Linear Algebra

1.1 Suppose x is a column vector. Is the equation $\| x \|_2^2 = x^{\mathrm{T}} x$ correct?

A. Yes

B. No

Answer: A

Linear Algebra

1.2 Which following statements are correct?

(1) For any square matrix X, $XI = IX = X$

(2) For any square matrix X, $XX^T v - \lambda v = (XX^T - \lambda I)v$

(3) If u_i is an eigenvector of square matrix A, then $Au_i = u_i$

A. (1)

B. (2)

C. (3)

D. (1)(2)

E. (1)(3)

F. (2)(3)

G. (1)(2)(3)

Answer: D. The eigenvalue is missing in option 3.

PCA Math

2.1 If v is a unit column vector, which one is correct :

A. $v^T v = 1$

B. $\| v \|_2 = 1$

C. both are correct

Answer: C

PCA Math

2.2 If $v_1, v_2, ..., v_d$ are principal components, which is correct :

A. $v_1^T v_2 = 0$

B. $v_2^T v_d = 0$

C. $v_1^T v_1 = 1$

D. the above options are all correct

Answer: D

PCA Dimension Reduction

3.1 Suppose we have a data matrix $X \in R^{n \times p}$ where n is the number of data points and p is the number of features. After applying PCA, we keep the first k eigenvectors with largest eigenvalues and project the data. What is the dimension of the projected data?

A. $n \times k$

B. $n \times p$

C. $k \times p$

Answer: A. After applying PCA, the data feature is reduced from p-dimension to k-dimension since we keep k principal components.

PCA Dimension Reduction

3.2 Consider the same setting as last question. We apply PCA on the data $X \in R^{n\times p}$ and keep the first k principal components with largest eigenvalues. What is the dimension of each principal component?

A. n

B. p

C. k

Answer: B. Each principal component has the same dimension as the feature of original data.