

### Practice questions:

1. Given a real matrix  $A$ , find out the left and right singular vectors and the singular values of the matrix. (Try out with a small  $2 \times 2$  or  $3 \times 3$  matrix.)
2. You are given 10 data points with 3 features. If you want to preserve 50% variance on a new projected space, what is the minimum number of principal components you need to take to transform these data points on new space. (try this with a small real matrix.)
3. You are given 10 data points with 3 features. Compute the first two principal components and based on these principal components project the data point on new space.
4. Under what condition a one hidden layer autoencoder is equivalent to linear transformation?
5. What is the relationship between left and right singular vectors in SVD?
6. You are given a rectangular matrix  $A$ , where the rows are the customers and the columns are the product. The  $ij$ -th entry of  $A$  denotes the rating given by  $i$ -th customer for  $j$ -the product (higher is better). If some of the entries of  $A$  are missing, what would a good objective function to fill those missing values that you want to optimize using gradient descent?