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############################################################
#                                                          #
#                       EXPERIMENT 7                       #
#                       Decision Tree                      #
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#                                                          #
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import pandas as pd
from sklearn.datasets import load_iris
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn import tree
import matplotlib.pyplot as plt

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

# Splitting the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize the DecisionTreeClassifier with the ID3 criterion (entropy)
clf = DecisionTreeClassifier(criterion='entropy', random_state=42)

# Fit the model on the training data
clf.fit(X_train, y_train)

# Predicting a new sample
new_sample = [[5.1, 3.5, 1.4, 0.2]]
prediction = clf.predict(new_sample)
print(f'Predicted class for the new sample: {iris.target_names[prediction[0]]}')

# Plotting the decision tree
plt.figure(figsize=(20, 10))
tree.plot_tree(clf, filled=True, feature_names=iris.feature_names, class_names=iris.target_names)
plt.show()


OUTPUT:
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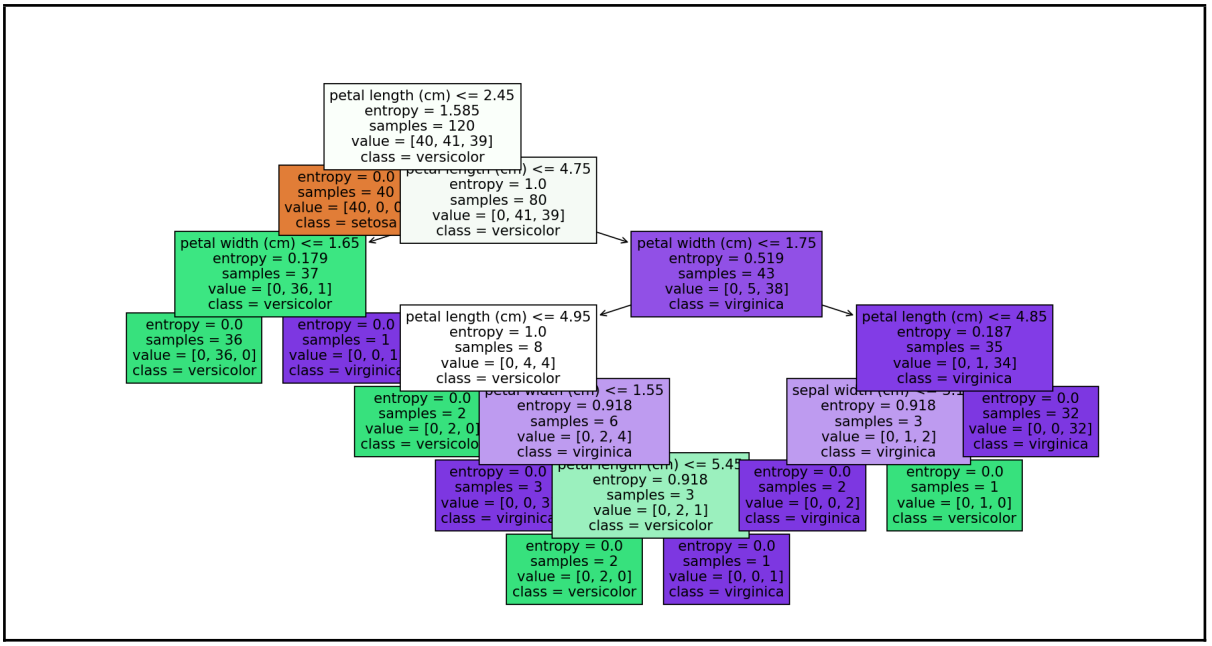
petal length (cm) <= 2.45
entropy = 1.585
samples = 120
value = [40, 41, 39]
class = versicolor
entropy = 0.0
samples = 40
class = setosa
petal length (cm) <= 4.75
entropy = 1.0
samples = 80
value = [0, 41, 39]
class = versicolor
petal width (cm) <= 1.65
entropy = 0.179
samples = 37
value = [0, 36, 1]
class = versicolor
petal width (cm) <= 1.75
entropy = 0.519
samples = 43
value = [0, 5, 38]
class = virginica
entropy = 0.0
samples = 36
value = [0, 36, 0]
class = versicolor
entropy = 0.0
samples = 1
value = [0, 0, 1
class = virginica
petal length (cm) <= 4.95
entropy = 1.0
samples = 8
value = [0, 4, 4]
class = versicolor
petal length (cm) <= 4.85
entropy = 0.187
samples = 35
value = [0, 1, 34]
class = virginica
entropy = 0.0
samples = 2
value = [0, 2, 0]
class = versicolor
petal width (cm) <= 1.55
entropy = 0.918
samples = 6
value = [0, 2, 4]
class = virginica
sepal width (cm) <= 3.1
entropy = 0.918
samples = 3
value = [0, 1, 2]
class = virginica
entropy = 0.0
samples = 32
value = [0, 0, 32]
class = virginica
entropy = 0.0
samples = 3
value = [0, 0, 3
class = virginica
petal length (cm) <= 5.45
entropy = 0.918
samples = 3
value = [0, 2, 1]
class = versicolor
entropy = 0.0
samples = 2
value = [0, 0, 2]
class = virginica
entropy = 0.0
samples = 1
value = [0, 1, 0]
class = versicolor
entropy = 0.0
samples = 2
value = [0, 2, 0]
class = versicolor
entropy = 0.0
samples = 1
value = [0, 0, 1]
class = virginica