IE517_HWK2

September 3, 2021

0.1 IRIS dataset

[ ]:
```
from sklearn import datasets
import numpy as np

iris = datasets.load_iris()
X = iris.data[:, [2,3]]
y = iris.target
print('Class lables:', np.unique(y))
```

```
Class lables: [0 1 2]
```

[ ]:
```
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 = 1, stratify␣
 ↪= y)
```

[ ]:
```
print('Labels couts in y:', np.bincount(y))
print('Labels counts in y_train: ', np.bincount(y_train))
print('Labels coutns in y_test: ', np.bincount(y_test))
```

```
Labels couts in y: [50 50 50]
Labels counts in y_train:  [35 35 35]
Labels coutns in y_test:  [15 15 15]
```

[ ]:
```
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap
def plot_decision_regions(X,y,classifier, test_idx = None, resolution = 0.02):

  markers = ('s', 'x', 'o', '^', 'v')
  colors = ('red', 'blue', 'lightgreen', 'gray', 'cyan')
  cmap = ListedColormap(colors[:len(np.unique(y))])

  x1_min, x1_max = X[:,0].min() - 1, X[:,0].max()+1
  x2_min, x2_max = X[:,1].min() -1, X[:,1].max()+1
  xx1, xx2 = np.meshgrid(np.arange(x1_min, x1_max, resolution), np.
 ↪arange(x2_min, x2_max, resolution))
```

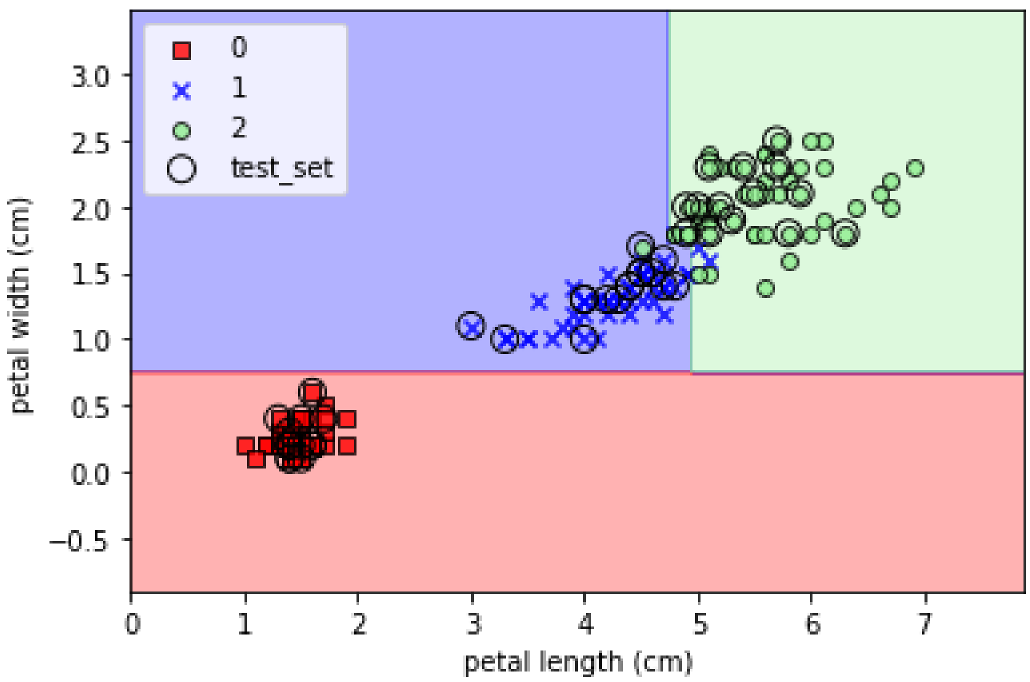
```
  Z = classifier.predict(np.array([xx1.ravel(), xx2.ravel()]).T)
  Z = Z.reshape(xx1.shape)
  plt.contourf(xx1, xx2, Z, alpha = 0.3, cmap = cmap)
  plt.xlim(xx1.min(), xx1.max())
  plt.ylim(xx2.min(), xx2.max())

  for idx, cl in enumerate(np.unique(y)):
    plt.scatter(x = X[y == cl, 0], y=X[y == cl, 1], alpha = 0.8, c =␣
↪colors[idx],
                marker = markers[idx], label = cl, edgecolor = 'black')

  if test_idx:
    X_test, y_test = X[test_idx, :], y[test_idx]

    plt.scatter(X_test[:,0], X_test[:,1], c = '', edgecolor = 'black', alpha =␣
↪1.0,
                linewidth=1, marker = 'o', s = 100, label = 'test_set')
```

0.1.1 Decision Tree

[ ]:

```
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score

tree = DecisionTreeClassifier(criterion = 'gini', max_depth = 4, random_state =␣
 ↪1)
tree.fit(X_train, y_train)
X_combined = np.vstack((X_train, X_test))
y_combined = np.hstack((y_train, y_test))

plot_decision_regions(X_combined, y_combined, classifier = tree, test_idx =␣
 ↪range(105, 150))
plt.xlabel('petal length (cm)')
plt.ylabel('petal width (cm)')
plt.legend(loc = 'upper left')
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:26:
MatplotlibDeprecationWarning: Using a string of single character colors as a
color sequence is deprecated. Use an explicit list instead.
```



[ ]:

```
from pydotplus import graph_from_dot_data
from sklearn.tree import export_graphviz

dot_data = export_graphviz(tree, filled = True, rounded = True,
                           class_names = ['Setosa', 'Versicolor', 'Virginica'],
                           feature_names = ['petal length', 'petal width'],␣
 ↪out_file = None)

graph = graph_from_dot_data(dot_data)
graph.write_png('tree.png')
```

[ ]: True

0.1.2 KNN

[ ]:

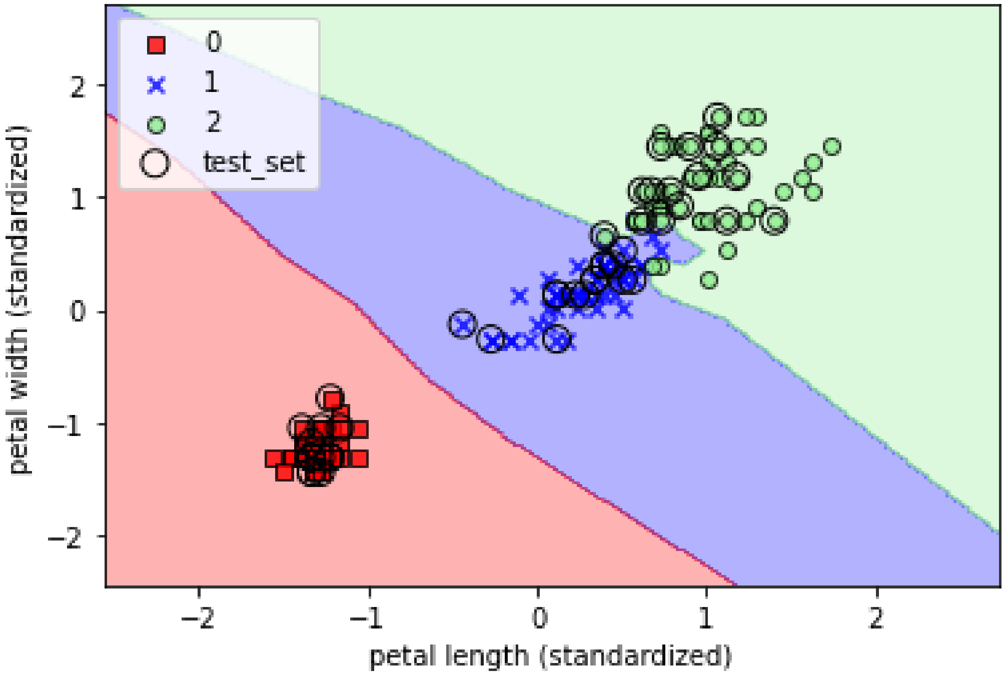
```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
sc.fit(X_train)
X_combined_std = sc.transform(X_combined)
X_train_std = sc.transform(X_train)
X_test_std = sc.transform(X_test)
```

[ ]:

```
from sklearn.neighbors import KNeighborsClassifier


k_range = range(1,26)
```

```python
scores = []
for k in k_range:
  knn = KNeighborsClassifier(n_neighbors = k, p = 2, metric = 'minkowski')
  knn.fit(X_train_std, y_train)
  y_pred = knn.predict(X_test_std)
  scores.append(accuracy_score(y_test, y_pred))

k_max = scores.index(max(scores))

knn = KNeighborsClassifier(n_neighbors = k_max, p = 2, metric = 'minkowski')
knn.fit(X_train_std, y_train)
plot_decision_regions(X_combined_std, y_combined, classifier = knn,
                      test_idx = range(105,150))
plt.xlabel('petal length (standardized)')
plt.ylabel('petal width (standardized)')
plt.legend(loc = 'upper left')
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:26:
MatplotlibDeprecationWarning: Using a string of single character colors as a
color sequence is deprecated. Use an explicit list instead.
```



[ ]:
```python
scores
```

```
[ ]: [0.9777777777777777,
      0.9777777777777777,
      1.0,
      0.9777777777777777,
      1.0,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777,
      0.9777777777777777]
```

1 Treasury Squeeze Dataset

[ ]:

```
import pandas as pd
df = pd.read_csv('Treasury_Squeeze_raw_score_data.csv', header=0)
```

[ ]:

```
df.head()
```

```
[ ]:    rowindex      contract  ...  delivery_ratio  squeeze
     0         1  TUZ92 Comdty  ...        0.099313     True
     1         2  TUH93 Comdty  ...        1.000000    False
     2         3  TUM93 Comdty  ...        0.171676    False
     3         4  TUU93 Comdty  ...        1.000000     True
     4         5  TUZ93 Comdty  ...        0.145025    False

     [5 rows x 12 columns]
```

[ ]:

```
df = df.drop(columns = ['rowindex', 'contract'])
X = df.drop(columns = ['squeeze'])
y = df['squeeze']
X.head()
```

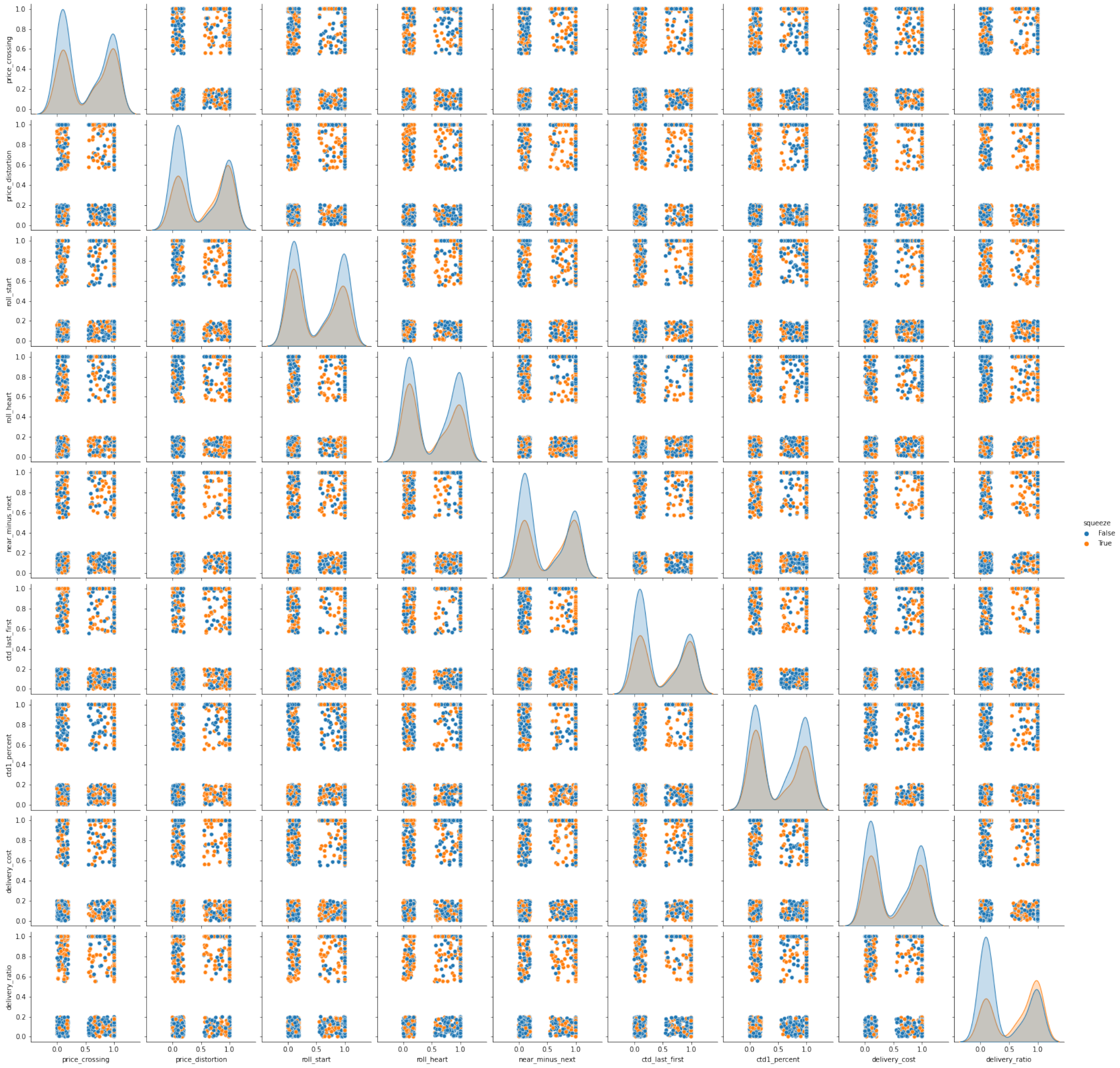
```
[ ]:    price_crossing  price_distortion  ...  delivery_cost  delivery_ratio
     0        0.157659          0.900783  ...       0.010743        0.099313
     1        0.018588          1.000000  ...       0.154116        1.000000
     2        0.035755          0.045987  ...       0.034743        0.171676
     3        0.663832          1.000000  ...       0.956668        1.000000
     4        0.109678          0.113601  ...       0.105467        0.145025

     [5 rows x 9 columns]
```

```
[ ]: y.head()
```

```
[ ]: 0     True
     1    False
     2    False
     3     True
     4    False
     Name: squeeze, dtype: bool
```

```
[ ]: # Seaborn visualization library
     import seaborn as sns# Create the default pairplot
     sns.pairplot(df, hue = 'squeeze')
```

```
[ ]: <seaborn.axisgrid.PairGrid at 0x7f6c14353050>
```



[ ]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size = 0.3,
                                                    random_state = 1, stratify␣
 ↪= y)
```

[ ]:
```
X_combined
```

[ ]:
```
array([[1.4, 0.2],
       [1.7, 0.2],
       [5.3, 2.3],
       [5.7, 2.1],
       [1.2, 0.2],
       [5.6, 2.4],
       [6.6, 2.1],
       [1.2, 0.2],
       [5.8, 1.6],
       [4.6, 1.3],
       [3.3, 1. ],
       [3.9, 1.4],
       [1.3, 0.2],
       [4.7, 1.2],
       [4. , 1.3],
       [5.1, 1.9],
       [1.9, 0.2],
       [3.5, 1. ],
       [3.9, 1.2],
       [1.6, 0.2],
       [4.8, 1.8],
       [6.9, 2.3],
       [4.5, 1.5],
       [4.5, 1.3],
       [3.8, 1.1],
       [5.6, 2.4],
       [4.7, 1.4],
       [5.6, 1.4],
       [5.8, 2.2],
       [5.1, 2.4],
       [4.1, 1.3],
       [1.5, 0.4],
       [6.7, 2.2],
       [5. , 1.9],
       [4.8, 1.8],
       [5.6, 2.1],
       [4.2, 1.5],
       [6.7, 2. ],
       [5.5, 1.8],
       [1.6, 0.2],
       [4.9, 1.8],
       [1.4, 0.2],
       [5.1, 1.5],
       [1.9, 0.4],
       [1. , 0.2],
       [4.9, 1.5],
       [1.5, 0.2],
       [1.1, 0.1],
       [5.5, 1.8],
       [4.7, 1.5],
       [1.7, 0.3],
       [3.5, 1. ],
       [4.1, 1. ],
       [1.5, 0.2],
       [1.5, 0.2],
       [1.5, 0.2],
       [3.7, 1. ],
       [6.1, 2.5],
       [1.3, 0.3],
       [4.9, 1.5],
       [1.3, 0.2],
       [4.5, 1.6],
       [6. , 1.8],
       [1.6, 0.2],
       [1.4, 0.2],
       [4.4, 1.2],
       [5.1, 1.9],
       [3.6, 1.3],
       [4.1, 1.3],
       [4.8, 1.8],
       [6.1, 2.3],
       [4.5, 1.5],
       [4.5, 1.5],
       [5.4, 2.1],
       [5.6, 2.2],
       [4.6, 1.4],
       [1.5, 0.4],
       [1.7, 0.5],
       [6.1, 1.9],
       [5.1, 1.6],
       [6.4, 2. ],
       [5. , 1.5],
       [1.5, 0.2],
       [4.2, 1.3],
       [5.1, 2. ],
       [6. , 2.5],
       [1.5, 0.3],
       [1.4, 0.2],
       [5.6, 1.8],
       [1.4, 0.3],
       [5.9, 2.3],
       [3.9, 1.1],
       [4.2, 1.2],
       [4.3, 1.3],
       [1.5, 0.1],
       [5.2, 2.3],
       [4.4, 1.3],
       [1.3, 0.2],
       [1.4, 0.3],
       [5. , 1.7],
       [1.3, 0.3],
       [4. , 1.2],
       [1.6, 0.4],
       [1.5, 0.2],
       [1.3, 0.2],
       [5.4, 2.3],
       [1.7, 0.4],
       [1.4, 0.3],
       [4.5, 1.7],
       [4.4, 1.4],
       [4. , 1.3],
       [5.8, 1.8],
       [4.5, 1.5],
       [5.3, 1.9],
       [1.3, 0.4],
       [1.5, 0.4],
       [4.9, 1.8],
       [1.4, 0.2],
       [3.3, 1. ],
       [1.4, 0.2],
       [4.8, 1.4],
       [5.1, 2.3],
       [4.5, 1.5],
       [4.3, 1.3],
       [5.2, 2. ],
       [5.9, 2.1],
       [1.4, 0.1],
       [4.4, 1.4],
       [4.9, 2. ],
       [4.2, 1.3],
       [4.7, 1.6],
       [3. , 1.1],
       [5.7, 2.5],
       [1.6, 0.6],
       [5. , 2. ],
       [1.6, 0.2],
       [1.4, 0.2],
       [4. , 1. ],
       [4. , 1.3],
       [6.3, 1.8],
       [5.5, 2.1],
       [1.4, 0.1],
       [1.6, 0.2],
       [1.4, 0.2],
       [4.7, 1.4],
       [5.7, 2.3],
       [5.1, 1.8],
       [4.6, 1.5],
       [1.5, 0.2],
       [1.5, 0.1]])
```

1.0.1 Decision Tree

[ ]:
```
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score

tree = DecisionTreeClassifier(criterion = 'gini', max_depth = 4, random_state =␣
 ↪1)
tree.fit(X_train, y_train)
X_combined = np.vstack((X_train, X_test))
y_combined = np.hstack((y_train, y_test))

y_pred = tree.predict(X_test)
print(accuracy_score(y_test, y_pred))
```

```
0.5888888888888889
```

[ ]:
```
from pydotplus import graph_from_dot_data
from sklearn.tree import export_graphviz

dot_data = export_graphviz(tree, filled = True, rounded = True,
                           class_names = ['True', 'False'],
                           feature_names = ['price_crossing',␣
 ↪'price_distortion',
                                            'roll_start', 'roll_heart',␣
 ↪'near_minus_next',
                                            'ctd_last_first', 'ctd1_percent',␣
 ↪'delivery_cost',
                                            'delivery_ratio'], out_file = None)

graph = graph_from_dot_data(dot_data)
graph.write_png('TStree.png')
```

[ ]:
```
True
```

1.0.2 KNN

[ ]:
```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
sc.fit(X_train)
X_combined_std = sc.transform(X_combined)
X_train_std = sc.transform(X_train)
X_test_std = sc.transform(X_test)
```

[ ]:
```
from sklearn.neighbors import KNeighborsClassifier


k_range = range(1,26)
scores = []
```

```
for k in k_range:
  knn = KNeighborsClassifier(n_neighbors = k, p = 2, metric = 'minkowski')
  knn.fit(X_train_std, y_train)
  y_pred = knn.predict(X_test_std)
  scores.append(accuracy_score(y_test, y_pred))

k_max = scores.index(max(scores))

knn = KNeighborsClassifier(n_neighbors = k_max, p = 2, metric = 'minkowski')
knn.fit(X_train_std, y_train)

print(scores[k_max])
```

```
0.6407407407407407
```

[ ]:

```
scores
```

[ ]:

```
[0.5888888888888889,
 0.5888888888888889,
 0.5777777777777777,
 0.5925925925925926,
 0.5666666666666667,
 0.6,
 0.5925925925925926,
 0.6,
 0.6,
 0.6037037037037037,
 0.6037037037037037,
 0.6148148148148148,
 0.6259259259259259,
 0.6407407407407407,
 0.6333333333333333,
 0.6296296296296297,
 0.6222222222222222,
 0.6370370370370371,
 0.6296296296296297,
 0.6333333333333333,
 0.6296296296296297,
 0.6296296296296297,
 0.6259259259259259,
 0.6296296296296297,
 0.6185185185185185]
```

1.1 Final Statements

[ ]:

```
print("My name is Emma Mayes")
print("My NetID is: eemayes2")
print("I hereby certify that I have read the University policy on Academic␣
 ↪Integrity and that I am not in violation.")
```

```
My name is Emma Mayes
My NetID is: eemayes2
I hereby certify that I have read the University policy on Academic Integrity
and that I am not in violation.
```

[ ]:

```
!wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('IE517_HWK2.ipynb')
```

```
File colab_pdf.py already there; not retrieving.


WARNING: apt does not have a stable CLI interface. Use with caution in scripts.


WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

Extracting templates from packages: 100%
```