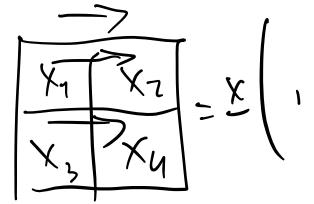


image

$$\sqrt{n} \times \sqrt{n}$$

$$x_s \in \{-1, 1\}$$



$$p(\text{error}) = \varepsilon$$

$$P(y_s|x_s) = (1 - \varepsilon) \frac{1 + y_s x_s}{2} + \varepsilon \frac{1 - y_s x_s}{2}$$

$$= \exp\left\{\frac{1 + y_s x_s}{2} \log(1 - \varepsilon) + \frac{1 - y_s x_s}{2} \log(\varepsilon)\right\}$$

$$\propto \exp\left\{y_s x_s \frac{1}{2} \log\left(\frac{1 - \varepsilon}{\varepsilon}\right)\right\}$$

$$P(y_s|x_s) = \exp\{y_s x_s \lambda\}$$

$$p(x_s) \propto \prod_{s \sim t} \psi_{st}(x_s, x_t)$$

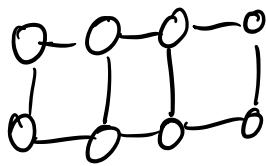
$$\psi_{st}(x_s, X_t) = \begin{pmatrix} e^J & e^{-J} \\ e^{-J} & e^J \end{pmatrix}$$

$$p(y|x) \propto p(y, x) = p(x) \prod_s p(y_s|x_s)$$

$$= \exp \left\{ J \sum_{s \sim t} x_s x_t + \lambda \sum_s y_s x_s \right\}$$

$$= \prod_{s \sim t} \psi_{st}(x_s, x_t) \prod_s \psi_s(x_s)$$

$$\psi_s(x_s) = \exp \{ \lambda y_s x_s \}$$



$$1. M_{i \rightarrow j}(x_j) = \begin{pmatrix} 1 \\ \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{pmatrix}$$

$$2. M_{j \rightarrow i}(x_i) = \sum_{x_j} \psi_j(x_j) \psi_{ij}(x_i, x_j) \prod_{k \in N(j) \setminus i} M_{k \rightarrow j}(x_j)$$

$$3. \quad \overset{\text{normalized}}{M_{j \rightarrow i}(x_i)} = \frac{M_{j \rightarrow i}(x_i)}{\sum_{x_i} M_{j \rightarrow i}(x_i)}$$

$$4. \quad b(x_i) \propto \psi_i(x_i) \prod_{k \in N(i)} M_{k \rightarrow i}(x_i)$$

$$\hat{x}_i = \underset{x_i}{\operatorname{argmax}} b(x_i)$$

