PCA derivation

Video: Welcome to module 4
1 min

Reading: Vector spaces
20 min

Reading: Orthogonal complements
20 min

Video: Problem setting and PCA objective
7 min

Reading: Multivariate chain rule
20 min

Practice Quiz: Chain rule practice
3 questions

Video: Finding the coordinates of the projected data
5 min

Video: Reformulation of the objective
10 min

Reading: Lagrange multipliers
20 min

Video: Finding the basis vectors that span the principal subspace
7 min

PCA algorithm

Orthogonal complements

Have a look at the following links:

1. Orthogonal complement
2. Orthogonal decomposition

The key points are

- If we look at an n-dimensional vector space V and a k-dimensional subspace $W \subset V$, then the orthogonal complement $W^\perp$ is an $(n-k)$-dimensional subspace of V and contains all vectors in V that are orthogonal to every vector in W.
- Every vector $\mathbf{x} \in V$ can be (uniquely) decomposed into $\mathbf{x} = \sum_{i=1}^{k} \lambda_i \mathbf{b}_i + \sum_{j=1}^{n-k} \psi_j \mathbf{b}_j^\perp$, $\lambda_i, \psi_j \in \mathbb{R}$, where $\mathbf{b}_1, \ldots, \mathbf{b}_k$ is a basis of W and $\mathbf{b}_1^\perp, \ldots, \mathbf{b}_{n-k}^\perp$ is a basis of $W^\perp$.

✓ Complete Go to next item