情報システム工学科

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塩貝亮宇

GBM

T1076006 塩貝亮宇

1 GBM

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

$$\tag{2}$$

1.1 GBMBiasIterate

$$E(\boldsymbol{v},\boldsymbol{h}) = -\sum_{i=1}^{D} a_i v_i - \sum_{j=1}^{P} b_j h_j \tag{3}$$

$$+ \sum_{i=1}^{D}\sum_{k=i+1}^{D} v_i L_{ik} v_k + \sum_{j=1}^{P}\sum_{j=i+1}^{P} h_j J_{jm} h_m + \sum_{i=1}^{D}\sum_{j=1}^{P} v_i W_{ij} h_j \tag{4}$$

$$\mu_j \leftarrow \sigma(-b_j + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} \mu_m J_{mj}) \tag{5}$$

$$p(h_j = 1|\boldsymbol{v},\boldsymbol{h}_{-j}) = \sigma(-b_j + \sum_{m=1\backslash j}^{P} J_{jm} h_m) \tag{6}$$

$$p(v_i = 1|\boldsymbol{h},\boldsymbol{v}_{-i}) = \sigma(-a_i + \sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1}^{D} L_{ik} v_k) \tag{7}$$

$$\tag{8}$$

1.2 GBMNoBiasIterate

$$E(\boldsymbol{v},\boldsymbol{h}) = \sum_{i=1}^{D}\sum_{k=i+1}^{D} v_i L_{ik} v_k + \sum_{j=1}^{P}\sum_{j=i+1}^{P} h_j J_{jm} h_m + \sum_{i=1}^{D}\sum_{j=1}^{P} v_i W_{ij} h_j \tag{9}$$

$$\mu_j \leftarrow \sigma\left(\sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} \mu_m J_{mj}\right) \tag{10}$$

$$p(h_j = 1|\boldsymbol{v},\boldsymbol{h}_{-j}) = \sigma\left(\sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} J_{jm} h_m\right) \tag{11}$$

$$p(v_i = 1|\boldsymbol{h},\boldsymbol{v}_{-i}) = \sigma\left(\sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1\backslash i}^{D} L_{ik} v_k\right) \tag{12}$$

$$\tag{13}$$

1.3 GBMNoBiasNoIterate

$$E(\boldsymbol{v},\boldsymbol{h}) = -\sum_{i=1}^{D}\sum_{k=i+1}^{D} v_i L_{ik} v_k - \sum_{j=1}^{P}\sum_{m=j+1}^{P} h_j J_{jm} h_m - \sum_{i=1}^{D}\sum_{j=1}^{P} v_i W_{ij} h_j \tag{14}$$

$$\mu_j \leftarrow \sigma(\sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} J_{mj}\mu_j) \tag{15}$$

$$p(h_j = 1|\boldsymbol{v},\boldsymbol{h}_{-j}) = \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} h_j J_{jm} \tag{16}$$

$$p(v_i = 1|\boldsymbol{h},\boldsymbol{v}_{-i}) = \sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1\backslash i}^{D} v_i L_{ik} \tag{17}$$

1.4 GBMBiasIterate

$$E(\boldsymbol{v},\boldsymbol{h}) = \sum_{i}^{D} a_i v_i + \sum_{j}^{P} b_j h_j \tag{18}$$

$$- \sum_{i=1}^{D}\sum_{k=i+1}^{D} v_i L_{ik} v_k - \sum_{j=1}^{P}\sum_{m=j+1}^{P} h_j J_{jm} h_m - \sum_{i=1}^{D}\sum_{j=1}^{P} v_i W_{ij} h_j \tag{19}$$

$$\mu_j \leftarrow \sigma(b_j + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} \mu_m J_{mj}) \tag{20}$$

$$p(h_j = 1|\boldsymbol{v},\boldsymbol{h}_{-j}) = \sigma(b_j + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} J_{jm} h_m) \tag{21}$$

$$p(v_i = 1|\boldsymbol{h},\boldsymbol{v}_{-i}) = \sigma(a_i + \sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1\backslash i}^{D} L_{ik} v_k) \tag{22}$$

$$\tag{23}$$

1.5 GBMBiasIterate2

$$E(\boldsymbol{v},\boldsymbol{h}) = \sum_{i=1}^{D} a_i v_i + \sum_{j=1}^{P} b_j h_j \tag{24}$$

$$- \sum_{i=1}^{D}\sum_{k=i+1}^{D} v_i L_{ik} v_k - \sum_{j=1}^{P}\sum_{m=j+1}^{P} h_j J_{jm} h_m - \sum_{i=1}^{D}\sum_{j=1}^{P} v_i W_{ij} h_j \tag{25}$$

$$\mu_j \leftarrow \sigma\left(b_j + \sum_{i=1}^{D} a_i v_i + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} \mu_m J_{mj}\right) \tag{26}$$

$$p(h_j = 1|\boldsymbol{v},\boldsymbol{h}_{-j}) = \sigma\left(b_j + \sum_{i=1}^{D} a_i v_i + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} J_{jm} h_m\right) \tag{27}$$

$$p(v_i = 1|\boldsymbol{h}, \boldsymbol{v}_{-i}) = \sigma\left(a_i + \sum_{j=1}^{P} b_j h_j + \sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1\backslash i}^{D} L_{ik} v_k\right) \tag{28}$$

$$\tag{29}$$

1.6 GBMBiasIterate3

$$E(\boldsymbol{v}, \boldsymbol{h}) = \sum_{i}^{D} a_i v_i + \sum_{j}^{P} b_j h_j \tag{30}$$

$$- \sum_{i=1}^{D} \sum_{k=i+1}^{D} v_i L_{ik} v_k - \sum_{j=1}^{P} \sum_{m=j+1}^{P} h_j J_{jm} h_m - \sum_{i=1}^{D} \sum_{j=1}^{P} v_i W_{ij} h_j \tag{31}$$

$$\mu_j \leftarrow \sigma\left(\sum_{i=1}^{D} a_i v_i + \sum_{m=1}^{P} b_m h_m + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} \mu_m J_{mj}\right) \tag{32}$$

$$p(h_j = 1|\boldsymbol{v}, \boldsymbol{h}_{-j}) = \sigma\left(\sum_{i=1}^{D} a_i v_i + \sum_{m=1}^{P} b_m h_m + \sum_{i=1}^{D} v_i W_{ij} + \sum_{m=1\backslash j}^{P} J_{jm} h_m\right) \tag{33}$$

$$p(v_i = 1|\boldsymbol{h}, \boldsymbol{v}_{-i}) = \sigma\left(\sum_{k=1}^{D} a_k v_k + \sum_{j=1}^{P} b_j h_j + \sum_{j=1}^{P} W_{ij} h_j + \sum_{k=1\backslash i}^{D} L_{ik} v_k\right) \tag{34}$$

$$\tag{35}$$