

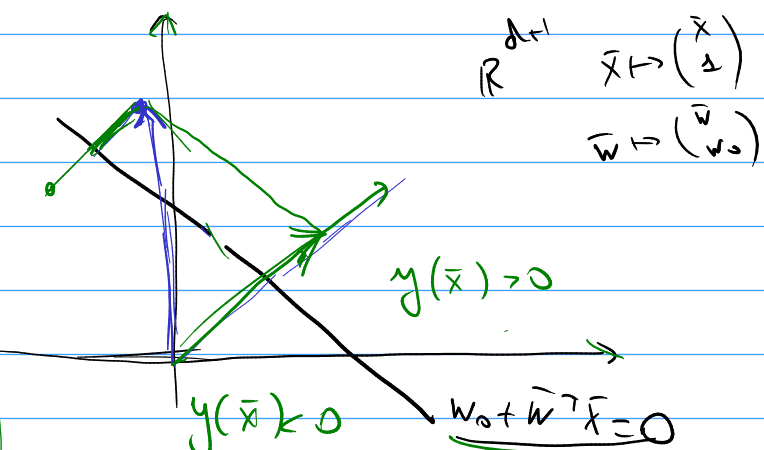
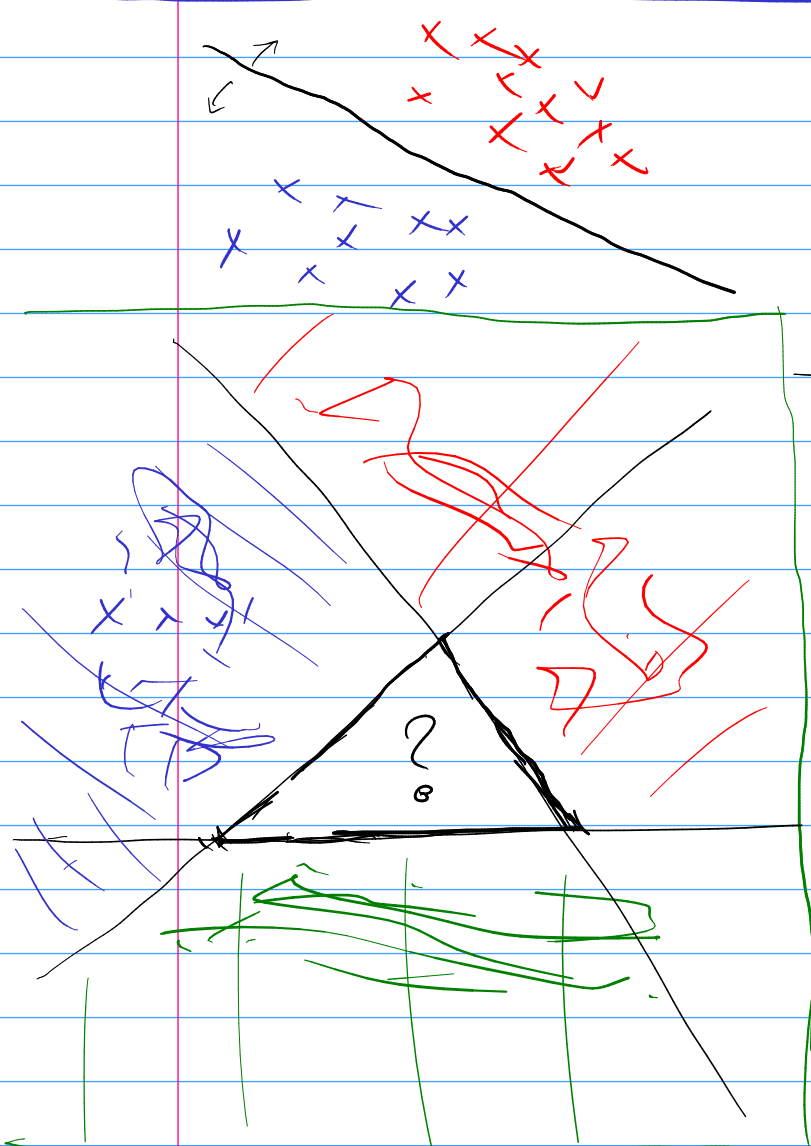
probit

$$\Phi(a) = \int_{-\infty}^a \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx$$

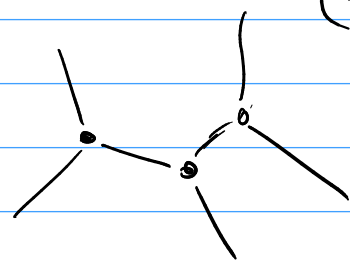
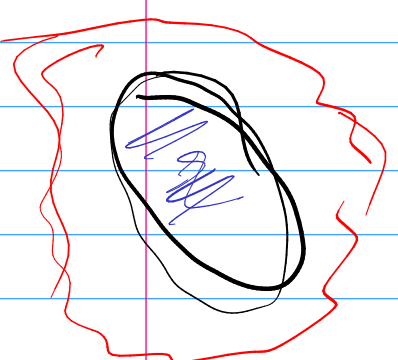
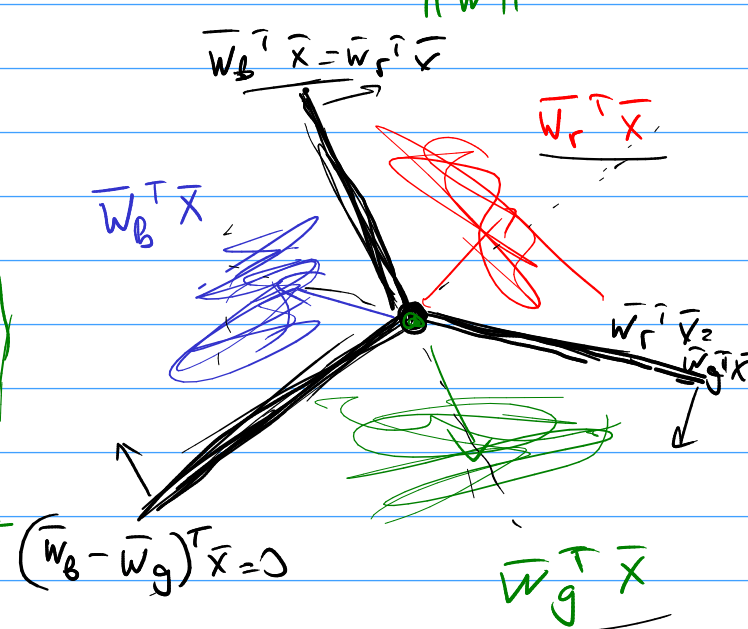
$$\int_{-\infty}^a e^{-w_0 - w_1 x - w_2 x^2} dx$$

$$y \sim e^{-w_0 - w_1 x - w_2 x^2}$$

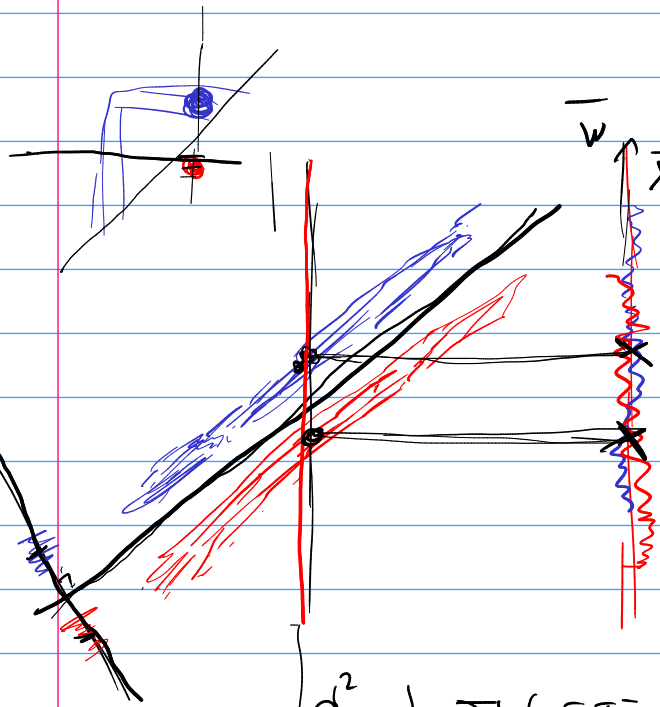
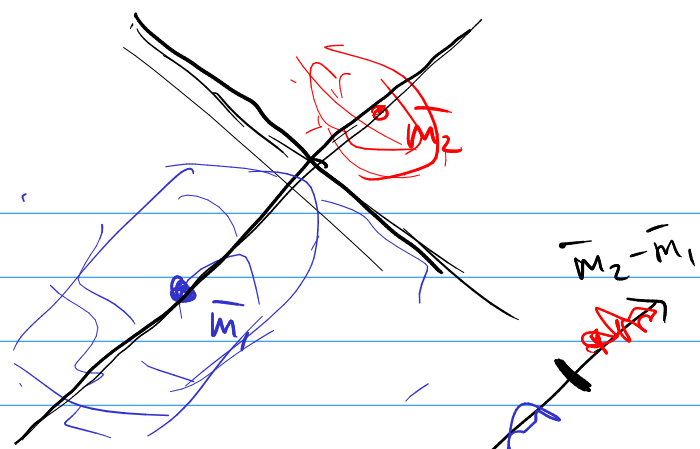
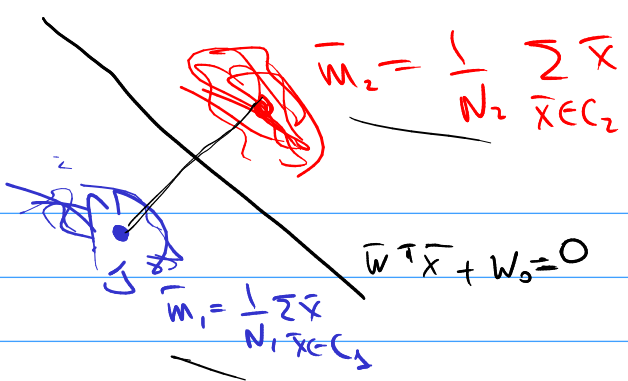
$$-\ln y \sim w_0 + w_1 x + w_2 x^2$$



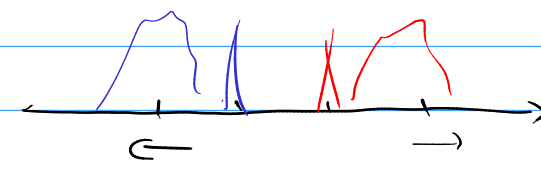
$$d(\bar{x}, \dots) = \frac{\bar{w}^T \bar{x} + w_0}{\|\bar{w}\|}$$



$\max(\bar{w}_b^T \bar{x}, \bar{w}_g^T \bar{x}, \bar{w}_r^T \bar{x})$
 the equilibrium is
 tropical variety
 $(\min, +)$ -algebra



$$\left(\frac{w^T (\bar{m}_2 - \bar{m}_1)}{\|w\|} \right)^2 \rightarrow \max$$



$$\nabla_x (x^T A x) = (A + A^T) x$$

$$\sum_{x \in C_1} \frac{1}{N_1} \sum_i (\bar{w}^T x - \bar{w}^T \bar{m}_1)^2 = \left(\frac{1}{N_1} \right) \bar{w}^T S_1 \bar{w}$$

$$= \sum (\bar{x} - \bar{m}_1) (\bar{x} - \bar{m}_1)^T$$

$$S_w = S_1 + S_2 \quad \bar{w}^T (S_1 + S_2) \bar{w} \xrightarrow{\bar{w}} \min$$

Fischer
diger

$$J(\bar{w}) = \frac{\bar{w}^T (\bar{m}_2 - \bar{m}_1) (\bar{m}_2 - \bar{m}_1)^T \bar{w}}{\bar{w}^T S_w \bar{w}} = \frac{\bar{w}^T S_B \bar{w}}{\bar{w}^T S_w \bar{w}} \rightarrow \max$$

$$\nabla_{\bar{w}} J = \frac{2(\bar{w}^T S_w \bar{w}) \cdot S_B \bar{w} - 2(\bar{w}^T S_B \bar{w}) \cdot S_w \bar{w}}{(\bar{w}^T S_w \bar{w})^2} = 0$$

S_B - between-class covariance
 S_w - within-class

$$(\bar{w}^T S_w \bar{w}) S_B \bar{w} \propto (\bar{w}^T S_B \bar{w}) S_w \bar{w}$$

$$S_w + S_B = S =$$

$$S_B \bar{w} \propto S_w \bar{w}$$

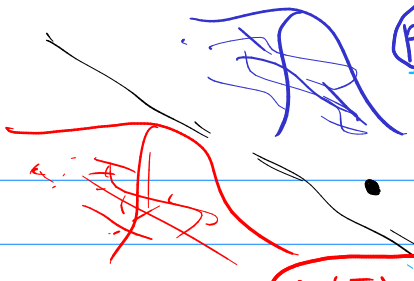
$$(\bar{m}_2 - \bar{m}_1) (\bar{m}_2 - \bar{m}_1)^T \bar{w}$$

$$\bar{w} \propto S_w^{-1} (\bar{m}_2 - \bar{m}_1) = \frac{1}{N} \sum_{X \in C_1 \cup C_2} (\bar{x} - \bar{m}) (\bar{x} - \bar{m})^T$$

$$S_w \bar{w} \propto \bar{m}_2 - \bar{m}_1$$

$$\frac{p(y|\bar{x})}{p(\bar{x})}$$

$$p_1(\bar{x}) = p(\bar{x}|c_1)$$



$$\bullet p(c_1|\bar{x}) = \frac{p(c_1)p(\bar{x}|c_1)}{p(c_1)p(\bar{x}|c_1) + p(c_2)p(\bar{x}|c_2)}$$

Optimal Bayes classifier

$$p_2(\bar{x}) = p(\bar{x}|c_2)$$

Generative models
Discriminative models

$$p(c_1|\bar{x}) = ?$$

$$p(\bar{x}) = p(c_1)p(\bar{x}|c_1) + p(c_2)p(\bar{x}|c_2)$$