

$$\ell(\phi, \mu_0, \mu_1, \Sigma) = \log \prod_{i=1}^p (x^{(i)}, y^{(i)}; \phi, \mu_0, \mu_1, \Sigma)$$

$$\partial \ell / \partial \phi = \Sigma (y^i \phi - 1 - y^i 1 - \phi)$$