Mahalanobis transformation

X multivariate, E[**X**] = $\boldsymbol{\mu}$, Cov**[X]= Σ Σ**

$\boldsymbol{Y} = \boldsymbol{\Sigma}^{-1/2}\left(\boldsymbol{X} - \boldsymbol{\mu}\right)$, E[**Y**]=**0**. Cov[**Y**] =**I.**

Principal components

$\boldsymbol{\Sigma}_{\mathbf{X}} = \boldsymbol{P}\boldsymbol{\Lambda}\boldsymbol{P}^{\mathrm{T}}$. Principal components $\boldsymbol{Y} = \boldsymbol{P}^{\mathrm{T}}\boldsymbol{X}$, $Cov[\boldsymbol{Y}] = \boldsymbol{\Lambda}$, $tr[\boldsymbol{\Sigma}] = tr[\boldsymbol{\Lambda}]$.

Z Standardized **X** $\Rightarrow Cov[\mathbf{Z}] = Cor[\mathbf{X}] = \boldsymbol{\rho}$

$\rho_{Y_i,X_k} = \dfrac{\sqrt{\lambda_i}e_{ik}}{\sqrt{\sigma_{kk}}}$, eigenvector-eigenvalues pairs from **Σ**.

$\rho_{Y_i,X_k} = \sqrt{\lambda_i}e_{ik}$, eigenvector-eigenvalues pairs from $\boldsymbol{\rho}$

Interpretation: correlations, eigenvectors, eigenvalues, screeplot, biplots.