Generate data

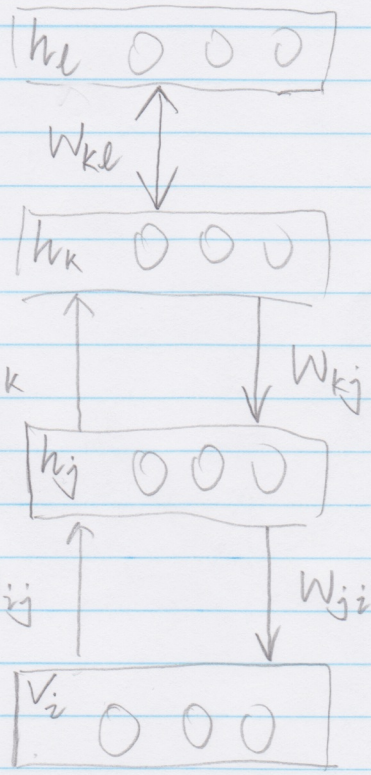
Wake-phase

$$h_\ell = \sigma\left(\sum_k W_{k\ell} h_k + b_\ell\right) > \text{rand}(0,1)$$

$$h_k = \sigma\left(\sum_j W_{jk} h_j + b_k\right) > \text{rand}(0,1)$$

$$h_j = \begin{cases} 1, & \text{if } \sigma\left(\sum_i W_{ij} v_i + b_j\right) > \text{rand}(0,1) \\ 0, & \text{otherwise} \end{cases}$$

$$\text{Where } \sigma(x) = \frac{1}{1+\exp(-x)}$$



sleep-phase

$$\hat{h}_\ell = \sigma\left(\sum_k W_{k\ell} \hat{h}_k + \hat{b}_\ell\right) > \text{rand}$$

$$\hat{h}_k = \sigma\left(\sum_\ell W_{k\ell} \hat{h}_\ell + \hat{b}_k\right) > \text{rand}$$

$$\hat{h}_j = \sigma\left(\sum_k W_{kj} \hat{h}_k + \hat{b}_j\right) > \text{rand}$$

$$\hat{v}_i = \sigma\left(\sum_j W_{ji} \hat{h}_j + \hat{b}_i\right)$$

Learning weights

① figure one which are tarsee/output and input from edge direction

② Use data generated in the opposite direction to update the directed weight

Generative param.

$$\Delta W_{ji} = \varepsilon\, h_j \left[v_i - \sigma\left(\sum_j W_{ji} h_j + \hat{b}_i\right)\right]$$

$$\Delta W_{kj} = \varepsilon\, h_k \left[h_j - \sigma\left(\sum_k W_{kj} h_k + \hat{b}_j\right)\right]$$

Assoc. Mem. param.

$$\Delta W_{k\ell} = \varepsilon\left(h_k h_\ell - \hat{h}_k \hat{h}_\ell\right)$$

Recognition param.

$$\Delta W_{jk} = \varepsilon\, \hat{h}_j \left[\hat{h}_k - \sigma\left(\sum_j W_{jk} \hat{h}_j + b_k\right)\right]$$

$$\Delta W_{ij} = \varepsilon\, \hat{v}_i \left[\hat{h}_j - \sigma\left(\sum_i W_{ij} \hat{v}_i + b_j\right)\right]$$

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