Machine Learning Lab program 1

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AIM: Study and implement the Naive Bayes learner on a breast cancer dataset

GitHub link: - https://github.com/pranshuag9/machine-learning-lab/blob/main/lab4/Naive%20Bayes.ipynb

Program Snippets: -

1. Loading dataset

Loading dataset

In [2]:
```
import pandas as pd
df = pd.read_csv("cancer.csv")
```

In [3]:
```
df.head(10)
```

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	co
0	842302	M	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3
1	842517	M	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0
2	84300903	M	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1
3	84348301	M	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2
4	84358402	M	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1
5	843786	M	12.45	15.70	82.57	477.1	0.12780	0.17000	0.1
6	844359	M	18.25	19.98	119.60	1040.0	0.09463	0.10900	0.1
7	84458202	M	13.71	20.83	90.20	577.9	0.11890	0.16450	0.0
8	844981	M	13.00	21.82	87.50	519.8	0.12730	0.19320	0.1
9	84501001	M	12.46	24.04	83.97	475.9	0.11860	0.23960	0.2

10 rows × 33 columns

In [4]:
```
df.tail(5)
```

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	co
564	926424	M	21.56	22.39	142.00	1479.0	0.11100	0.11590	0.2
565	926682	M	20.13	28.25	131.20	1261.0	0.09780	0.10340	0.1
566	926954	M	16.60	28.08	108.30	858.1	0.08455	0.10230	0.0
567	927241	M	20.60	29.33	140.10	1265.0	0.11780	0.27700	0.3
568	92751	B	7.76	24.54	47.92	181.0	0.05263	0.04362	0.0

5 rows × 33 columns

2. Data Cleaning/ Preprocessing

dropping id and unnamed: 32 column because they are noise are doesnt affect result

In [38]:
```
df = df.drop(["id"], axis= 1)
```

In [40]:
```
df.columns.values
```

```
array(['diagnosis', 'radius_mean', 'texture_mean', 'perimeter_mean',
       'area_mean', 'smoothness_mean', 'compactness_mean',
       'concavity_mean', 'concave points_mean', 'symmetry_mean',
       'fractal_dimension_mean', 'radius_se', 'texture_se',
       'perimeter_se', 'area_se', 'smoothness_se', 'compactness_se',
       'concavity_se', 'concave points_se', 'symmetry_se',
       'fractal_dimension_se', 'radius_worst', 'texture_worst',
       'perimeter_worst', 'area_worst', 'smoothness_worst',
       'compactness_worst', 'concavity_worst', 'concave points_worst',
       'symmetry_worst', 'fractal_dimension_worst', 'Unnamed: 32'],
      dtype=object)
```

In [42]:
```
df = df.drop(["Unnamed: 32"], axis=1)
```

In [43]:
```
df.columns.values
```

```
array(['diagnosis', 'radius_mean', 'texture_mean', 'perimeter_mean',
       'area_mean', 'smoothness_mean', 'compactness_mean',
       'concavity_mean', 'concave points_mean', 'symmetry_mean',
       'fractal_dimension_mean', 'radius_se', 'texture_se',
       'perimeter_se', 'area_se', 'smoothness_se', 'compactness_se',
       'concavity_se', 'concave points_se', 'symmetry_se',
       'fractal_dimension_se', 'radius_worst', 'texture_worst',
       'perimeter_worst', 'area_worst', 'smoothness_worst',
       'compactness_worst', 'concavity_worst', 'concave points_worst',
       'symmetry_worst', 'fractal_dimension_worst'], dtype=object)
```

In [66]:
```
# Normalization:
x = (x - np.min(x)) / (np.max(x) - np.min(x))
x
```

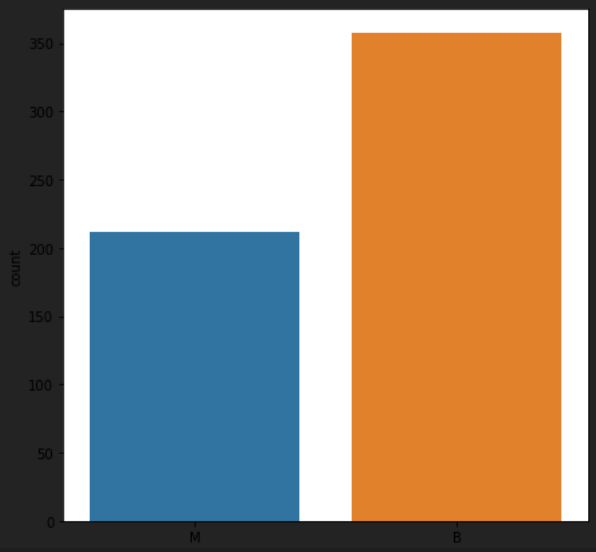
	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	poin
0	0.521037	0.022658	0.545989	0.363733	0.593753	0.792037	0.703140	0.731
1	0.643144	0.272574	0.615783	0.501591	0.289880	0.181768	0.203608	0.348
2	0.601496	0.390260	0.595743	0.449417	0.514309	0.431017	0.462512	0.635
3	0.210090	0.360839	0.233501	0.102906	0.811321	0.811361	0.565604	0.522
4	0.629893	0.156578	0.630986	0.489290	0.430351	0.347893	0.463918	0.518
...	...	...	...	...	...	...	...	...
564	0.690000	0.428813	0.678668	0.566490	0.526948	0.296055	0.571462	0.690
565	0.622320	0.626987	0.604036	0.474019	0.407782	0.257714	0.337395	0.486
566	0.455251	0.621238	0.445788	0.303118	0.288165	0.254340	0.216753	0.263
567	0.644564	0.663510	0.665538	0.475716	0.588336	0.790197	0.823336	0.755
568	0.036869	0.501522	0.028540	0.015907	0.000000	0.074351	0.000000	0.000

569 rows × 10 columns

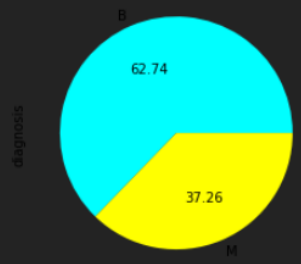
3. Data Visualization

In [48]:
```
plt.figure(figsize=(7,7))
sns.countplot(df['diagnosis'])
plt.show()
```

```
D:\Softwares\Anaconda\envs\tensorflow-gpu\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
  FutureWarning
```



In [55]:
```
df.diagnosis.value_counts().plot(kind = "pie" , colors = ("cyan","yellow"), autopct = "%.2f")
plt.show()
```



4. Dividing data into train/test splits

```
In [67]: from sklearn.model_selection import train_test_split

         #for checking testing results
         from sklearn.metrics import classification_report, confusion_matrix

         #for visualizing tree
         from sklearn.tree import plot_tree

         x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.2, random_state = 0)

         print("Training split input- ", x_train.shape)
         print("Testing split input- ", x_test.shape)

          Training split input-  (455, 10)
          Testing split input-  (114, 10)
```

5. Using Naive Bayes gaussian learning method on breast cancer dataset

```
In [41]: from sklearn.model_selection import train_test_split
         from sklearn.naive_bayes import GaussianNB
         from sklearn.metrics import accuracy_score
         from sklearn import metrics

In [31]: nb = GaussianNB()

In [32]: nb.fit(x_train,y_train)

          GaussianNB()

In [33]: y_pred = nb.predict(x_test)
         print("Classification report - \n", classification_report(y_test,y_pred))

          Classification report -
                        precision    recall  f1-score   support

                     B       0.90      0.91      0.90        67
                     M       0.87      0.85      0.86        47

              accuracy                           0.89       114
             macro avg       0.88      0.88      0.88       114
          weighted avg       0.89      0.89      0.89       114
```

6. Confusion matrix

In [34]:
```
cm=confusion_matrix(y_test,y_pred)
cm
```

```
array([[61,  6],
       [ 7, 40]], dtype=int64)
```

In [40]:
```
plt.figure(figsize=(5,5))

sns.heatmap(data=cm,linewidths=1.0, annot=True,square = True,  cmap = 'Blues')

plt.ylabel('Actual label')
plt.xlabel('Predicted label')

all_sample_title = 'Accuracy Score: {0}'.format(round(nb.score(x_test, y_test),2))

plt.title(all_sample_title, size = 15)

plt.savefig("accuracy_nb.png")
```