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2. Gradient learning rule

$x \in \mathcal{X} \subset R^n$ $y \in \mathcal{Y} \subset R^m$ $p(x,y)$ $p(x)p(y|x)$ $q(x,y)$ $q(x|y)q(y)$, y $y \in \mathcal{Y}$ $\{1,2,\ldots,k\} \subset R$ m 1. D_x $\{x_t\}_{t\ 1}^{N}$, $p(y|x), p(x), q(x|y), q(y)$

$$H(p\|q) \quad \int p(y|x)p(x) \quad q(x|y)q(y) \quad x \quad y - \quad z_q, \tag{1}$$

z_q $p(y|x)$ $q(x|y)$ $\theta \in R^d$, $q(j)$ α_j $\alpha_j \geqslant 0$ $\sum_{j\ 1}^{k} \alpha_j$ 1. z_q z_q 1) $p(x)$ $p_0(x)$ $(1/N)\sum_{t\ 1}^{N} \delta(x - x_t)$, $x \in \mathcal{X}$ R^n.

$$p(y \quad j|x) \quad \frac{\alpha_j q(x|\theta_j)}{q(x|\Theta_k)}, \quad q(x|\Theta_k) \quad \sum_{j\ 1}^{k} \alpha_j q(x|\theta_j), \tag{2}$$

$q(x|\theta_j)$ $q(x|y \quad j)$ θ_j Θ_k $\{\alpha_j, \theta_j\}_{j\ 1}^{k}$. (1),

$$H(p\|q) \quad J(\Theta_k) \quad \frac{1}{N} \sum_{t\ 1}^{N} \sum_{j\ 1}^{k} \frac{\alpha_j q(x_t|\theta_j)}{\sum_{i\ 1}^{k} \alpha_i q(x_t|\theta_i)} \quad \alpha_j q(x_t|\theta_j) \ . \tag{3}$$

, $H(p\|q)$ $J(\Theta_k)$ Θ_k , $J(k)$ k. $q(x|\theta_j)$

$$q(x|\theta_j) \quad q(x|m_j,\Sigma_j) \quad \frac{1}{(2\pi)^{n/2}|\Sigma_j|^{1/2}} \quad {}^{-(1/2)(x-m_j)\ \Sigma_j^{-1}(x-m_j)}, \qquad (\ )$$

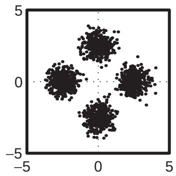
m_j Σ_j , $\alpha_j \quad e^{\beta_j}/\sum_{i\ \ 1}^{k} e^{\beta_i}$ $j \quad 1,2,\ldots,k$ $-\infty < \beta_1,\ldots,\beta_k < +\infty$. $J(\Theta_k)$ β_j, m_j Σ_j, :

$$\Delta\beta_j \quad \eta\frac{\alpha_j}{N}\sum_{i\ \ 1}^{k}\sum_{t\ \ 1}^{N} h(i|x_t)U(i|x_t)(\delta_{ij}-\alpha_i), \qquad (\ )$$

$$\Delta m_j \quad \eta\frac{\alpha_j}{N}\sum_{t\ \ 1}^{N} h(j|x_t)U(j|x_t)\Sigma_j^{-1}(x_t-m_j), \qquad (\ )$$

$$\Delta\Sigma_j \quad \eta\frac{\alpha_j}{2N}\sum_{t\ \ 1}^{N} h(j|x_t)U(j|x_t)\Sigma_j^{-1}\ (x_t-m_j)(x_t-m_j)^T - I\ \Sigma_j^{-1}, \qquad (\ )$$

$$U(i|x_t) \quad \sum_{r\ \ 1}^{k}(\delta_{ri}-p(r|x_t)) \quad \alpha_r q(x_t|\theta_r)+1)\ x$$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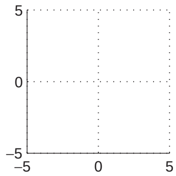
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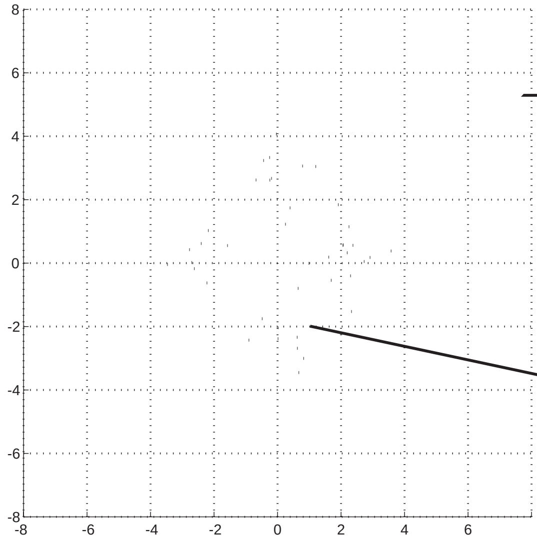
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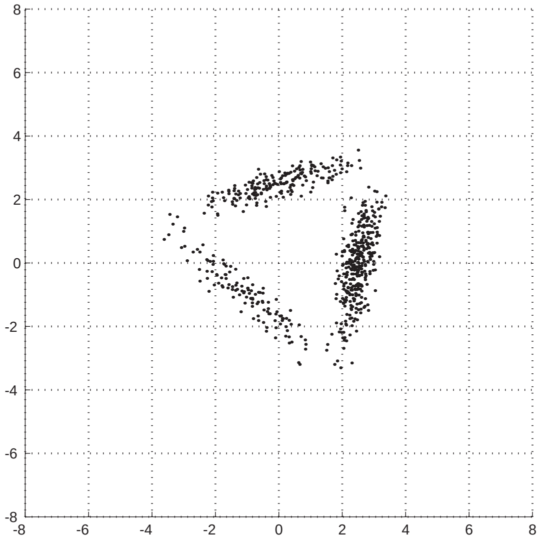
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[illegible] 0.1.

[illegible] $p(j|x_t)$ [illegible] Θ_k, [illegible] k- [illegible] k [illegible] k^*. [illegible]

4. Conclusions

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References

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