37.0 67000.0]]
-------------
[0 1 0 0 1 1 0 1]
-------------
[0 1]
```

Normalization

```
from sklearn.preprocessing import MinMaxScaler
mm = MinMaxScaler()
X_train[:, 3:] = mm.fit_transform(X_train[:, 3:])
X_test[:, 3:] = mm.transform(X_test[:, 3:])
```

```
print(X_train[:, 3:])
print(X_test[:, 3:])
```

```
[[0.2846003898635477 0.11428571428571432]
 [0.22807017543859648 0.45079365079365075]
 [1.0 0.6857142857142855]
 [0.19298245614035087 0.37142857142857144]
 [0.0 0.0]
 [0.3684210526315789 0.8857142857142857]
 [0.40350877192982454 1.0]
 [0.1403508771929824 0.2857142857142856]]
[[0.05263157894736842 0.17142857142857149]
 [0.17543859649122812 0.5428571428571427]]
```

Standardization

```
from sklearn.preprocessing import StandardScaler
sta = StandardScaler()
X_train[:, 3:] = sta.fit_transform(X_train[:, 3:])
X_test[:, 3:] = sta.transform(X_test[:, 3:])
print(X_train[:, 3:])
```

```
[[-0.15173380619625246 -1.0781259408412427]
 [-0.3528894806964267 -0.07013167641635429]
 [2.393925936616301 0.6335624327104543]
 [-0.47774472693791437 -0.3078661727429787]
 [-1.164448581266096 -1.4204636155515824]
 [0.14653150426952366 1.2326533634535488]
 [0.2713867505110113 1.5749910381638885]
 [-0.665027596300146 -0.5646194287757338]]
```

Practice

```
practice_df = pd.read_csv("/content/tanishak.txt", delimiter="|")
practice_df
```

	user_id	age	gender	occupation	zip_code
0	1	24	M	technician	85711
1	2	53	F	other	94043
2	3	23	M	writer	32067
3	4	24	M	technician	43537
4	5	33	F	other	15213
...	...	...	...	...	...
938	939	26	F	student	33319
939	940	32	M	administrator	02215
940	941	20	M	student	97229
941	942	48	F	librarian	78209
942	943	22	M	student	77841

943 rows × 5 columns

```
practice_df.isnull().sum()
```

	0
user_id	0
age	0
gender	0
occupation	0
zip_code	0

dtype: int64

```
practice_df.dtypes
```

	0
user_id	int64
age	int64
gender	object
occupation	object
zip_code	object

dtype: object

```
X1 = practice_df.iloc[0:, 1]
X1
```

	age
0	24
1	53
2	23
3	24
4	33
...	...
938	26
939	32
940	20
941	48
942	22

943 rows × 1 columns

dtype: int64

```
sns.boxplot(y=X1, data=practice_df)
```