8	Aim	Demonstrate and analyse the results of classification based on KNN Algorithm
	Program	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

CONCEPT - k-Nearest Neighbour

- The most basic instance-based method is the K- Nearest Neighbor Learning. This algorithm assumes all instances correspond to points in the n-dimensional space R^n.
- The nearest neighbors of an instance are defined in terms of the standard Euclidean distance.
- Let an arbitrary instance x be described by the feature vector

  $$((a_1(x), a_2(x), \ldots\ldots, a_n(x))$$

  Where, $a_r(x)$ denotes the value of the r^{th} attribute of instance x.

- Then the distance between two instances x_i and x_j is defined to be $d(x_i , x_j)$
  Where,

$$d(x_i, x_j) \equiv \sqrt{\sum_{r=1}^{n} (a_r(x_i) - a_r(x_j))^2}$$

- In nearest-neighbor learning the target function may be either discrete-valued or real-valued.

Training algorithm:

- For each training example (x, f (x)), add the example to the list training examples

Classification algorithm:

- Given a query instance x_q to be classified,
  - Let $x_1 \ldots x_k$ denote the k instances from training examples that are nearest to x_q
  - Return

$$\hat{f}(x_q) \leftarrow \frac{\sum_{i=1}^{k} f(x_i)}{k}$$

  - Where, $f(x_i)$ function to calculate the mean value of the k nearest training examples.

Training Instances:

- Iris Plants Dataset: Dataset contains 150 instances, 50 in each of three classes – Iris-setosa, Iris-versicolor, Iris-virginica
- There are four Attributes and values in centimetres- Sepal length, Sepal width, Petal length, Petal width

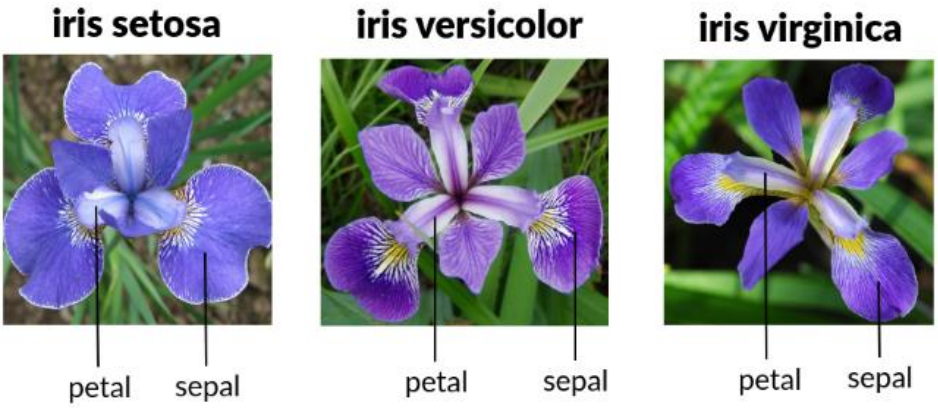
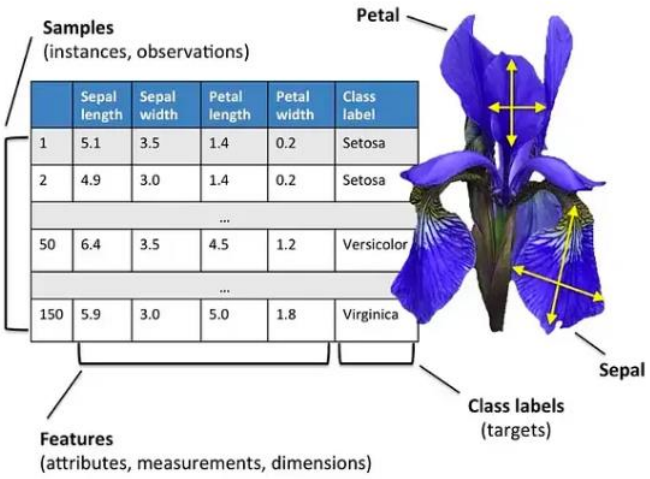


Image Source: https://www.analyticsvidhya.com/blog/2022/06/iris-flowers-classification-using-machine-learning/



	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
...					
50	6.4	3.5	4.5	1.2	Versicolor
...					
150	5.9	3.0	5.0	1.8	Virginica

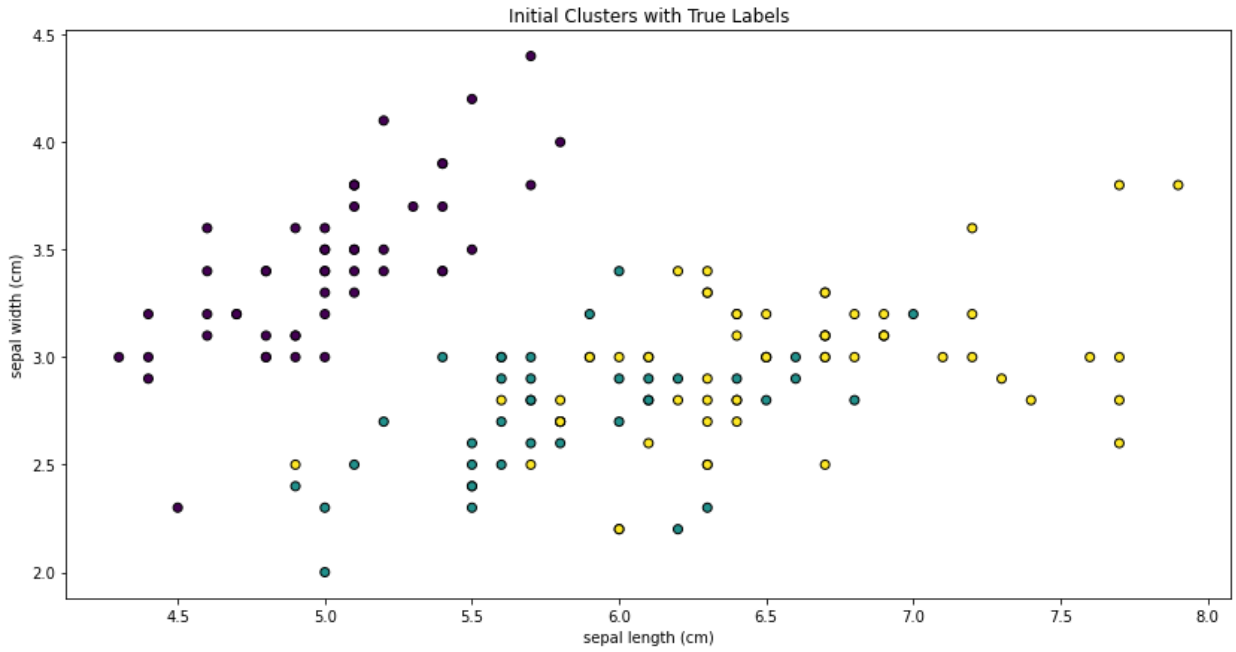
Image Source: https://eminebozkus.medium.com/exploring-the-iris-flower-dataset-4e000bcc266c

	sepal-length	sepal-width	petal-length	petal-width	Class
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

Program:

```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import classification_report, confusion_matrix
from sklearn import datasets
import matplotlib.pyplot as plt

# Load the Iris dataset
iris = datasets.load_iris()
x = iris.data
y = iris.target

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

# Plot the initial clusters
plt.figure(figsize=(14, 7))

# Plot the initial clusters (True labels)
plt.scatter(x[:, 0], x[:, 1], c=y, cmap='viridis', marker='o', edgecolor='k')
plt.xlabel(iris.feature_names[0])
plt.ylabel(iris.feature_names[1])
plt.title('Initial Clusters with True Labels')
plt.show()

#To Training the model and Nearest nighbors K=3
classifier = KNeighborsClassifier(n_neighbors=3)
classifier.fit(x_train, y_train)

#To make predictions on our test data
y_pred=classifier.predict(x_test)

print('Confusion Matrix')
print(confusion_matrix(y_test,y_pred))

print('Accuracy Metrics')
print(classification_report(y_test,y_pred))
```

Output:




```
Confusion Matrix
[[10  0  0]
 [ 0  8  1]
 [ 0  0 11]]
Accuracy Metrics
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       1.00      0.89      0.94         9
           2       0.92      1.00      0.96        11

    accuracy                           0.97        30
   macro avg       0.97      0.96      0.97        30
weighted avg       0.97      0.97      0.97        30
```