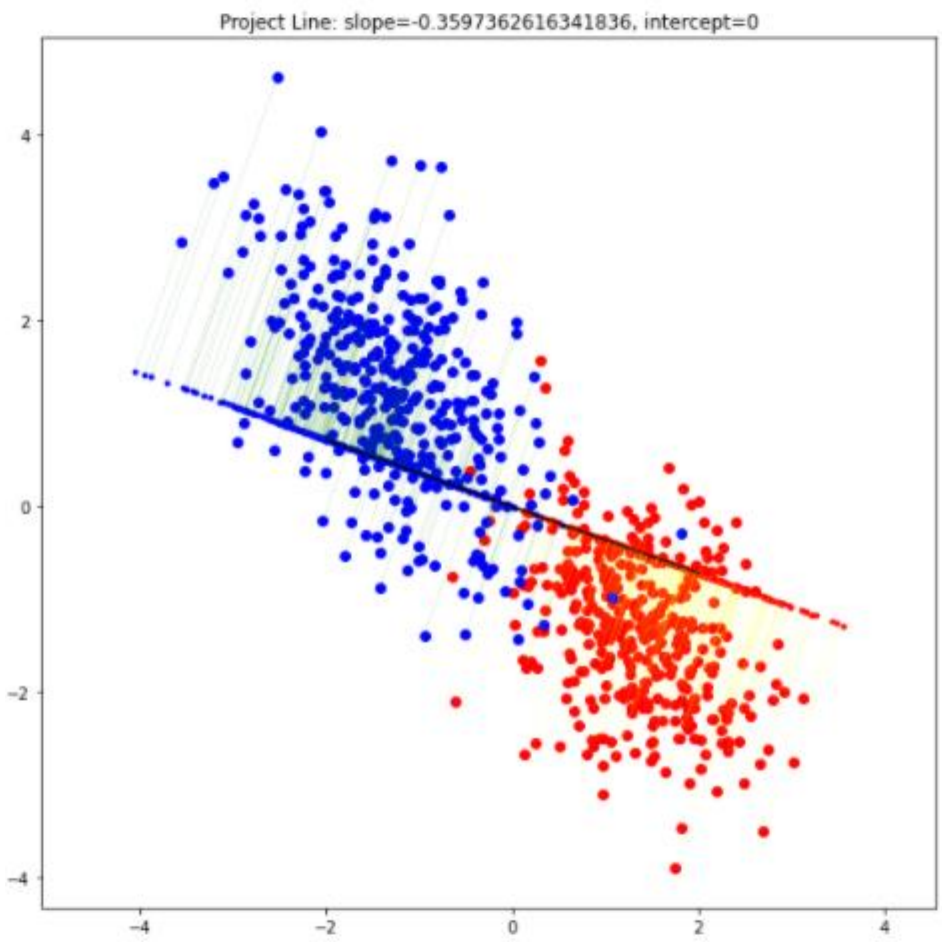
Part. 1

1. mean vector of class 1: [1.3559426 -1.34746216] mean vector of class 2: [-1.29735587 1.29096203]
2. Within-class scatter matrix SW: [[388.64001349 -228.92177708] [-228.92177708 665.56910433]]
3. Between-class scatter matrix SB: [[7.03999279 -7.00052687] [-7.00052687 6.9612822]]
4. Fisher’s linear discriminant: [[-0.00563343] [0.00202655]]
5. Accuracy of test-set 0.916
6.



Part 2

1. $L = w^T(m_2 - m_1) + \lambda(w^T w - 1)$

Taking the gradient wrt. w

$\nabla L = m_2 - m_1 + 2\lambda w$

setting gradient to zero

$w = -\frac{1}{2\lambda}(m_2 - m_1) \Rightarrow w \propto \cancel{(m_2)} (m_2 - m_1)$ #

2. (1) Prove $\sigma(-a) = 1 - \sigma(a)$

sigmoid function : $f(x) = \frac{1}{1+e^{-x}}$

$1 - \sigma(a) = 1 - \frac{1}{1+e^{-a}}$

$= \frac{1+e^{-a}}{1+e^{-a}} - \frac{1}{1+e^{-a}}$

$= \frac{e^{-a}}{1+e^{-a}} = \frac{1}{\frac{1}{e^{-a}}+1} = \frac{1}{1+e^{a}}$

$= \sigma(-a)$ #

(2) Prove $\sigma^{-1}(y) = \ln(y(1-y))$

$y = \frac{1}{1+e^{-x}}$

$e^{-x} = \frac{1}{y} - 1$

取 ln : $-x = \ln(\frac{1}{y} - 1) = \ln(\frac{1-y}{y})$

$x = -\ln(\frac{1-y}{y}) = \ln(\frac{y}{1-y})$ #