CS 156b Equations

Joseph Choi

2014/5/12

Blending on Quiz

$$Q = Rw$$
$$w = (R^T R)^{-1} R^T Q$$

In order to compute the linear regression weights w, we need but do not have

$$(R^T Q)_i = \sum_j R_{ij} Q_j$$

Note that this can be acquired from the Quiz RMSE:

$$RMSE_{quiz} \Rightarrow \sum_j (R_{ij} - Q_j)^2 = \sum_j R_{ij}^2 - 2 \sum_j R_{ij} Q_j + \sum_j Q_j^2$$

For convenience I will give you:

$$RMSE_{quiz,0} = 3.84358$$

Time Frequency SVD++

$$\hat{r}_{uit} = b_{uit} + \sum_k \left[\left(q_{ik} + q_{iBin(t)k} + q_{if_t k} \right)^T \left(p_{uk} + \alpha_{uk} \mathrm{dev}_u(t) + p_{utk} + \frac{1}{\sqrt{|N(u)|}} \sum_{j \in N(u)} (y_{jk} + y_{jBin(t)k}) \right) \right]$$
$$b_{uit} = \mu + b_u + \alpha_u \mathrm{dev}_u(t) + b_{ut} + (b_i + b_{iBin(t)})(c_u + c_{ut}) + b_{if_t}$$

Temporal Conditional Factored RBM

$$\hat{r}_{uit} = \frac{\sum_k k f(k)}{\sum_k f(k)}$$
$$f(k) = \exp \left\{ b_u^k + b_{ut}^k + b_i^k + b_{if_t}^k + \sum_{j=1}^{F} \sum_{c=1}^{C} \left[A_{ic}^k B_{cj} \sigma \left(b_j + \sum_{i=1}^{m} \sum_{k=1}^{K} \sum_{c=1}^{C} \delta_{r_i k} A_{ic}^k B_{cj} + \sum_{i=1}^{M} r_i D_{ij} \right) \right] \right\}$$

Temporal Conditional RBM

$$\hat{r}_{uit} = \sum_k k p(v_i^k = 1|\mathbf{h}, u, t)$$

$$p(v_i^k = 1|\mathbf{h}, u, t) = \frac{\exp(b_u^k + b_{ut}^k + b_i^k + b_{if_t}^k + \sum_j h_j W_{ij}^k)}{\sum_l \exp(b_u^l + b_{ut}^l + b_i^l + b_{if_t}^l + \sum_j h_j W_{ij}^l)}$$

$$p(h_j = 1|\mathbf{v}) = \sigma\left(b_j + \sum_{i \in R(u)} \sum_k v_i^k W_{ij}^k + \sum_{i \in N(u)} D_{ij}\right)$$

Equivalently:

$$\hat{r}_{uit} = \sum_{k=1}^{K} k p(v_i^k = 1|\mathbf{h}, u, t)$$

$$p(v_i^k = 1|\mathbf{h}, u, t) = \frac{\exp(b_u^k + b_{ut}^k + b_i^k + b_{if_t}^k + \sum_{j=1}^F h_j W_{ij}^k)}{\sum_{l=1}^K \exp(b_u^l + b_{ut}^l + b_i^l + b_{if_t}^l + \sum_{j=1}^F h_j W_{ij}^l)}$$

$$p(h_j = 1|\mathbf{v}, \mathbf{r}) = \sigma\left(b_j + \sum_{i=1}^{m} \sum_{k=1}^{K} v_i^k W_{ij}^k + \sum_{i=1}^{M} r_i D_{ij}\right)$$

Or also equivalently:

$$\hat{r}_{uit} = \sum_{k=1}^{K} \frac{k \exp(b_u^k + b_{ut}^k + b_i^k + b_{if_t}^k + \sum_{j=1}^F h_j W_{ij}^k)}{\sum_{l=1}^K \exp(b_u^l + b_{ut}^l + b_i^l + b_{if_t}^l + \sum_{j=1}^F h_j W_{ij}^l)}$$

$$h_j = \left[1 + \exp\left(-b_j - \sum_{i=1}^{m} \sum_{k=1}^{K} \delta_{r_i k} W_{ij}^k - \sum_{i=1}^{M} r_i D_{ij}\right)\right]^{-1}$$

Or in short:

$$\hat{r}_{uit} = \sum_k \left\{ \frac{k \exp(b_u^k + b_{ut}^k + b_i^k + b_{if_t}^k + \sum_j \sigma\left(b_j + \sum_k \sum_{i \in R(u)} \delta_{r_i k} W_{ij}^k + \sum_{i \in N(u)} D_{ij}\right) W_{ij}^k)}{\sum_l \left[\exp(b_u^l + b_{ut}^l + b_i^l + b_{if_t}^l + \sum_j \sigma\left(b_j + \sum_k \sum_{i \in R(u)} \delta_{r_i l} W_{ij}^l + \sum_{i \in N(u)} D_{ij}\right) W_{ij}^l)\right]} \right\}$$

RMSE to % Above Water

$$\text{Quiz \% Above Water} = (1 - \frac{\text{RMSE}_{quiz}}{0.9514}) \times 100\%$$

$$\text{Test \% Above Water} = (1 - \frac{\text{RMSE}_{test}}{0.9525}) \times 100\%$$