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Domain:- Machine Learning

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Company:- CODETECH IT SOLUTIONS

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TASK 1:DECISION TREE IMPLEMENTATION

BUILD AND VISUALIZE A DECISION TREE MODEL USING SCIKIT-LEARN TO CLASSIFY OR PREDICT OUTCOMES ON A CHOSEN DATASET. DELIVERABLE: A NOTEBOOK WITH MODEL VISUALIZATION AND ANALYSIS.

```
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier, export_text, plot_tree
import matplotlib.pyplot as plt
import seaborn as sns
```

```
# Loading the Iris dataset
iris = load_iris()
data = pd.DataFrame(iris.data, columns=iris.feature_names)
data['target'] = iris.target

# Displaying  the first few rows of the dataset
print("Dataset preview:")
print(data.head())
```

```
Dataset preview:
   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

   target
0       0
1       0
2       0
3       0
4       0
```

```
#getting the top 10 values
data.head(10)
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target
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
5	5.4	3.9	1.7	0.4	0
6	4.6	3.4	1.4	0.3	0
7	5.0	3.4	1.5	0.2	0
8	4.4	2.9	1.4	0.2	0
9	4.9	3.1	1.5	0.1	0

```
# geeting the 10 bottom values
data.tail(10)
```

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target
140	6.7	3.1	5.6	2.4	2
141	6.9	3.1	5.1	2.3	2
142	5.8	2.7	5.1	1.9	2
143	6.8	3.2	5.9	2.3	2
144	6.7	3.3	5.7	2.5	2
145	6.7	3.0	5.2	2.3	2
146	6.3	2.5	5.0	1.9	2
147	6.5	3.0	5.2	2.0	2
148	6.2	3.4	5.4	2.3	2
149	5.9	3.0	5.1	1.8	2

```
# Spliting  the dataset into training and testing sets
X = data[iris.feature_names]
y = data['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
# Initialize the Decision Tree model
dt_model = DecisionTreeClassifier(random_state=42)
```

```
# Train the model on the training data
dt_model.fit(X_train, y_train)
```

```
DecisionTreeClassifier
DecisionTreeClassifier(random_state=42)
```

```
# Evaluate the model on the test data
accuracy = dt_model.score(X_test, y_test)
print(f"Model accuracy: {accuracy:.2f}")
```

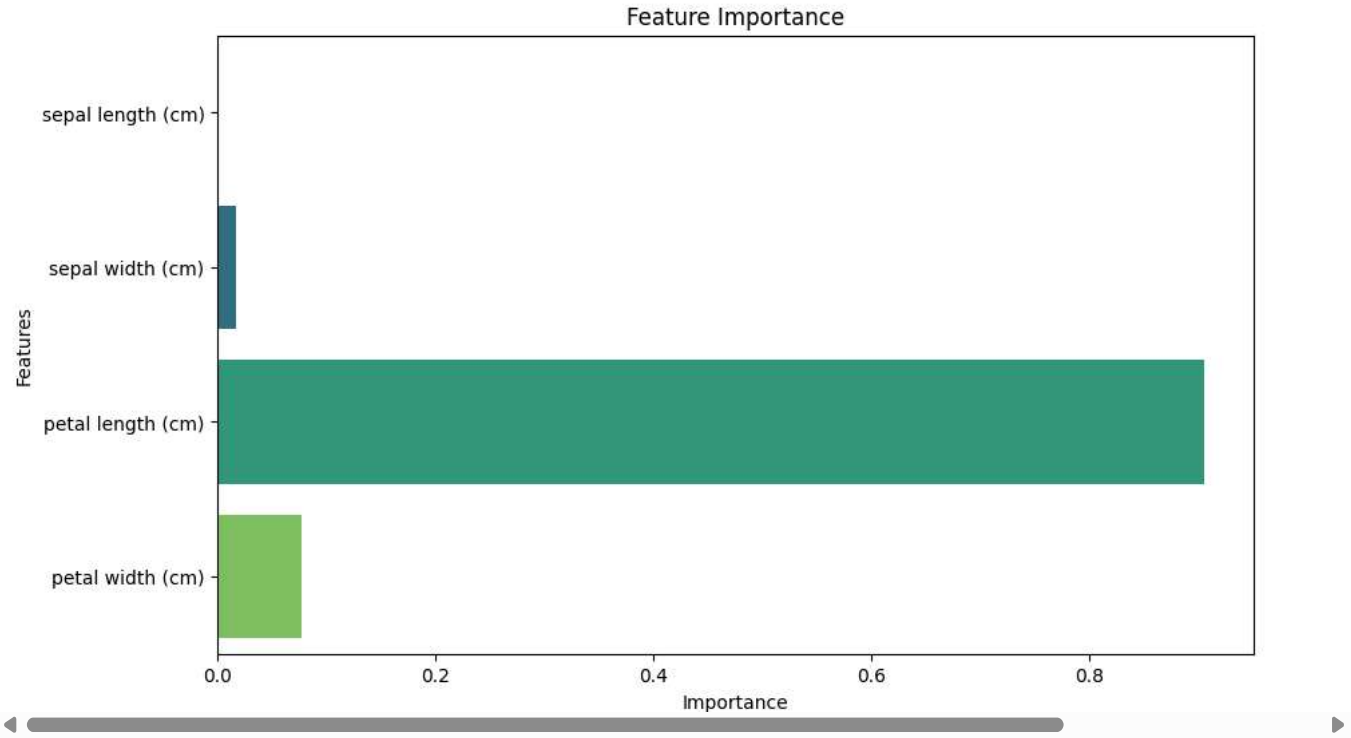
```
Model accuracy: 1.00
```

```
# Visualize feature importance
feature_importances = dt_model.feature_importances_
plt.figure(figsize=(10, 6))
sns.barplot(x=feature_importances, y=iris.feature_names, palette="viridis")
plt.title("Feature Importance")
plt.xlabel("Importance")
plt.ylabel("Features")
plt.show()
```

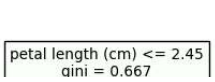
```
<ipython-input-9-327d3bdff328>:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` and set `le

  sns.barplot(x=feature_importances, y=iris.feature_names, palette="viridis")
```

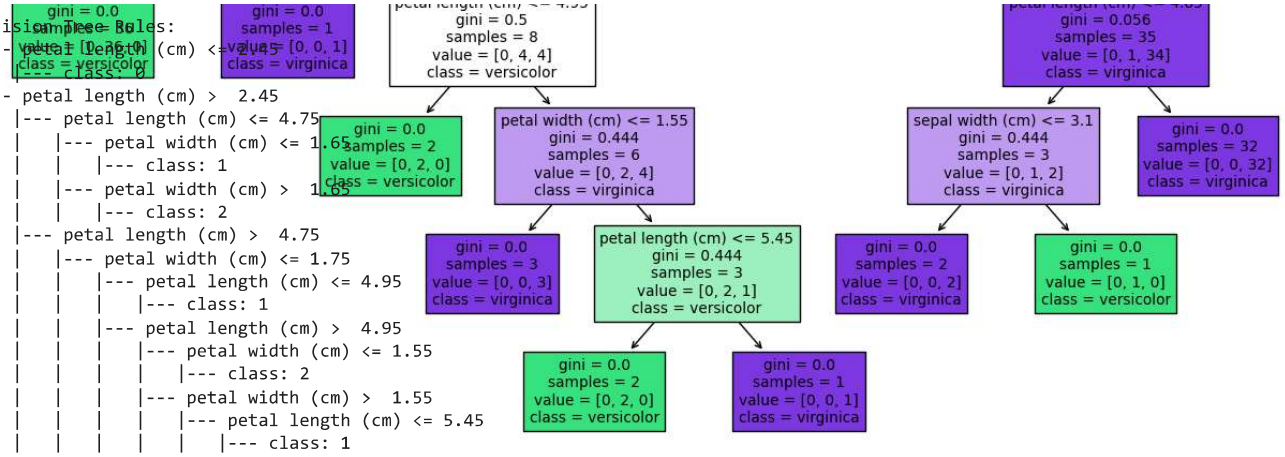



```
# Visualize the Decision Tree
plt.figure(figsize=(16, 10))
plot_tree(dt_model, feature_names=iris.feature_names, class_names=iris.target_names.tolist(), filled=True)
plt.title("Decision Tree Visualization ")
plt.show()
```




```
# Export the tree in textual format
tree_rules = export_text(dt_model, feature_names=iris.feature_names)
print("Decision Tree Rules:")
print(tree_rules)


# Pairplot of the dataset to show relationships between features
sns.pairplot(data, hue="target", palette="deep", diag_kind="kde", markers=["o", "s", "D"],
             plot_kws={'alpha': 0.7})
plt.suptitle("Pairplot of Iris Dataset", y=1.02)
plt.show()
```




```
Decision Tree Rules:
|--- petal length (cm) <= 2.45
|   |--- class: 0
|--- petal length (cm) >  2.45
|   |--- petal length (cm) <= 4.75
|   |   |--- petal width (cm) <= 1.65
|   |   |   |--- class: 1
|   |   |--- petal width (cm) >  1.65
|   |   |   |--- class: 2
|   |--- petal length (cm) >  4.75
|   |   |--- petal width (cm) <= 1.75
|   |   |   |--- petal length (cm) <= 4.95
|   |   |   |   |--- class: 1
|   |   |   |--- petal length (cm) >  4.95
|   |   |   |   |--- petal width (cm) <= 1.55
|   |   |   |   |   |--- class: 2
|   |   |   |   |--- petal width (cm) >  1.55
|   |   |   |   |   |--- petal length (cm) <= 5.45
|   |   |   |   |   |   |--- class: 1
|   |   |   |   |   |--- petal length (cm) >  5.45
|   |   |   |   |   |   |--- class: 2
|   |   |--- petal width (cm) >  1.75
|   |   |   |--- petal length (cm) <= 4.85
|   |   |   |   |--- sepal width (cm) <= 3.10
|   |   |   |   |   |--- class: 2
|   |   |   |   |--- sepal width (cm) >  3.10
|   |   |   |   |   |--- class: 1
|   |   |   |--- petal length (cm) >  4.85
|   |   |   |   |--- class: 2
```