Pattern Recognition Assignment -2

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Question 2

This repository contains the dataset

In [61]:
```
cd ./datasets/
```

```
[Errno 2] No such file or directory: './datasets/'
/mnt/c/Users/siddh/ML_lab/PR-assignment-2/datasets
```

In [62]:
```
ls
```

```
 Index*          bezdekIris.data*   iris.names*      sat.trn*
'Index (1)'*     iris.data*         'sat (1).doc'*   sat.tst*
```

In [63]:
```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import seaborn as sns

from sklearn.cluster import KMeans
from sklearn import metrics
from sklearn.model_selection import train_test_split
from sklearn import datasets
from scipy.spatial.distance import cdist
import math
```

Loading the dataset

In [64]:
```
# load iris dataset
iris = datasets.load_iris()


# Since this is a bunch, create a dataframe
iris_df=pd.DataFrame(iris.data)
iris_df['class']=iris.target

iris_df.columns=['sepal_length', 'sepal_width', 'petal_length', 'petal_width', 'class']
```

In [65]:
```
iris_df.head()
```

Out[65]:

	sepal_length	sepal_width	petal_length	petal_width	class
0	5.1	3.5	1.4	0.2	0
1	4.9	3.0	1.4	0.2	0
2	4.7	3.2	1.3	0.2	0
3	4.6	3.1	1.5	0.2	0
4	5.0	3.6	1.4	0.2	0

In [66]:
```
iris_df.describe()
```

Out[66]:

	sepal_length	sepal_width	petal_length	petal_width	class
count	150.000000	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.057333	3.758000	1.199333	1.000000
std	0.828066	0.435866	1.765298	0.762238	0.819232
min	4.300000	2.000000	1.000000	0.100000	0.000000
25%	5.100000	2.800000	1.600000	0.300000	0.000000
50%	5.800000	3.000000	4.350000	1.300000	1.000000
75%	6.400000	3.300000	5.100000	1.800000	2.000000
max	7.900000	4.400000	6.900000	2.500000	2.000000

In [67]:
```
sns.heatmap(iris_df.corr(), annot = True, linecolor='black')
```

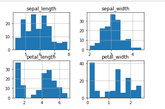
Out[67]:
```
<AxesSubplot:>
```

In [68]:
```
iris_df.shape
```

Out[68]:
```
(150, 5)
```

In [69]:
```
X = iris_df.iloc[:,:4]
Y = iris_df.iloc[:,4]
```

In [70]:
```
X.hist()
plt.show()
```

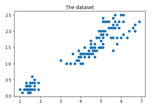


Test Train split

In [71]:
```
xtrain, xval, ytrain, yval = train_test_split(X,Y, test_size=0.3, random_state=42)
```

In [100]:
```
plt.scatter(x=iris_df.petal_length,y=iris_df.petal_width)
plt.title("The dataset")
```

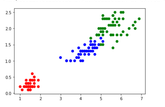
Out[100]:
```
Text(0.5, 1.0, 'The dataset')
```



In [103]:
```
color =np.array(['red','blue','green'])

plt.scatter(x=iris_df.petal_length,y=iris_df.petal_width,c=color[iris.target])
```

Out[103]:
```
<matplotlib.collections.PathCollection at 0x7f5a746395b0>
```



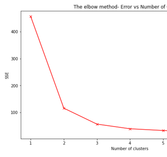
Elbow Method

In [82]:
```
sse=[] #sum of squared error

# Finding inertia on various k values
for i in range(1,8):
    kmeans=KMeans(n_clusters = i, init = 'k-means++', max_iter = 100, n_init = 10, random_state = 0).fit(xtrain)
    sse.append(kmeans.inertia_)

plt.figure(figsize=(10, 6))
plt.plot(range(1, 8), sse, 'bx-', color='red')
plt.title('The elbow method- Error vs Number of Clusters')
plt.xlabel('Number of clusters')
plt.ylabel('SSE')
```

Out[82]:
```
Text(0, 0.5, 'SSE')
```



The optimal value for number of clusters is 3.

In [105]:
```
kmeans = KMeans(n_clusters=3, init = 'k-means++', max_iter = 100, n_init = 10, random_state = 0)

y_kmeans = kmeans.fit_predict(x)
```

In [106]:
```
kmeans.cluster_centers_
```

Out[106]:
```
array([[5.79555556, 2.69555556, 4.34444444, 1.41777778],
       [4.96451613, 3.37741935, 1.46451613, 0.2483871 ],
       [6.85517241, 3.10344828, 5.76689655, 2.02068966]])
```

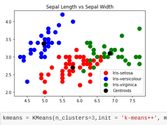
Scatter Plot Visualisations

In [107]:
```
plt.scatter(x[y_kmeans == 0, 0], x[y_kmeans == 0, 1],
            s = 100, c = 'red', label = 'Iris-setosa')
plt.scatter(x[y_kmeans == 1, 0], x[y_kmeans == 1, 1],
            s = 100, c = 'blue', label = 'Iris-versicolour')
plt.scatter(x[y_kmeans == 2, 0], x[y_kmeans == 2, 1],
            s = 100, c = 'green', label = 'Iris-virginica')

# Plotting the centroids of the clusters
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:,1],
            s = 100, c = 'black', label = 'Centroids')

plt.legend()
plt.title('Sepal Length vs Sepal Width')
```

Out[107]:
```
Text(0.5, 1.0, 'Sepal Length vs Sepal Width')
```



In [125]:
```
kmeans = KMeans(n_clusters=3,init = 'k-means++', max_iter = 100, n_init = 10, random_state = 0)

predictedy = kmeans.fit_predict(xtrain)
```

In [126]:
```
metrics.accuracy_score(predictedy, ytrain)
```

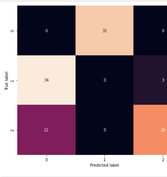
Out[126]:
```
0.24761904761904763
```

In [131]:
```
con_matrix = metrics.confusion_matrix(ytrain, predictedy)
print(con_matrix)
```

```
[[ 0 31  0]
 [34  0  3]
 [11  0 26]]
```

In [134]:
```
def draw_confusionmatrix(ytest, yhat):
    plt.figure(figsize=(10,7))
    cm = metrics.confusion_matrix(ytest, yhat)
    ax = sns.heatmap(cm, annot=True, fmt="d")
    plt.ylabel('True label')
    plt.xlabel('Predicted label')
```

In [135]:
```
draw_confusionmatrix(ytrain, predictedy)
```



In [136]:
```
kmeans = KMeans(n_clusters=3,init = 'k-means++', max_iter = 100, n_init = 10, random_state = 0)

predictedy = kmeans.fit_predict(xval)
```

In [137]:
```
metrics.accuracy_score(predictedy, yval)
```

Out[137]:
```
0.9333333333333333
```

In [140]:
```
draw_confusionmatrix(yval, predictedy)
```