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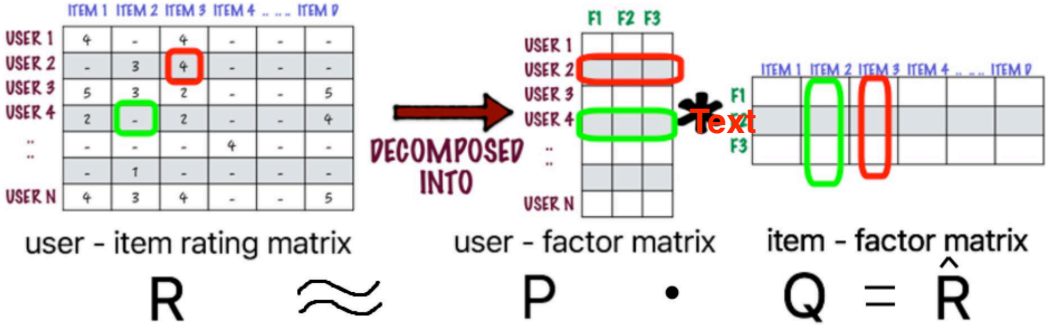
Algorithm implemented for recommender system

Nonnegative Matrix Factorization (NMF)

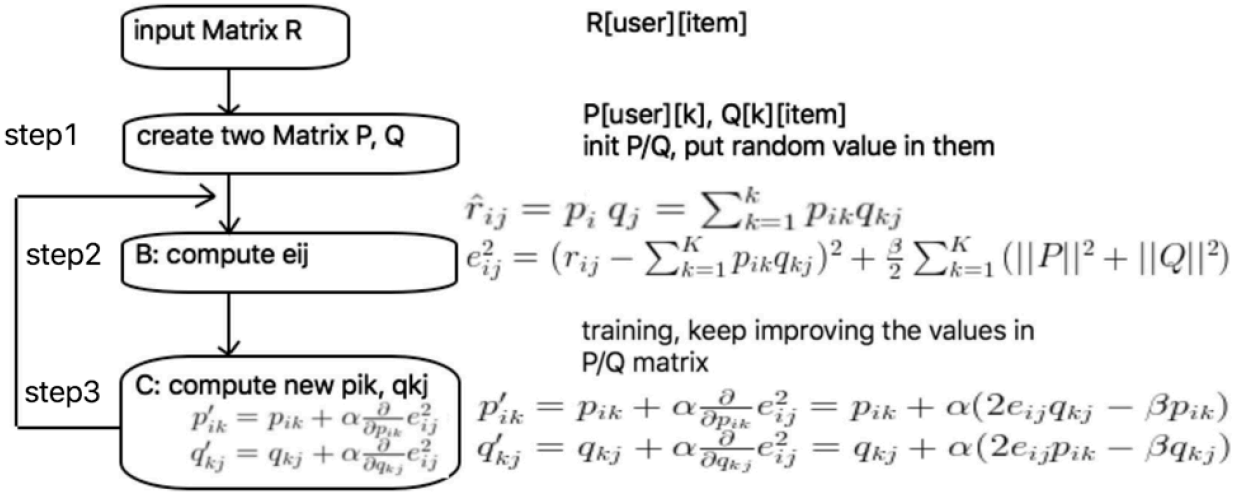
A matrix R is factorized into (usually) two matrices P and Q, with the property that these matrices have no negative elements.



We can use P, Q to create a new R matrix which is approximately equal to the origin R matrix. Through training P, Q matrix, we can make sure new R is closer to origin R.

Step1: initialize P, Q matrix with random value (these random values should not be too far away from 1).
Step2: compute error eij between items in original R and new R matrix.
Step3: use error eij to improve the items in P, Q matrix.
Keep doing Step2 and Step 3, it is training loop, until the result acceptable.
Some parameters need to be adjust base on the test result:

1. Loop times. (I set 5000 times here)
2. Alpha, we can consider that it is the improving step size in updating items in P, Q matrix.
3. Beta relate to the weight of Regularization, make sure this model does over fitting.



Finally, I use RMSE as my metric to evaluate this model, calculate the error between each item between new R and original R.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (X_i - X_{is})^2}{n}}$$