Perceptron Learning Algorithm

```
from IPython.display import Image
%matplotlib inline
```

First steps with scikit-learn

Loading the Iris dataset from scikit-learn. Here, the third column represents the petal length, and the fourth column the petal width of the flower examples. The classes are already converted to integer labels where 0=Iris-Setosa, 1=Iris-Versicolor, 2=Iris-Virginica.

```
"Import of IRIS dataset from sklearn"

from sklearn import datasets
import numpy as np

iris = datasets.load_iris()
X = iris.data[:, [2, 3]]
y = iris.target

print('Class labels:', np.unique(y))

#INFERENCE :
```

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

Splitting data into 70% training and 30% test data:

```
"Splitting dataset into train and test, Have used stratify for equal distribution for labels
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, stra
```

```
"Checking the label count in train and testing labels"

print('Labels count in y:', np.bincount(y))
print('Labels count in y_train:', np.bincount(y_train))
print('Labels count in y_test:', np.bincount(y_test))
```

```
Labels count in y: [50 50 50]
Labels count in y_train: [35 35 35]
Labels count in y_test: [15 15 15]
```

Standardizing the features:

```
"Standardizing of features using standard scalar to train the model"

from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
sc.fit(X_train)
X_train_std = sc.transform(X_train)
X_test_std = sc.transform(X_test)
```

Training a perceptron via scikit-learn

```
"Training the perceptron for x_train and y_train"

from sklearn.linear_model import Perceptron

ppn = Perceptron(eta0=0.1, random_state=1)
ppn.fit(X_train_std, y_train)
```

```
     Perceptron(eta0=0.1, random_state=1)
```

Note

- You can replace `Perceptron(n_iter, ...)` by `Perceptron(max_iter, ...)` in scikit-learn >= 0.19. The `n_iter` parameter is used here deliberately, because some people still use scikit-learn 0.18.

```
"Prediction of labels for test data using the trained perceptron"

y_pred = ppn.predict(X_test_std)
print('Misclassified examples: %d' % (y_test != y_pred).sum())
```

```
     Misclassified examples: 1
```

```
"Checking the accuracy for the trained perceptron by comparing y_test and y_pred"

from sklearn.metrics import accuracy_score

print('Accuracy: %.3f' % accuracy_score(y_test, y_pred))
```

```
     Accuracy: 0.978
```

```
print('Accuracy: %.3f' % ppn.score(X_test_std, y_test))
```

```
     Accuracy: 0.978
```

```
"Scatter plot fot the obtained trained perceptron"

from matplotlib.colors import ListedColormap
import matplotlib.pyplot as plt


def plot_decision_regions(X, y, classifier, test_idx=None, resolution=0.02):

    # setup marker generator and color map
    markers = ('s', 'x', 'o', '^', 'v')
    colors = ('red', 'blue', 'lightgreen', 'gray', 'cyan')
    cmap = ListedColormap(colors[:len(np.unique(y))])

    # plot the decision surface
    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')

    # highlight test examples
    if test_idx:
        # plot all examples
        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')
```

Training a perceptron model using the standardized training data:

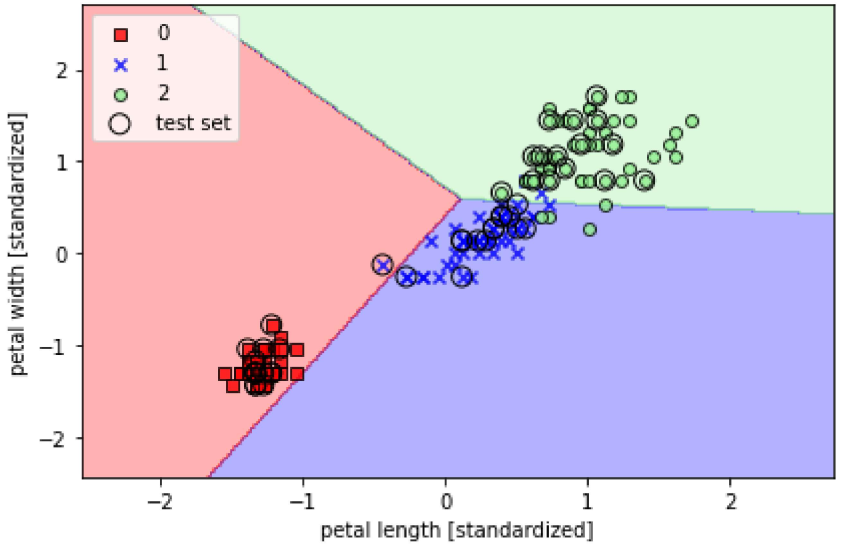
```
"VIsualization of result of trained perceptron"

X_combined_std = np.vstack((X_train_std, X_test_std))
y_combined = np.hstack((y_train, y_test))

plot_decision_regions(X=X_combined_std, y=y_combined,
                      classifier=ppn, test_idx=range(105, 150))
plt.xlabel('petal length [standardized]')
plt.ylabel('petal width [standardized]')
plt.legend(loc='upper left')

plt.tight_layout()
#plt.savefig('images/03_01.png', dpi=300)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:45: MatplotlibDeprecationWa
```


🟥 0
× 1
● 2
○ test set
petal width [standardized]
petal length [standardized]