Decision Tree - 분류

```
import warnings
warnings.filterwarnings('ignore')
```

실습용 데이터 설정

- iris.csv

```
import seaborn as sns

DF = sns.load_dataset('iris')
```

- pandas DataFrame

```
DF.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   sepal_length  150 non-null    float64
 1   sepal_width   150 non-null    float64
 2   petal_length  150 non-null    float64
 3   petal_width   150 non-null    float64
 4   species       150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

```
DF.head(3)
```

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa

I. 탐색적 데이터 분석

1) 빈도분석

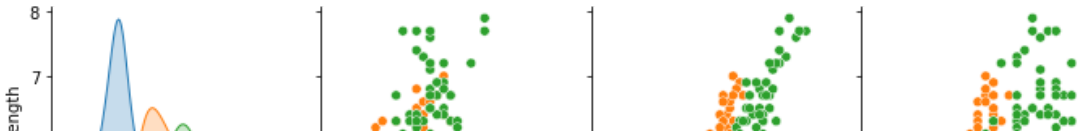
```
DF.species.value_counts()
```

```
versicolor    50
virginica     50
setosa        50
Name: species, dtype: int64
```

2) 분포 시각화

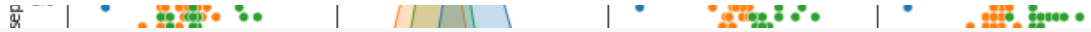
```
import matplotlib.pyplot as plt
import seaborn as sns

sns.pairplot(hue = 'species', data = DF)
plt.show()
```



II. Data Preprocessing

1) Data Set



```
X = DF[['sepal_length', 'sepal_width', 'petal_length', 'petal_width']]
y = DF['species']
```

2) Train & Test Split

- 7:3

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y,
                                                    test_size = 0.3,
                                                    random_state = 2045)

print('Train Data : ', X_train.shape, y_train.shape)
print('Test Data : ', X_test.shape, y_test.shape)
```

```
Train Data :  (105, 4) (105,)
Test Data :  (45, 4) (45,)
```

III. Modeling

1) Train_Data로 모델 생성

```
from sklearn.tree import DecisionTreeClassifier

Model_dt = DecisionTreeClassifier(random_state = 2045)
Model_dt.fit(X_train, y_train)
```

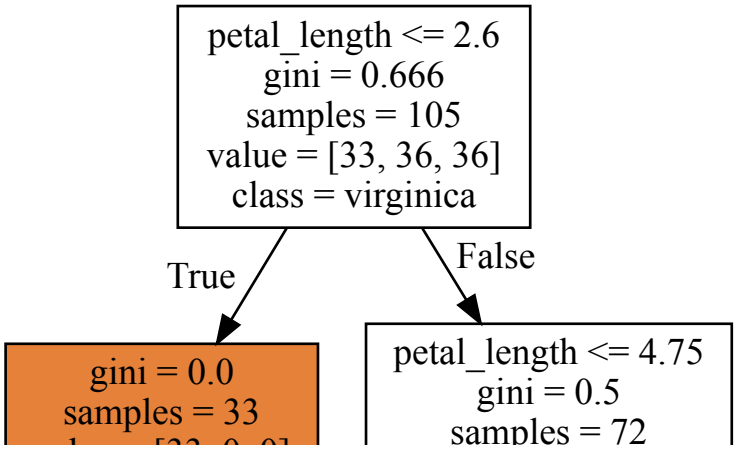
```
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='gini',
                       max_depth=None, max_features=None, max_leaf_nodes=None,
```

```
min_impurity_decrease=0.0, min_impurity_split=None,
min_samples_leaf=1, min_samples_split=2,
min_weight_fraction_leaf=0.0, presort='deprecated',
random_state=2045, splitter='best')
```

2) Visualization

```
from sklearn.tree import export_graphviz
import graphviz

graphviz.Source(export_graphviz(Model_dt,
                                class_names = (['setosa', 'virginica', 'versi
                                feature_names = (['sepal_length', 'sepal_widt
                                filled = True))
```



3) Test_Data에 Model 적용

```
y_hat = Model_dt.predict(X_test)

y_hat
```

```
array(['setosa', 'setosa', 'versicolor', 'virginica', 'setosa',
       'versicolor', 'virginica', 'setosa', 'virginica', 'setosa',
       'versicolor', 'virginica', 'versicolor', 'setosa', 'setosa',
       'versicolor', 'versicolor', 'setosa', 'versicolor', 'setosa',
       'setosa', 'setosa', 'virginica', 'setosa', 'virginica',
       'versicolor', 'setosa', 'versicolor', 'versicolor', 'virginica',
       'setosa', 'versicolor', 'setosa', 'versicolor', 'versicolor',
       'versicolor', 'virginica', 'versicolor', 'setosa', 'versicolor',
       'virginica', 'setosa', 'virginica', 'virginica', 'virginica'],
      dtype=object)
```

4) Confusion Matrix

```
from sklearn.metrics import confusion_matrix

confusion_matrix(y_test, y_hat)
```

```
array([[17,  0,  0],
       [ 0, 14,  0],
       [ 0,  2, 12]])
```

5) Accuracy, Precision, Recall

```
from sklearn.metrics import accuracy_score, precision_score, recall_score

print(accuracy_score(y_test, y_hat))
print(precision_score(y_test, y_hat, average = None))
print(recall_score(y_test, y_hat, average = None))
```

```
print(recall_score(y_test, y_hat, average = None))
```

```
0.9555555555555556
[1.    0.875 1.   ]
[1.         1.         0.85714286]
```

6) F1_Score

```
from sklearn.metrics import f1_score

f1_score(y_test, y_hat, average = None)
```

```
array([1.        , 0.93333333, 0.92307692])
```

IV. Pruning(가지치기)

- min_samples_split : 분할을 위한 최소한의 샘플데이터 개수
- min_samples_leaf : 말단 노드가 되기 위한 최소한의 샘플데이터 개수
- max_leaf_nodes : 말단 노드의 최대 개수
- max_depth : 트리모델의 최대 깊이를 지정

1) Model Pruning

```
from sklearn.tree import DecisionTreeClassifier

Model_pr = DecisionTreeClassifier(max_depth = 3,
                                  random_state = 2045)
Model_pr.fit(X_train, y_train)
```

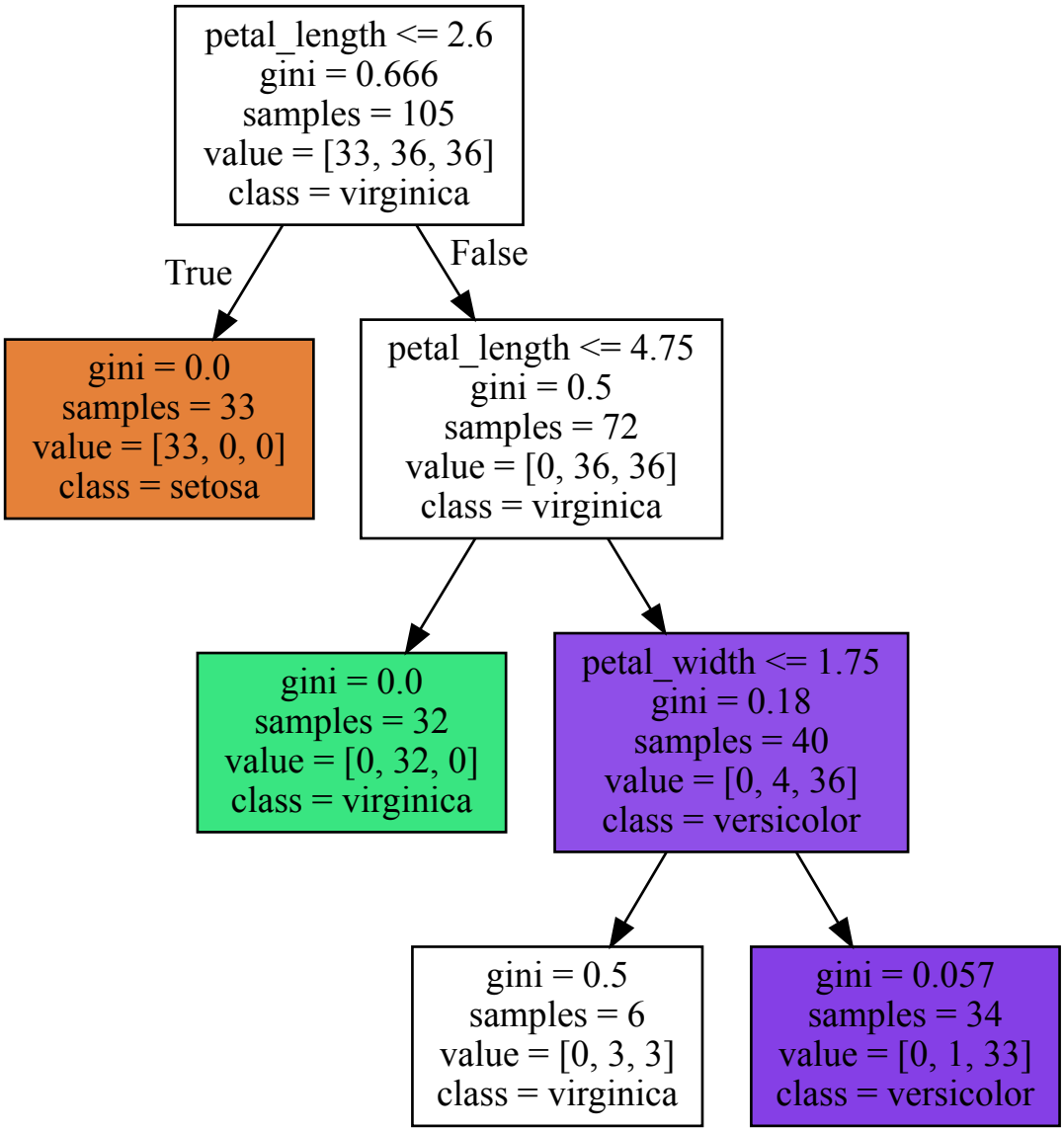
```
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='gini',
                       max_depth=3, max_features=None, max_leaf_nodes=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, presort='deprecated',
                       random_state=2045, splitter='best')
```

2) Model Visualization

```
from sklearn.tree import export_graphviz
import graphviz

graphviz.Source(export_graphviz(Model_pr
```

```
graphviz.Source(export_graphviz(Model_pr,
                                class_names = (['setosa', 'virginica', 'versi
                                feature_names = (['sepal_length', 'sepal_widt
                                filled = True))
```



3) Model Evaluate

- Confusion Matrix

```
from sklearn.metrics import confusion_matrix, accuracy_score, precision_score

y_hat = Model_pr.predict(X_test)

print(confusion_matrix(y_test, y_hat))
```

```
[[17  0  0]
 [ 0 14  0]
 [ 0  2 12]]
```

- Accuracy, Precision, Recall

```
print(accuracy_score(y_test, y_hat))
print(precision_score(y_test, y_hat, average = None))
print(recall_score(y_test, y_hat, average = None))
```

```
0.9555555555555556
[1.    0.875 1.   ]
[1.         1.         0.85714286]
```

- F1-Score

```
f1_score(y_test, y_hat, average = None)
```

```
array([1.        , 0.93333333, 0.92307692])
```

V. Feature Importance

1) Feature Importance 값 확인

```
Model_pr.feature_importances_
```

```
array([0.        , 0.        , 0.96524977, 0.03475023])
```

2) Feature Importance 시각화

```
plt.figure(figsize = (9, 6))
sns.barplot(Model_pr.feature_importances_,
            ['sepal_length', 'sepal_width', 'petal_length', 'petal_width'])
plt.show()
```

#

#

#

The End

#

#

#