Workshop - Decision Trees

This workshop deals with understanding the working of decision trees.

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In [1]:

```
# Importing libraries in Python
import sklearn.datasets as datasets
import pandas as pd

# Loading the iris dataset
data=datasets.load_iris()

# Forming the iris dataframe
df=pd.DataFrame(data.data, columns=data.feature_names)
print(df.head(5))

y=data.target
print(y)
```

```
   sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)
0                5.1               3.5                1.4               0.2
1                4.9               3.0                1.4               0.2
2                4.7               3.2                1.3               0.2
3                4.6               3.1                1.5               0.2
4                5.0               3.6                1.4               0.2
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 2 2]
```

Now let us define the Decision Tree Algorithm

In [2]:

```
# Defining the decision tree algorithm
from sklearn import tree
from sklearn.tree import DecisionTreeClassifier
dtree=DecisionTreeClassifier()
dtree.fit(df,y)

print('Decision Tree Classifer Created')
```

```
Decision Tree Classifer Created
```

Let us visualize the Decision Tree to understand it better.

In [3]:

```
# Install required libraries
!pip install pydotplus
```

```
Requirement already satisfied: pydotplus in c:\users\sneha bhattcharjee\anaconda3
\lib\site-packages (2.0.2)
Requirement already satisfied: pyparsing>=2.0.1 in c:\users\sneha bhattcharjee\ana
conda3\lib\site-packages (from pydotplus) (3.0.9)
```

In [4]:

```
pip install graphviz
```

```
Requirement already satisfied: graphviz in c:\users\sneha bhattcharjee\anaconda3\l
ib\site-packages (0.20.1)Note: you may need to restart the kernel to use updated p
ackages.
```

In [5]:

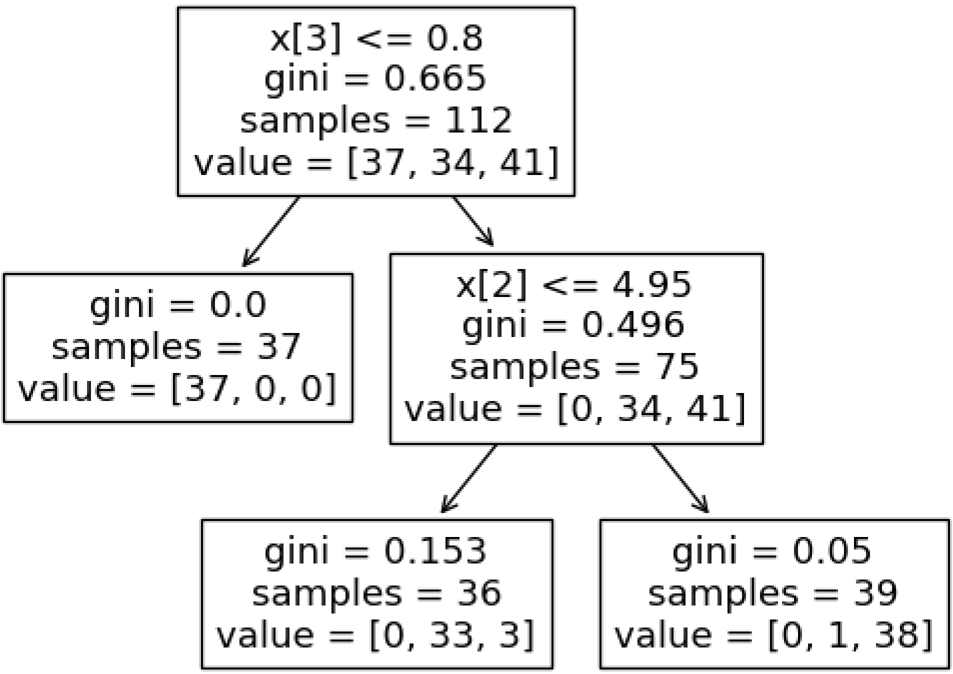
```python
# Import necessary libraries for graph viz
#from sklearn.externals.six import StringIO
from IPython.display import Image
from sklearn.tree import export_graphviz
import pydotplus
```

In [6]:

```python
import numpy as np
from matplotlib import pyplot as plt

from sklearn.model_selection import train_test_split
from sklearn.datasets import load_iris
from sklearn.tree import DecisionTreeClassifier
from sklearn import tree

iris = load_iris()
X = iris.data
y = iris.target
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0)

clf = DecisionTreeClassifier(max_leaf_nodes=3, random_state=0)
clf.fit(X_train, y_train)
n_nodes = clf.tree_.node_count
children_left = clf.tree_.children_left
children_right = clf.tree_.children_right
feature = clf.tree_.feature
threshold = clf.tree_.threshold

node_depth = np.zeros(shape=n_nodes, dtype=np.int64)
is_leaves = np.zeros(shape=n_nodes, dtype=bool)
stack = [(0, 0)]  # start with the root node id (0) and its depth (0)
while len(stack) > 0:
    # `pop` ensures each node is only visited once
    node_id, depth = stack.pop()
    node_depth[node_id] = depth

    # If the left and right child of a node is not the same we have a split
    # node
    is_split_node = children_left[node_id] != children_right[node_id]
    # If a split node, append left and right children and depth to `stack`
    # so we can loop through them
    if is_split_node:
        stack.append((children_left[node_id], depth + 1))
        stack.append((children_right[node_id], depth + 1))
    else:
        is_leaves[node_id] = True

print(
    "The binary tree structure has {n} nodes and has "
    "the following tree structure:\n".format(n=n_nodes)
)
for i in range(n_nodes):
    if is_leaves[i]:
        print(
            "{space}node={node} is a leaf node.".format(
                space=node_depth[i] * "\t", node=i
            )
        )
    else:
```

```
        print(
            "{space}node={node} is a split node: "
            "go to node {left} if X[:, {feature}] <= {threshold} "
            "else to node {right}.".format(
                space=node_depth[i] * "\t",
                node=i,
                left=children_left[i],
                feature=feature[i],
                threshold=threshold[i],
                right=children_right[i],
            )
        )
        tree.plot_tree(clf)
plt.show()
```

```
The binary tree structure has 5 nodes and has the following tree structure:

node=0 is a split node: go to node 1 if X[:, 3] <= 0.800000011920929 else to node 2.
	node=1 is a leaf node.
	node=2 is a split node: go to node 3 if X[:, 2] <= 4.950000047683716 else to node 4.
		node=3 is a leaf node.
		node=4 is a leaf node.
```



In [ ]:

```
```

You can now feed any new/test data to this classifer and it would be able to predict the right class accordingly.