CUNY IS 622 Week 15 Homework

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11.1.6

For the matrix of Exercise 11.1.4:

```
matrix <- matrix(c(1,1,1,1,2,3,1,3,5), ncol=3, byrow=TRUE)
matrix
```

```
##      [,1] [,2] [,3]
## [1,]    1    1    1
## [2,]    1    2    3
## [3,]    1    3    5
```

(a) Starting with a vector of three 1's, use power iteration to find an approximate value of the principal eigenvector.

(b) Compute an estimate the principal eigenvalue for the matrix.

(c) Construct a new matrix by subtracting out the effect of the principal eigenpair, as in Section 11.1.3.

(d) From your matrix of (c), find the second eigenpair for the original matrix of Exercise 11.1.4.

(e) Repeat (c) and (d) to find the third eigenpair for the original matrix.

11.3.2

Use the SVD from Fig. 11.7. Suppose Leslie assigns rating 3 to Alien and rating 4 to Titanic, giving us a representation of Leslie in "movie space" of [0, 3, 0, 0, 4]. Find the representation of Leslie in concept space. What does that representation predict about how well Leslie would like the other movies appearing in our example data?

$$\underset{M}{\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 3 & 3 & 3 & 0 & 0 \\ 4 & 4 & 4 & 0 & 0 \\ 5 & 5 & 5 & 0 & 0 \\ 0 & 0 & 0 & 4 & 4 \\ 0 & 0 & 0 & 5 & 5 \\ 0 & 0 & 0 & 2 & 2 \end{bmatrix}} = \underset{U}{\begin{bmatrix} .14 & 0 \\ .42 & 0 \\ .56 & 0 \\ .70 & 0 \\ 0 & .60 \\ 0 & .75 \\ 0 & .30 \end{bmatrix}} \underset{\Sigma}{\begin{bmatrix} 12.4 & 0 \\ 0 & 9.5 \end{bmatrix}} \underset{V^{\mathrm{T}}}{\begin{bmatrix} .58 & .58 & .58 & 0 & 0 \\ 0 & 0 & 0 & .71 & .71 \end{bmatrix}}$$

Figure 11.7: SVD for the matrix M of Fig. 11.6