Algorithm Foundations of Data Science and Engineering
Welcome Tutorial :-)

Tutorial 6

GAO Ming

DaSE @ ECNU

1 Apr., 2019

Tutorial 6

1. Let A be

$$A = \begin{pmatrix} 1 & 1 \\ 2 & 2 \\ 0 & 0 \end{pmatrix}.$$

   a. Find the sigular values of matrix A;
   b. Find the SVD of matrix A.

2. Given the following 3-dimensional data

data	1	2	3
x	1	-1	4
y	2	1	3
z	1	3	-1

   a. Compute the co-variance matrix of the data;
   b. Find the principle components of the data.

Tutorial 6 Cont'd

3. Given $f(x) = x^3 - 6x^2 + 11x - 6$. Using Newton method, find all roots of the equation $f(x) = 0$.
4. Let J be the reconstruction error in matrix factorization,

$$J = \frac{1}{2} \sum_{(u,i) \in \mathscr{K}} (r_{ui} - \mathbf{p}_u^T \mathbf{q}_i)^2$$

where r_{ui} is the known rating of user u for item i, $\widehat{u}_{ui} = \mathbf{p}_u^T \mathbf{q}_i$ is the predicted rating given by user u for item i, and the set of all user-item pair (u, i), which are observed in R, be denoted by $\mathscr{K}$, i.e., $\mathscr{K} = \{(u, i) | r_{ui} \text{ is observed}\}$.

   a. Show J is not a convex function of parameters P and Q;
   b. Compute $\frac{\partial J}{\partial p_{uj}}$ and $\frac{\partial J}{\partial q_{ji}}$.
   c. When we employ Gradient descent method to learning the parameters, give the update rules for parameters p_{uj} and q_{ji}.