```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.neural_network import MLPClassifier
```

```
warnings.filterwarnings('ignore')
```

```
df = pd.read_csv('diabetes.csv')
df
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigree
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	
...	...	...	...	...	...	...	
763	10	101	76	48	180	32.9	
764	2	122	70	27	0	36.8	
765	5	121	72	23	112	26.2	
766	1	126	60	0	0	30.1	
767	1	93	70	31	0	30.4	

768 rows × 9 columns

```
df.shape
```

```
(768, 9)
```

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

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
```

```
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

```
df.info()
```

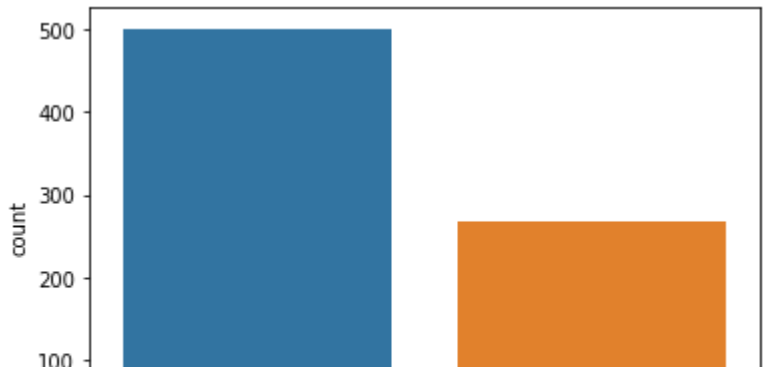
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Pregnancies               768 non-null    int64  
 1   Glucose                   768 non-null    int64  
 2   BloodPressure             768 non-null    int64  
 3   SkinThickness             768 non-null    int64  
 4   Insulin                   768 non-null    int64  
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64  
 8   Outcome                   768 non-null    int64  
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

```
df.describe()
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BM
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.00000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.99257
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.88416
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.30000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.00000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.60000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.10000

```
sns.countplot(x=df['Outcome'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa770863f50>
```



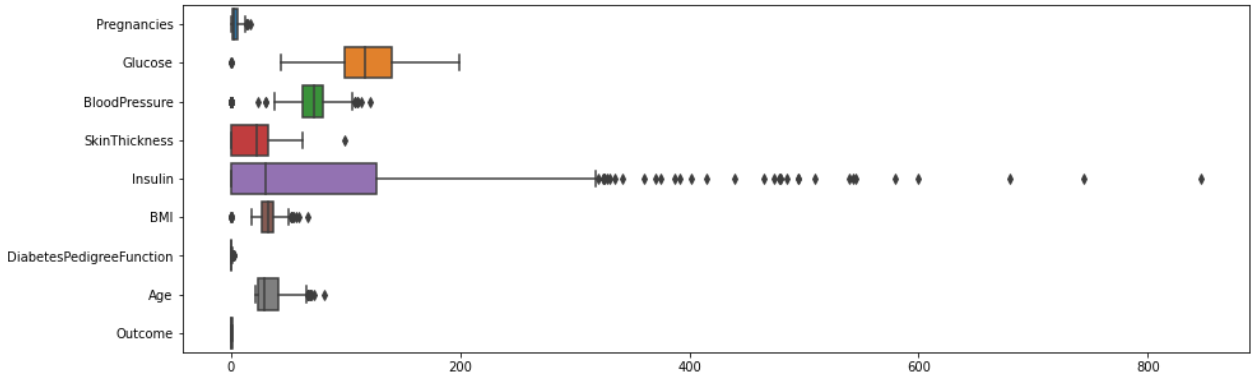

```
df['Outcome'].value_counts()
```

```
0    500
1    268
Name: Outcome, dtype: int64
```

```
df['Outcome'].unique()
```

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

```
plt.figure(figsize=(15,5))
sns.boxplot(data=df,orient='h')
plt.show()
```




```
sns.scatterplot(x = df['Insulin'], y = df['Outcome'])
plt.show()
```


```
X = df.drop('Outcome',axis=1)
Y = df['Outcome']
```

Insulin

```
X.describe()
```

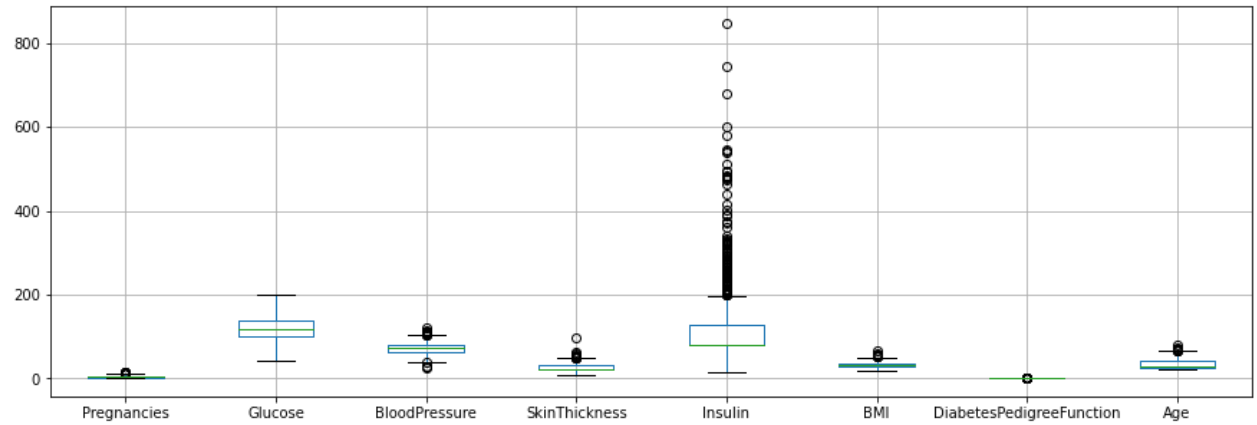
	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BM
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.00000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.99257
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.88416
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.30000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.00000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.60000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.10000

```
X.replace(to_replace=0 , value=X.mean(),inplace=True)
```

```
X.describe()
```

Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BM

```
X.boxplot(figsize=(15,5))
plt.show()
```




```
X_train , X_test , Y_train , Y_test = train_test_split(X,Y,test_size=0.2,random_state=101)
X_train.shape , X_test.shape , Y_train.shape , Y_test.shape
```

```
((614, 8), (154, 8), (614,), (154,))
```

```
Y_train.value_counts()
```

```
0    397
1    217
Name: Outcome, dtype: int64
```

```
sc = StandardScaler()
X_train_std = sc.fit_transform(X_train)
X_test_std = sc.transform(X_test)
X_train_std
```

```
array([[-0.81089478, -0.94320345, -0.67501765, ...,  0.77641365,
         0.62083528, -0.86196915],
       [-0.12231061,  2.06645544,  0.47764539, ...,  0.63250137,
        -0.64915711, -0.19012014],
       [-0.81089478,  0.11513814, -1.00434995, ...,  0.17198206,
        -1.19432458, -0.19012014],
       ...,
       [-1.15518687, -0.08330091, -2.32167913, ...,  0.41663294,
        -0.59959643, -0.6940069 ],
       [ 0.22198148, -0.21559361,  0.31297924, ..., -0.20218987,
        -0.40445126,  0.9016345 ],
```

```
            [ 1.59914984,  0.28050401, -0.1810192 , ...,  0.22954698,
              0.55268935,  0.98561563]])
```

```
X_test_std
```

```
     array([[-1.15518687,  0.14821131, -1.00434995, ..., -0.36049338,
             -0.38586601,  1.15357788],
            [-0.46660269,  2.16567496, -0.1810192 , ...,  0.546154  ,
             -0.203111  ,  0.22978549],
            [ 0.91056566, -0.51325218,  1.63030843, ..., -1.42544428,
             -0.73898584,  1.23755901],
            ...,
            [ 0.56627357,  0.41279671, -0.1810192 , ...,  0.40224172,
              0.21195968, -0.35808239],
            [ 1.94344193, -1.77003282,  2.78297147, ...,  0.41663294,
             -0.58410872,  1.15357788],
            [ 3.32061028, -0.71169123,  0.47764539, ...,  0.57493645,
             -0.19072083,  1.06959676]])
```

```
svc = SVC()
svc.fit(X_train_std,Y_train)
```

```
     SVC()
```

```
pred = svc.predict(X_test_std)
pred
```

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

```
print(f"Accuracy = {accuracy_score(Y_test,pred)*100}")
print(f"Confusion Matrix =\n {confusion_matrix(Y_test,pred)}")
print(f"Classification Report =\n {classification_report(Y_test,pred)}")
```

```
     Accuracy = 80.51948051948052
     Confusion Matrix =
      [[91 12]
      [18 33]]
     Classification Report =
                   precision    recall  f1-score   support

                0       0.83      0.88      0.86       103
                1       0.73      0.65      0.69        51

         accuracy                           0.81       154
        macro avg       0.78      0.77      0.77       154
     weighted avg       0.80      0.81      0.80       154
```

```
pd.DataFrame(np.c_[Y_test,pred],columns=['Actual','Predicted'])
```

	Actual	Predicted
0	1	0
1	1	1
2	0	0
3	1	0
4	0	0
...	...	...
149	1	1
150	1	0
151	1	1
152	0	0
153	1	1

154 rows × 2 columns

```
mlp = MLPClassifier(hidden_layer_sizes=(8,8))
mlp.fit(X_train_std,Y_train)
```

```
MLPClassifier(hidden_layer_sizes=(8, 8))
```

```
pred1 = mlp.predict(X_test_std)
pred1
```

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

```
print(f"Accuracy = {accuracy_score(Y_test,pred1)*100}")
print(f"Confusion Matrix =\n {confusion_matrix(Y_test,pred1)}")
print(f"Classification Report =\n {classification_report(Y_test,pred1)}")
```

```
Accuracy = 80.51948051948052
Confusion Matrix =
 [[89 14]
 [16 35]]
Classification Report =
```

```
                  precision    recall  f1-score   support

               0       0.85      0.86      0.86       103
               1       0.71      0.69      0.70        51

        accuracy                           0.81       154
       macro avg       0.78      0.78      0.78       154
    weighted avg       0.80      0.81      0.80       154
```

```
pd.DataFrame(np.c_[Y_test,pred1],columns=['Actual','Predicted'])
```

	Actual	Predicted
0	1	0
1	1	1
2	0	0
3	1	1
4	0	0
...	...	...
149	1	1
150	1	0
151	1	1
152	0	0
153	1	1

154 rows × 2 columns

Machine Learning Algorithm is clearly winner with a better accuracy

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