Iterate: On the *t*'th iteration let our estimates be, for y with k classes

$$\theta_t = \{ \mu_1 \dots \mu_k, \Sigma_1 \dots \Sigma_k, p_1, \dots, p_k \}$$

E-step

Compute "expected" classes of all datapoints for each class

$$P(y = i | x^j; \theta_t) \propto \frac{1}{\sqrt{(2\pi)^m |\Sigma_i|}} \exp\left(-\frac{1}{2} (x^j - \mu_i)^T \Sigma_i^{-1} (x^j - \mu_i) \right) p_i$$

Evaluate a Gaussian at x^j

M-step

Compute weighted MLE for **μ** and **Σ** given expected classes above

$$\mu_i = \frac{\sum_{j=1}^m p(y = i | x^j; \theta_t) x^j}{\sum_{j=1}^m p(y = i | x^j; \theta_t)} \qquad \Sigma_i = \frac{\sum_{j=1}^m p(y = i | x^j; \theta_t)(x^j - \mu_i)(x^j - \mu_i)^T}{\sum_{j=1}^m p(y = i | x^j; \theta_t)}$$

$$p_i = \frac{1}{m} \sum_{j=1}^m p(y = i | x^j; \theta_t)$$