Sesión 10 – Árboles de Decisión

En este laboratorio aprenderás a implementar, visualizar y evaluar **árboles de decisión** en Python usando `scikit-learn`.

Objetivo

Al finalizar la sesión el alumno será capaz de:

- Construir un árbol de decisión para clasificación y regresión.
- Calcular métricas y analizar el modelo.
- Aplicar poda y comparar con Random Forest.

```
# Instalación de librerías necesarias (en Colab)
!pip install scikit-learn matplotlib graphviz
```

```
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.11/dist-packages (1.6.1)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.11/dist-packages (3.10.0)
Requirement already satisfied: graphviz in /usr/local/lib/python3.11/dist-packages (0.21)
Requirement already satisfied: numpy>=1.19.5 in /usr/local/lib/python3.11/dist-packages (from scikit-learn) (2.0.2)
Requirement already satisfied: scipy>=1.6.0 in /usr/local/lib/python3.11/dist-packages (from scikit-learn) (1.16.1)
Requirement already satisfied: joblib>=1.2.0 in /usr/local/lib/python3.11/dist-packages (from scikit-learn) (1.5.1)
Requirement already satisfied: threadpoolctl>=3.1.0 in /usr/local/lib/python3.11/dist-packages (from scikit-learn) (3.6.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (1.3.3)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (4.59.0)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (1.4.9)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (25.0)
Requirement already satisfied: pillow>=8 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (11.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (3.2.3)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)
```

```
# Importación de librerías
import pandas as pd
import numpy as np
from sklearn.datasets import load_iris
from sklearn.tree import DecisionTreeClassifier, plot_tree, export_graphviz
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score
import matplotlib.pyplot as plt
```

```
# Cargar dataset Iris
iris = load_iris()
X = pd.DataFrame(iris.data, columns=iris.feature_names)
y = pd.Series(iris.target)
X.head()
```

	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

Próximos pasos: Generar código con X | Ver gráficos recomendados | New interactive sheet

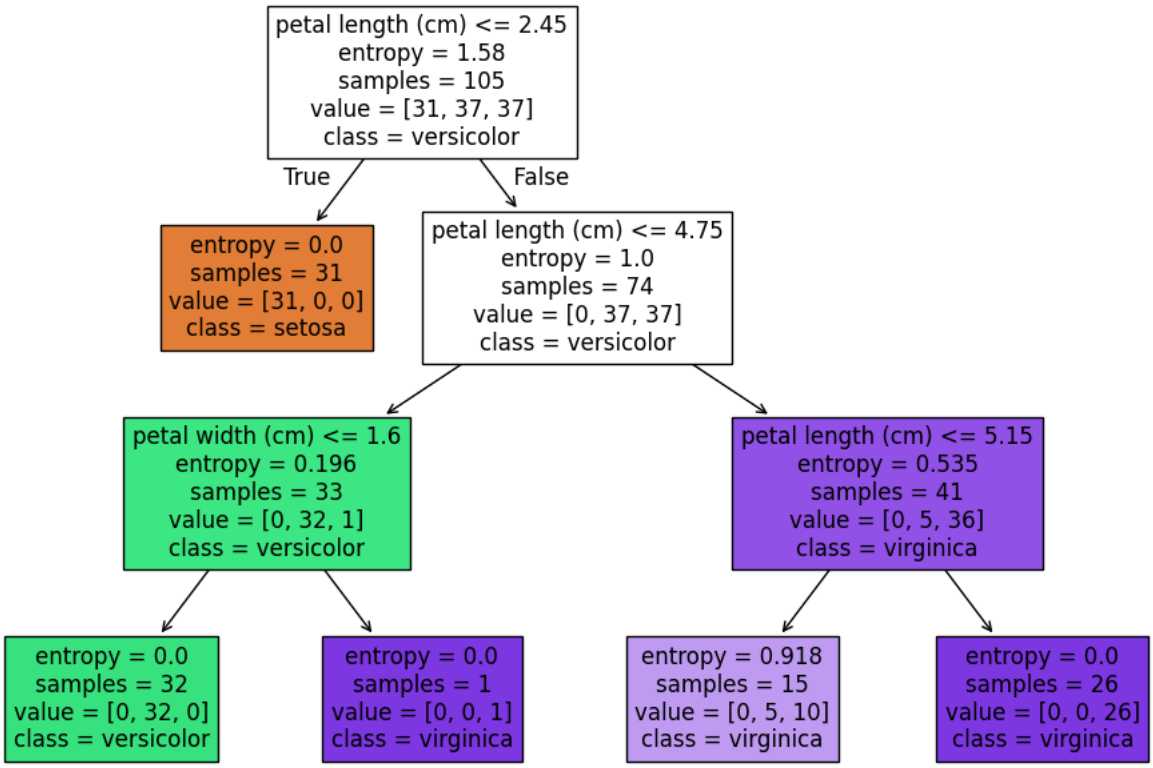
```
# División en entrenamiento y prueba
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
X_train.shape, X_test.shape
```

```
((105, 4), (45, 4))
```

```
# Entrenamiento de árbol de decisión
clf = DecisionTreeClassifier(criterion='entropy', max_depth=3, random_state=42)
clf.fit(X_train, y_train)
```

```
DecisionTreeClassifier
DecisionTreeClassifier(criterion='entropy', max_depth=3, random_state=42)
```

```
# Visualización del árbol
plt.figure(figsize=(12,8))
plot_tree(clf, feature_names=iris.feature_names, class_names=iris.target_names, filled=True)
plt.show()
```




```
# Evaluación
y_pred = clf.predict(X_test)
print(confusion_matrix(y_test, y_pred))
print(classification_report(y_test, y_pred))
print('Accuracy:', accuracy_score(y_test, y_pred))
```

```
[[19  0  0]
 [ 0 12  1]
 [ 0  0 13]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        19
           1       1.00      0.92      0.96        13
           2       0.93      1.00      0.96        13

    accuracy                           0.98        45
   macro avg       0.98      0.97      0.97        45
weighted avg       0.98      0.98      0.98        45

Accuracy: 0.9777777777777777
```

```
# Poda por coste-complejidad
path = clf.cost_complexity_pruning_path(X_train, y_train)
ccp_alphas = path.ccp_alphas
print('Posibles alphas:', ccp_alphas)
```

```
Posibles alphas: [0.         0.06157149 0.07769766 0.43430764 0.87539185]
```

```
# Comparativa con Random Forest
from sklearn.ensemble import RandomForestClassifier
rf = RandomForestClassifier(n_estimators=100, random_state=42)
rf.fit(X_train, y_train)
y_pred_rf = rf.predict(X_test)
print('Accuracy RF:', accuracy_score(y_test, y_pred_rf))
```

```
Accuracy RF: 1.0
```