$$P = P(X = x_i, Y = y_i) = P(X = x_i \mid Y = y_i) \cdot P(Y = y_i) \qquad \boxed{\theta_1 \ldots \theta_K}$$

θ

$\mu_1 \ldots \mu_k$

$\Sigma_1 \ldots \Sigma_k$

$$= \prod_{y=1}^{K} \Big[P(X = x_i \mid Y = y) \cdot \underbrace{P(Y = y)}_{\theta_1} \Big]^{\mathbb{1}[y = y_i]}$$

$$\log P = \sum_{y=1}^{k} \mathbb{1}[y = y_i] \cdot \big(\log P(x_i \mid y) + \log \theta_y \big)$$

$$\hat{\theta}_1 = \frac{1}{N} \sum \mathbb{1}[y_i = 1]$$

$$\max_{\theta} \sum_{i=1}^{N} \log P_\theta(x_i)$$

$\mu_1 \dots \mu_K$

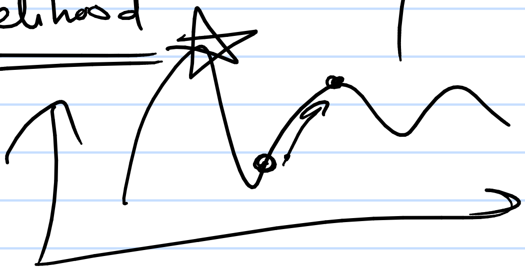
$\Sigma_1 \dots \Sigma_K$

α

Obj

$(x_1 \dots x_N) = \text{Data}$

maginal likelihood



EM

α^0

$$\boxed{P_{\alpha^0}(y_i = y \mid \text{Data})} \quad E$$

$$\{x_i, y_i\} \to \max_{\alpha} \sum_{i=1}^{N} P_\alpha(x_i, y_i) \quad M$$

α^1

α^2

$$\sum_{1}^{N} \log P = \log\left(\exp\left(\underbrace{\sum w_i f_i(x)}\right)\right) - \underbrace{\log Z}$$

$$\frac{\partial}{\partial w_i} = \sum_{i=1}^{J} w_i f_i(x) - \underbrace{\log Z(w_1 \ldots w_J)}$$

$$\boxed{\sum_{k=1}^{M} f_i(x)}$$