11002機器學習
四資工三A

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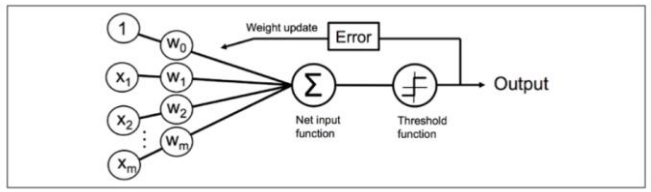
畫出感知器的概念示意圖 並說明各條件



學習期間輸出若有預測錯差則為重新更新加權在重來。
在重複運算判斷時還會有個「學習速率(learning rate)」介於 0.0 和 1.0 之間，作為調整的幅度大小。

Weight update

Error

該部分是要訓練的樣本資料。

1

X_1

X_2

X_m

W_0

W_1

W_2

W_m

此部分做運算的過程，而結果會給予標籤去後面分類。

Net input function

Threshold function

OUTPUT

輸出感知器結果

此部分為將計算結果分為兩類判斷結果，感知器只能分兩類。

此階段為收到X樣本的輸入將他們與加權值w相乘，就會得到一個淨輸入，並能在後面判斷及給予標籤(1 or -1)。

感知器實作結果1

Plotting the Iris data

In [189]:
```
%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np

# select setosa and versicolor
#y = df.iloc[0:150, 4].values
y = df.iloc[0:150, 0:5].values
print(y)
```

```
[[5.1 3.5 1.4 0.2 'Iris-setosa']
 [4.9 3.0 1.4 0.2 'Iris-setosa']
 [4.7 3.2 1.3 0.2 'Iris-setosa']
 [4.6 3.1 1.5 0.2 'Iris-setosa']
 [5.0 3.6 1.4 0.2 'Iris-setosa']
 [5.4 3.9 1.7 0.4 'Iris-setosa']
 [4.6 3.4 1.4 0.3 'Iris-setosa']
 [5.0 3.4 1.5 0.2 'Iris-setosa']
 [4.4 2.9 1.4 0.2 'Iris-setosa']
 [4.9 3.1 1.5 0.1 'Iris-setosa']
 [5.4 3.7 1.5 0.2 'Iris-setosa']
 [4.8 3.4 1.6 0.2 'Iris-setosa']
 [4.8 3.0 1.4 0.1 'Iris-setosa']
 [4.3 3.0 1.1 0.1 'Iris-setosa']
 [5.8 4.0 1.2 0.2 'Iris-setosa']
 [5.7 4.4 1.5 0.4 'Iris-setosa']
 [5.4 3.9 1.3 0.4 'Iris-setosa']
 [5.1 3.5 1.4 0.3 'Iris-setosa']
 [5.7 3.8 1.7 0.3 'Iris-setosa']
```

感知器實作結果2

```
In [38]: %matplotlib inline
         import matplotlib.pyplot as plt
         import numpy as np

         # select setosa and versicolor
         y = df.iloc[0:150, 4].values
         print(y)
```

```
['Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica']
```

感知器實作結果2-1

跳行選取資料 0~50 筆及 100~150 筆

In [199]:
```
%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np

# select setosa and versicolor
#y = df.iloc[0:150, 4].values
#y = df.iloc[0:150, 0:5].values
rows = list(range(0,50)) + list(range(100,150))
y = df.iloc[rows, 4].values
print(y)
```

```
['Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa' 'Iris-setosa'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
```

感知器實作結果3

In [182]:
```
y = np.where(y == 'Iris-setosa', -1, 1)
print(y)
```

```
[-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1]
```

In [183]:
```
# extract sepal length and petal length
#X = df.iloc[0:100, [0, 2]].values
X = df.iloc[0:150, [0, 2]].valuesS
print(X)
```

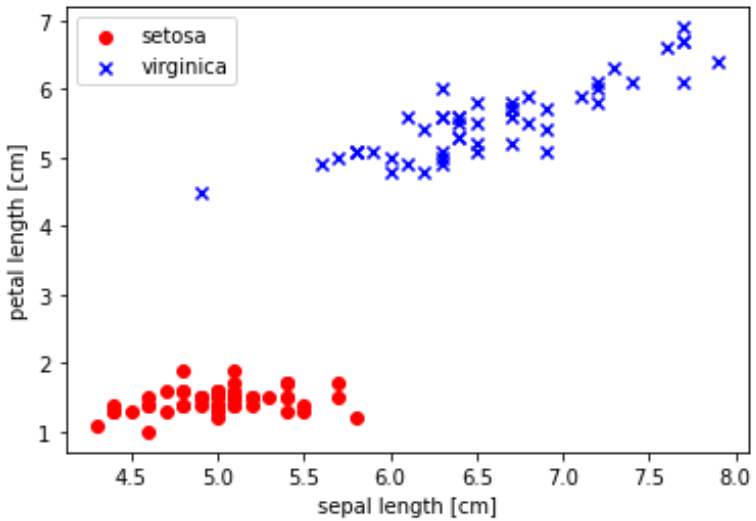
```
[[5.1 1.4]
 [4.9 1.4]
 [4.7 1.3]
 [4.6 1.5]
 [5.  1.4]
 [5.4 1.7]
 [4.6 1.4]
 [5.  1.5]
 [4.4 1.4]
 [4.9 1.5]
 [5.4 1.5]
 [4.8 1.6]
 [4.8 1.4]
 [4.3 1.1]
 [5.8 1.2]
 [5.7 1.5]
 [5.4 1.3]
 [5.1 1.4]
 [5.7 1.7]
```

感知器實作結果4

In [184]:
```
# plot data
plt.scatter(X[:50, 0], X[:50, 1],
            color='red', marker='o', label='setosa')
plt.scatter(X[100:150, 0], X[100:150, 1],
            color='blue', marker='x', label='virginica')

plt.xlabel('sepal length [cm]')
plt.ylabel('petal length [cm]')
plt.legend(loc='upper left')

# plt.savefig('images/02_06.png', dpi=300)
plt.show()
```



感知器實作結果5

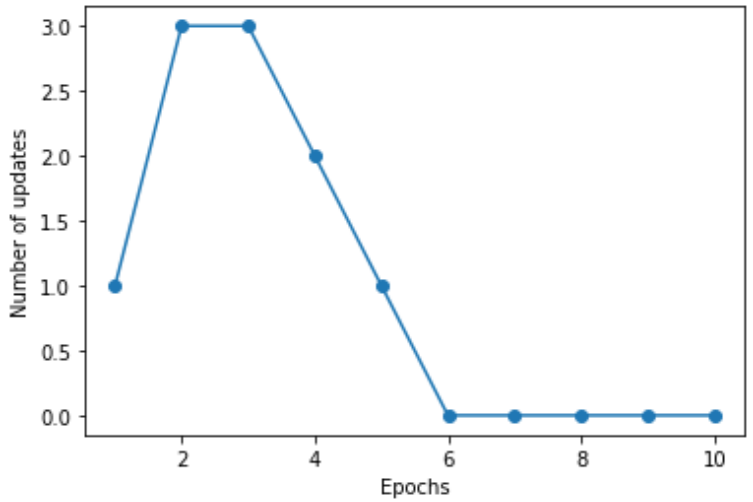
Training the perceptron model

In [185]:
```
ppn = Perceptron(eta=0.1, n_iter=10)

ppn.fit(X, y)

plt.plot(range(1, len(ppn.errors_) + 1), ppn.errors_, marker='o')
plt.xlabel('Epochs')
plt.ylabel('Number of updates')

# plt.savefig('images/02_07.png', dpi=300)
plt.show()
```



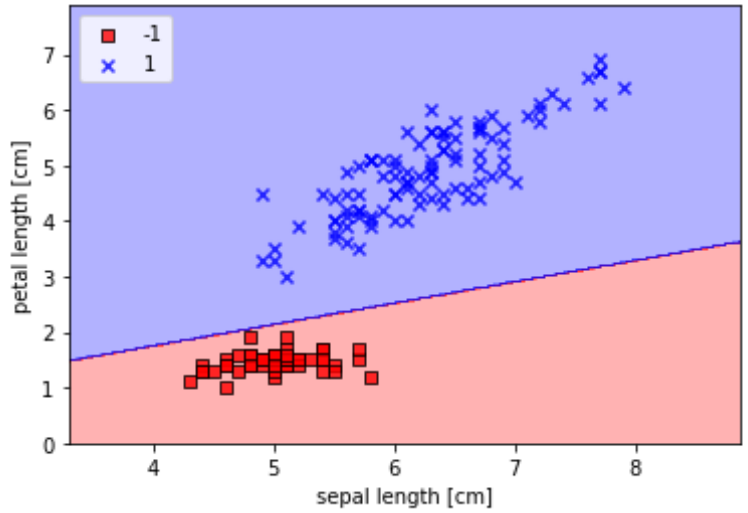
感知器實作結果6

Setosa 和 virginica

In [188]:
```
plot_decision_regions(X, y, classifier=ppn)
plt.xlabel('sepal length [cm]')
plt.ylabel('petal length [cm]')
plt.legend(loc='upper left')


# plt.savefig('images/02_08.png', dpi=300)
plt.show()
```

```
C:\Users\user\AppData\Local\Temp/ipykernel_6536/1032177424.py:24: UserWarning: You passed a edgecolor/edgecolors ('black') for
an unfilled marker ('x').  Matplotlib is ignoring the edgecolor in favor of the facecolor.  This behavior may change in the fut
ure.
  plt.scatter(x=X[y == cl, 0],
```



versicolor 和 virginica

感知器實作結果8

In [230]:

```python
%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np

# select setosa and versicolor
#y = df.iloc[0:150, 4].values
#y = df.iloc[0:150, 0:5].values
rows = list(range(50,100)) + list(range(100,150))
y = df.iloc[rows, 4].values
print(y)
```

```
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor' 'Iris-versicolor'
 'Iris-versicolor' 'Iris-versicolor' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica'
 'Iris-virginica' 'Iris-virginica' 'Iris-virginica' 'Iris-virginica']
```

感知器實作結果9

In [231]:
```
y = np.where(y == 'Iris-versicolor', -1, 1)
print(y)
```

```
[-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
  1  1  1  1]
```

In [232]:
```
# extract sepal length and petal length
#X = df.iloc[0:100, [0, 2]].values
#X = df.iloc[0:150, [0, 2]].values
X = df.iloc[rows, [0, 2]].values
print(X)
```

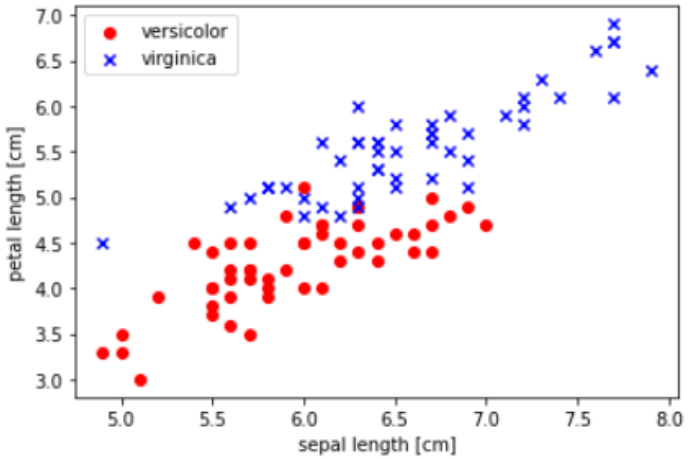
```
[[7.  4.7]
 [6.4 4.5]
 [6.9 4.9]
 [5.5 4. ]
 [6.5 4.6]
 [5.7 4.5]
 [6.3 4.7]
 [4.9 3.3]
 [6.6 4.6]
 [5.2 3.9]
 [5.  3.5]
 [5.9 4.2]
 [6.  4. ]
 [6.1 4.7]
 [5.6 3.6]
 [6.7 4.4]
 [5.6 4.5]
 [5.8 4.1]
 [6.2 4.5]
 [5.6 3.9]
```

感知器實作結果10

In [233]:
```
# plot data
plt.scatter(X[:50, 0], X[:50, 1],
            color='red', marker='o', label='versicolor')
plt.scatter(X[50:100, 0], X[50:100, 1],
            color='blue', marker='x', label='virginica')

plt.xlabel('sepal length [cm]')
plt.ylabel('petal length [cm]')
plt.legend(loc='upper left')

# plt.savefig('images/02_06.png', dpi=300)
plt.show()
```



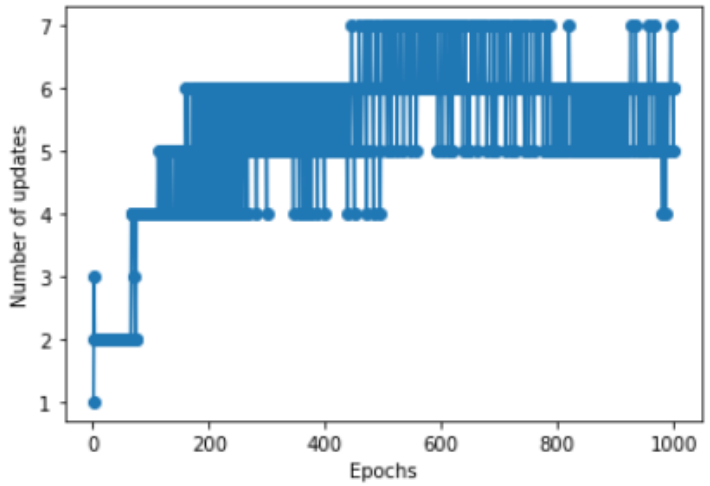
感知器實作結果11

In [237]:
```
ppn = Perceptron(eta=0.1, n_iter=1000)

ppn.fit(X, y)

plt.plot(range(1, len(ppn.errors_) + 1), ppn.errors_, marker='o')
plt.xlabel('Epochs')
plt.ylabel('Number of updates')

# plt.savefig('images/02_07.png', dpi=300)
plt.show()
```



感知器實作結果12

versicolor 和 virginica

In [240]:
```
plot_decision_regions(X, y, classifier=ppn)
plt.xlabel('sepal length [cm]')
plt.ylabel('petal length [cm]')
plt.legend(loc='upper left')


# plt.savefig('images/02_08.png', dpi=300)
plt.show()
```

```
C:\Users\user\AppData\Local\Temp/ipykernel_6536/1032177424.py:24: UserWarning: You passed a edgecolor/edgecolors ('black') for
an unfilled marker ('x').  Matplotlib is ignoring the edgecolor in favor of the facecolor.  This behavior may change in the fut
ure.
  plt.scatter(x=X[y == cl, 0],
```