$F(m, C) = \langle \log \phi(w^T h) \rangle_{q(w; m, C)}$ $\quad \log \phi :=$ concave

$$F(\theta m_1 + (1-\theta) m_2, \; \theta C_1 + (1-\theta) C_2) \geq \theta F(m_1, C_1) + (1-\theta) F(m_2, C_2)$$

$$w = \theta m_1 + (1-\theta) m_2 + [\theta C_1 + (1-\theta) C_2]^T z \qquad z \sim N(z|0, I)$$

$$\int N(z|0,I) \log \phi\left[\theta h^T (m_1 + C_1^T z) + (1-\theta) h^T (m_2 + C_2^T z)\right] dz$$

$$\geq \theta \int N(z|0,I) \log \phi(h^T(m_1 + C_1^T z)) \, dz + (1-\theta) \int N(z|0,I) \times \log \phi(h^T(m_2 + C_2^T z))$$

$$F(\dots) \geq \theta F(m_1, C_1) + (1-\theta) F(m_2, C_2)$$

$$1 \quad q_t = q_{t-1} + \alpha_t (h_t - q_{t-1})$$

$KL(q'\|p) \approx KL(q\|p) + \langle \nabla, h \rangle$ ✓

$\log(1+x) \simeq x + O(x)$

$$KL[q+\alpha(h-q)\|p] = \int (q+\alpha(h-q)) \log\left(\frac{q+\alpha(h-q)}{p}\right) dw =$$

$$= \int (q+\alpha(h-q)) \log \frac{q}{p}\left(1+\frac{\alpha}{q}(h-q)\right) dw =$$

$$= \int (q+\alpha(h-q)) \left(\log\left(\frac{q}{p}\right) + \frac{\alpha(h-q)}{q} + O\left(\alpha\left\|\frac{h-q}{q}\right\|\right)\right) dw =$$

$$= \int \Big[\underbrace{q \log \frac{q}{p}}_{KL[q\|p]} + \underbrace{\alpha(h-q)}_{=0} + \underbrace{\alpha(h-q)\log\frac{q}{p}}_{} + O(\alpha)\Big] dw$$

$\alpha \int (h-q)\, dw = \alpha(1-1) = 0$

$=0$

$KL[q'\|p] = KL[q\|p] + \alpha \langle h-q, \log \frac{q}{p} \rangle$.

$\int (h-q) \log \frac{q}{p}\, dw$

$$\|u\|_2^2 = \int u^2 \, d\theta$$