第一次模式识别作业

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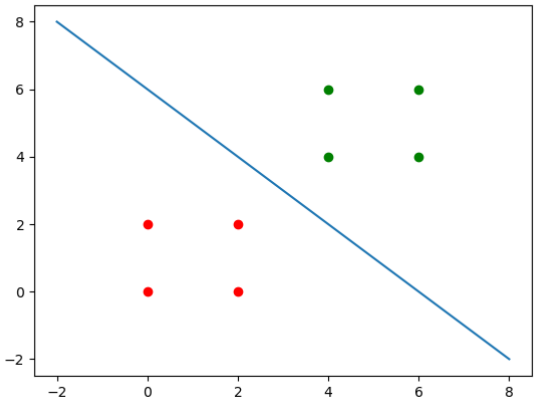
1 方程

均值向量如下：
$m_1 = (1,1)^T$
$m_2 = (2,2)^T$
协方差矩阵 $C_1 = C_2 = C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$，逆矩阵$C^{-1} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$。

由于$P(w_1) = P(w_2) = \frac{1}{2}$，且$C_1 = C_2$，所以判别界面为：

$$\begin{aligned} a_1(x) - a_2(x) &= (m_1 - m_2)^T C^{-1} x - \frac{1}{2} m_1^T C^{-1} m_1 + \frac{1}{2} m_2^T C^{-1} m_2 \\ &= -4x_1 - 4x_2 + 24 = 0 \end{aligned}$$

2 绘图



3 代码

```
import numpy as np

# w1 = [
#       [1, 0, 1],
#       [1, 0, 0],
#       [0, 0, 0],
#       [1, 1, 0],
# ]

# w2 = [
#       [1, 1, 1],
#       [0, 0, 1],
#       [0, 1, 1],
#       [0, 1, 0],
# ]

w1 = [
      [0, 0],
      [2, 0],
      [2, 2],
      [0, 2],
]

w2 = [
      [4, 4],
      [6, 4],
      [6, 6],
      [4, 6],
]

w1 = np.matrix(w1)
w2 = np.matrix(w2)

m1 = np.mean(w1, axis=0)
m2 = np.mean(w2, axis=0)

N = w1.shape[0]
cov1 = (w1 - m1).T * (w1 - m1) / N
cov2 = (w2 - m2).T * (w2 - m2) / N

if np.equal(cov1, cov2).all():
      coff = ((m1 - m2) * cov1.I).A.reshape(-1, )
      bias = (-1/2*m1*cov1.I*m1.T + 1/2*m2*cov2.I*m2.T).A\
      .reshape(-1, )[0]
      res = "".join(["+{}x{}".format(n, i) if n >= 0 else "{}x\
_________________{}".format(n, i) for i, n in enumerate(coff)])[:] + \
```

```
("+"+str(bias) if bias >= 0 else str(bias)) + "=0"
print(res)

from matplotlib import pyplot as plt
plt.scatter(w1[:, 0].A.reshape(-1, ), \
w1[:, 1].A.reshape(-1, ), c="r")
plt.scatter(w2[:, 0].A.reshape(-1, ), \
w2[:, 1].A.reshape(-1, ), c="g")
x = np.linspace(-2, 8, 1000)
plt.plot(x, 6-x)
plt.show()
```