

Erratum Sheet

Norikazu Takahashi and Ryota Hibi, “Global convergence of modified multiplicative updates for nonnegative matrix factorization”, Computational Optimization and Applications, vol.57, pp.417–440, 2014.

1. Eq.(42) on Page 437 is not correct. It should be replaced with

$$g_D^{\hat{W}}(H, H') - f_D(\hat{W}, H) = \sum_{i=1}^n \sum_{j=1}^m V_{ij} \left\{ \log(\hat{W}H)_{ij} - \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log \frac{H_{aj}}{H'_{aj}} - \log(\hat{W}H')_{ij} \right\}$$

which can be derived as follows:

$$\begin{aligned} & g_D^{\hat{W}}(H, H') - f_D(\hat{W}, H) \\ &= \sum_{i=1}^n \sum_{j=1}^m \left\{ V_{ij} \log V_{ij} - V_{ij} + \frac{V_{ij}}{(\hat{W}H')_{ij}} \sum_{a=1}^r \hat{W}_{ia}H'_{aj} \log \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \right\} \\ & \quad + \sum_{a=1}^r \sum_{j=1}^m \left\{ H_{aj} \sum_{i=1}^n \hat{W}_{ia} - H'_{aj} \sum_{i=1}^n \frac{\hat{W}_{ia}V_{ij}}{(\hat{W}H')_{ij}} \log(\hat{W}_{ia}H_{aj}) \right\} \\ & \quad - \sum_{i=1}^n \sum_{j=1}^m \left\{ V_{ij} \log \frac{V_{ij}}{(\hat{W}H)_{ij}} - V_{ij} + (\hat{W}H)_{ij} \right\} \\ &= \sum_{i=1}^n \sum_{j=1}^m \left\{ V_{ij} \log V_{ij} - V_{ij} + V_{ij} \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \right\} \\ & \quad + \sum_{i=1}^n \sum_{j=1}^m \left\{ \sum_{a=1}^r \hat{W}_{ia}H_{aj} - V_{ij} \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log(\hat{W}_{ia}H_{aj}) \right\} \\ & \quad - \sum_{i=1}^n \sum_{j=1}^m \left\{ V_{ij} \log \frac{1}{(\hat{W}H)_{ij}} - V_{ij} + (\hat{W}H)_{ij} \right\} \\ &= \sum_{i=1}^n \sum_{j=1}^m V_{ij} \left\{ \log(\hat{W}H)_{ij} + \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}\hat{W}_{ia}H_{aj}} \right\} \\ &= \sum_{i=1}^n \sum_{j=1}^m V_{ij} \left\{ \log(\hat{W}H)_{ij} - \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log \frac{H_{aj}}{H'_{aj}} - \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log(\hat{W}H')_{ij} \right\} \\ &= \sum_{i=1}^n \sum_{j=1}^m V_{ij} \left\{ \log(\hat{W}H)_{ij} - \sum_{a=1}^r \frac{\hat{W}_{ia}H'_{aj}}{(\hat{W}H')_{ij}} \log \frac{H_{aj}}{H'_{aj}} - \log(\hat{W}H')_{ij} \right\}. \end{aligned}$$

(Last updated: September 3, 2014)