Eigendecomposition

The eigenvectors of a square matrix A having distinct eigenvalues are linearly independent.

The eigenvectors of a square symmetric matrix are orthogonal.

The eigenvectors of a square symmetric matrix can thus form a convenient basis.

$$\mathrm{Cov}(\mathbf{x}) = \begin{bmatrix} \mathrm{Var}(x_1) & \mathrm{Cov}(x_1, x_2) & \mathrm{Cov}(x_1, x_3) & \cdots & \mathrm{Cov}(x_1, x_n) \\ \mathrm{Cov}(x_2, x_1) & \mathrm{Var}(x_2) & \mathrm{Cov}(x_2, x_3) & \cdots & \mathrm{Cov}(x_2, x_n) \\ \mathrm{Cov}(x_3, x_1) & \mathrm{Cov}(x_3, x_2) & \mathrm{Var}(x_3) & \cdots & \mathrm{Cov}(x_3, x_n) \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \mathrm{Cov}(x_n, x_1) & \mathrm{Cov}(x_n, x_2) & \mathrm{Cov}(x_n, x_3) & \cdots & \mathrm{Var}(x_n) \end{bmatrix}$$

Eigendecomposition