Documentation

The following are the main functions written in the ipython notebook IRassignment:

1) getEigenPairs (M,k)
This function computes the eigenvalues and eigenvectors using a generalised power iteration method. **Power iteration actually just calulates the principal eigenvector, but we iteratively keep on reducting the matrix to find eigenvectors corresponding to largest k eigenvalues.**
Arguments:
M: Square Matrix of which we want to calculate eigenvalues and eigenpairs.
k: Number of eigenpairs we want to calculate. k can can range from 1 to no. Of rows or collumns of M.
Returns:
Val: list of k eigenvalues caluculated
Vec: list of corresponding eigenvectors as list of numpy column arrays.

2) SVD(AAT,ATA,k):
This function calculates Singular Value Decomposition of the matrix.
Arguments:
AAT,ATA:
$A*A^T$ (Dimensions: MxM) and A^T*A (Dimensions NxN) where A is the MxN utility matrix which we want to decompose.
k: Rank of SVD we want to compute/ no. of singular values we want to consider /No of latent dimensions we want to break our space into
Returns:
U: User to concept matrix (dimension: M*k)
Sigma: Matrix of singular values (dimension: k*k)
V: Movie to concept matrix. (dimension: k*N)

3) signU(A,u,v):
Eigenvectors corresponding to a singular value can be of two opposite directions. Out of these two directions only one gurantees minimum reconstruction error. The correct direction is got by fixing v and multiplying u such that Avi/ei is positive where ei is the i th eigenvector of AA^T

4) getCUR(A,r):
This function calculates the CUR decomposition of utility matrix A breaking it into r latent factors.
Arguments:
A: Utility matrix that we want to decompose.
R: Rank.
Returns:
C: Matrix of randomly chosen columns of A using the probability function defined by the length of each collumn (list pfc in the code).
U: Moore Penrose Pseudoinverse of the matrix obtained by taking the intersection of C and R matrices.
R: Matrix of randomly chosen rows of A using the probability function defined by the length of each row (list pfr in the code).

4) **getU(W):**
Calculates the pseudoinverse of matrix W. Used in the function getCUR for calculating U.
Arguments:
W: Matrix for of which we want to calculate the pinv.
Returns:

U: Pseudoinverse of W.