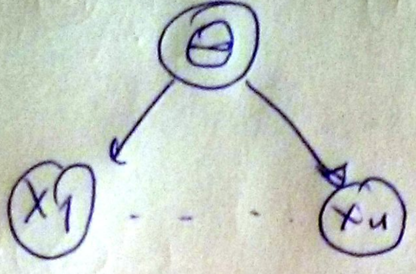
Bayesian Learning



$$\ln p(\theta) = \alpha_0 \cdot s(\theta) - A_g(\alpha_0)$$

$$\ln p(x|\theta) = \theta \cdot s(x) - A_e(\theta)$$
$$= \theta(x) \cdot s(\theta) - A_e(\theta(x))$$

$$\ln p(\theta|x_1,\dots,x_n) = \ln p(\theta) + \sum_i \ln p(x_i|\theta)$$
$$= \alpha_n \cdot s(\theta) - A(\alpha_n)$$

$$\alpha_n = \alpha_0 + \theta(x_1) + \cdots + \theta(x_n)$$

message from x_1 to θ.

$$\boxed{\alpha_n = \alpha_{n-1} + \theta(x_n)}$$

Fading

→ **No window**

$$\alpha_n = q \cdot \alpha_{n-1} + \theta(x_n)$$

sampl size → $\dfrac{1}{1-q}$

→ **Window**

$$\alpha_n = q \cdot \alpha_{n-1} + \sum_{i=n}^{n+w} \theta(x_i)$$

sampl size → $\dfrac{w}{1-q}$

Alternatives

- Fixed sample size

$$\alpha_n = \alpha_0 + \theta(x_1) \ldots \ldots + \theta(x_n)$$

$$\alpha_k = \alpha_0 + \frac{k}{N} \sum \theta(x_i)$$

uniform weigths

$$\bar{\alpha}_n = \left(1 - \frac{1}{n}\right) \bar{\alpha}_{n-1} + \frac{1}{n} \theta(x_n)$$

$$\boxed{\alpha_k = \alpha_0 + k\, \bar{\alpha}_n}$$