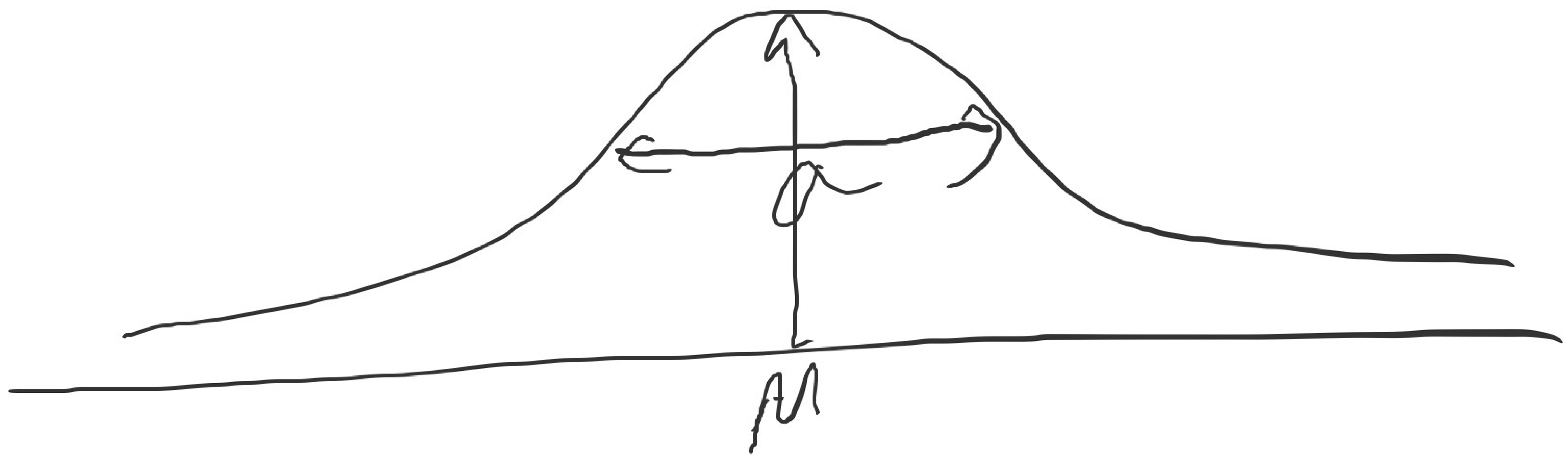
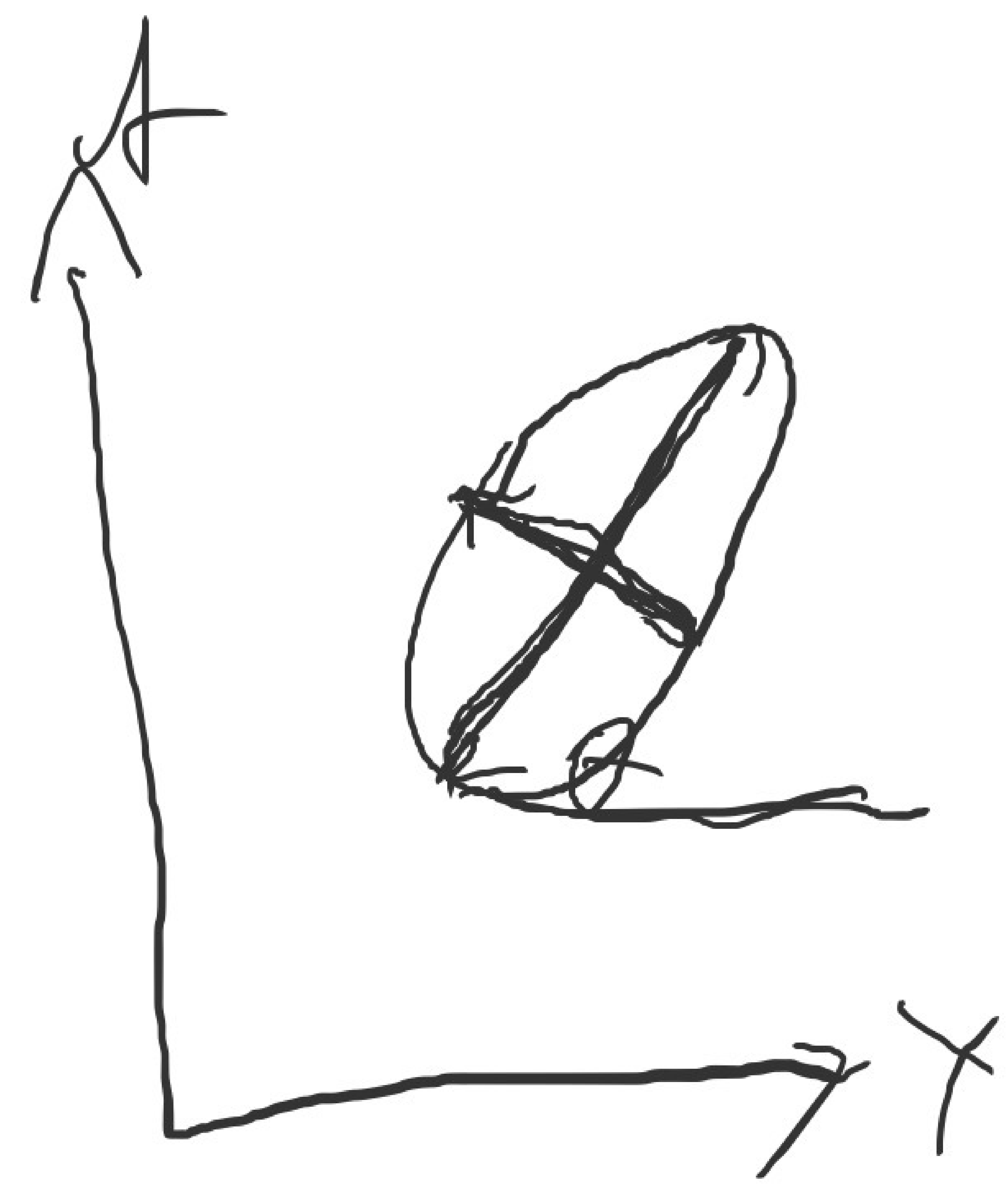
2/3 x

1/2 0

$z_{ij} \propto p(x_i | c_j)$ $\quad \forall_i \sum_j z_{ij} = 1$

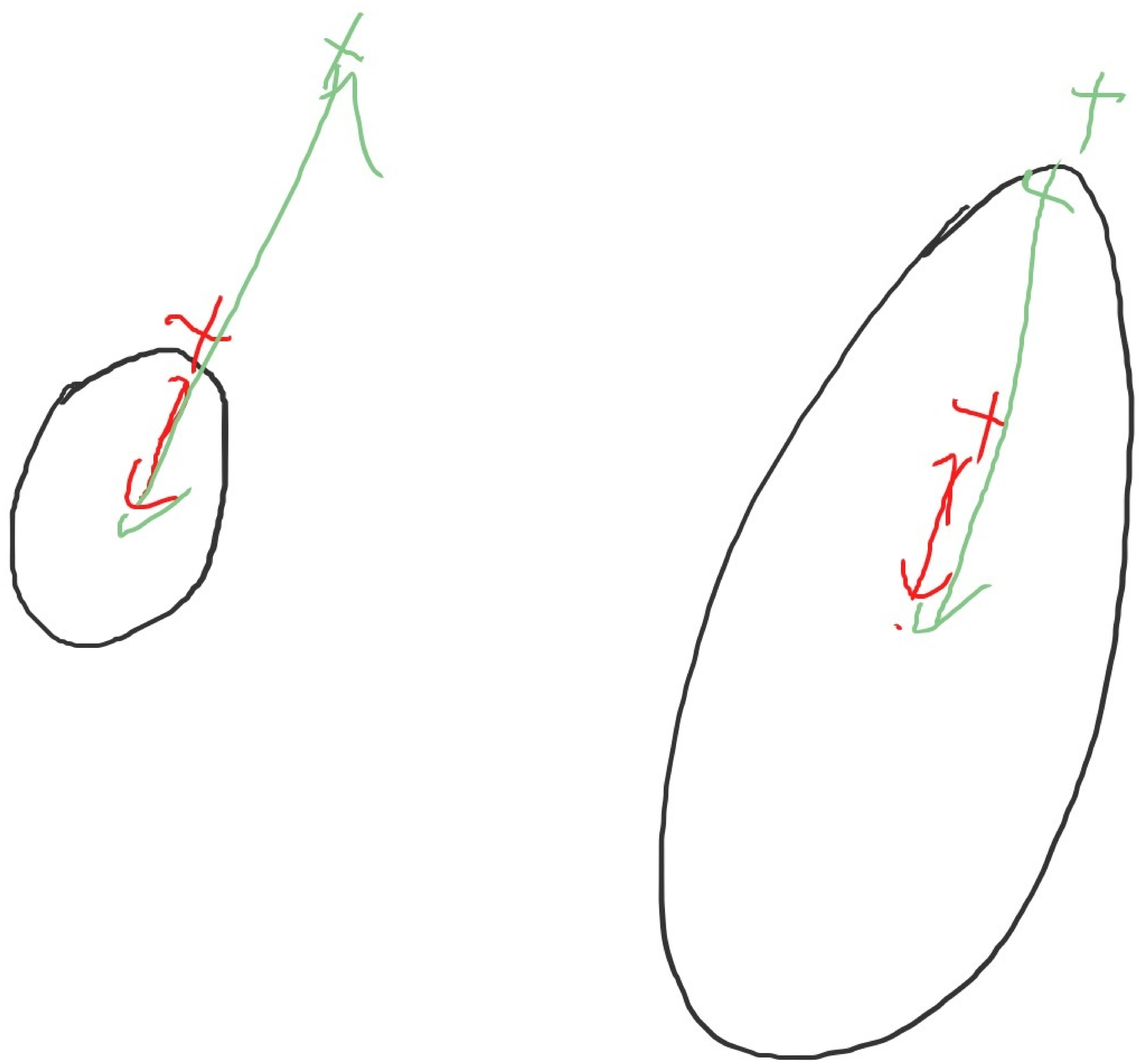
z_i





$$\|x\|^2 = \sqrt{x^T \cdot x} = \sqrt{x^2}$$

$$\|x-\mu\|^2 = \sqrt{(x-\mu)^T(x-\mu)}$$



$$\|x\|^2_{\mu,\Sigma} = (x-\mu)^T \Sigma^{-1} (x-\mu)$$ Mahalanobis Distance/Norm

$$\|x\|^2_{\mu} = (x-\mu)^T (x-\mu)$$ Euclidean Distance/Norm

$$\Sigma^{-1} = I$$

$$\mathcal{N}(x|\mu,\Sigma) = \frac{1}{\sqrt{2\pi^d |\Sigma|}} e^{-\frac{1}{2}\|x\|^2_{\mu,\Sigma}}$$

$$z_{ij} = \pi_j \, \mathcal{N}(x_i \mid \mu_j, \Sigma_j)$$

E-step

Expectation step

x_i

mixture model

sample $j \sim \pi$

1 2 . . . J

$\mathcal{N}(\mu_2, \Sigma_2)$

x_i

sample

1 - discrete distribution over class

2 - distribution for each class

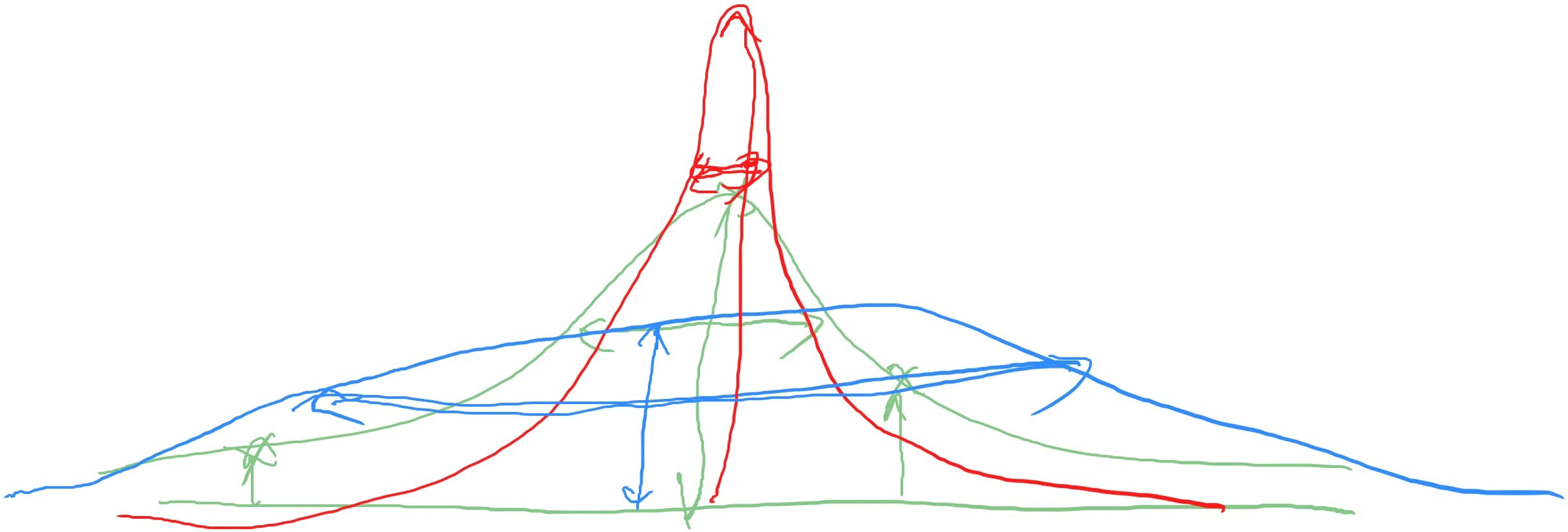
$$\pi_j \propto \sum_i z_{ij} \qquad \sum_j \pi_j = 1$$

$$\mu_j = \frac{1}{\pi_j} \sum_i z_{ij} x_i \qquad \frac{1}{I} \sum_i x_i$$

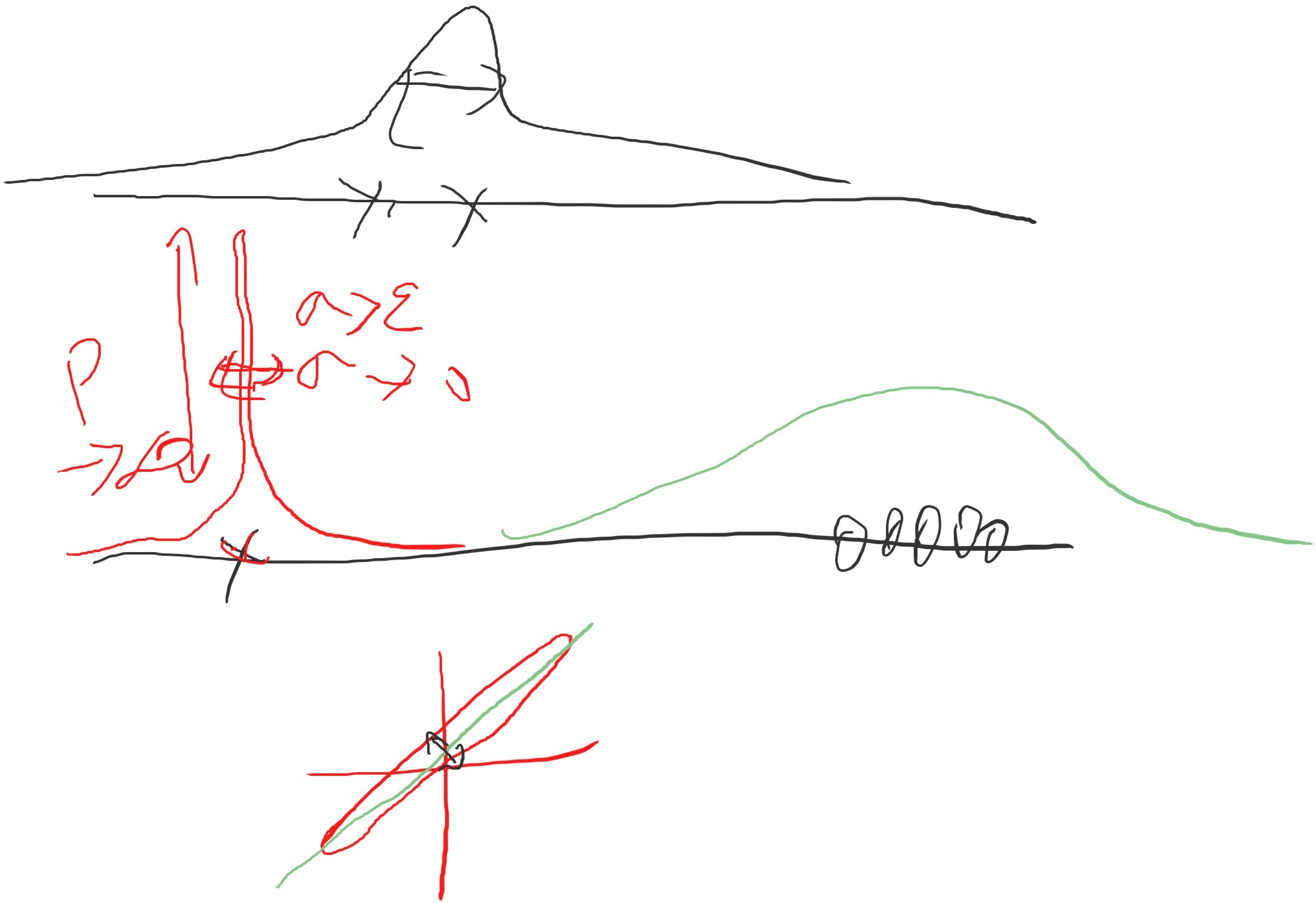
$$\Sigma_j = \frac{1}{\pi_j} \sum_i z_{ij} (x_i - \mu_j)(x_i - \mu_j)^T$$

M-step

Maximization step



μ



σ → Σ
σ → 0
P
→ ∞

$$z_{ij} = \frac{1}{\sum_j z_{ij}} P(x_i \mid \mu_j, \Sigma_j) = \frac{1}{\sum_j P(x_i \mid \mu_j, \Sigma_j)} P(x_i \mid \mu_j, \Sigma_j)$$

$$z_{ij} \propto P(x_i \mid \mu_j, \Sigma_j)$$

$$(\forall i) \sum_j z_{ij} = 1$$