Statistical Approach

Most calculations can be summarized by

- Choose a norm: $\|\mathbf{A}\|_E = \left(\mathsf{E}\,\mathrm{tr}(\mathbf{A}^\mathsf{T}\mathbf{A})\right)^{1/2}$ or ...

- Use the eigenvalue/eigenvector decomposition of $\widehat{\mathbf{P}}^f$:

$$\widehat{\mathbf{P}}^f = \boldsymbol{\Gamma}\widehat{\boldsymbol{\Lambda}}\boldsymbol{\Gamma}^\mathsf{T}$$

  $\boldsymbol{\Gamma}$ contains the eigenvectors
  $\widehat{\boldsymbol{\Lambda}} = (\widehat{\lambda}_{ij})$

- Simplify the norm to an expression containing $\{\lambda_i\}$, n:

$$\|\widehat{\mathbf{P}}^f\|_E^2 = \mathsf{E}\,\mathrm{tr}(\widehat{\mathbf{P}}^{f\mathsf{T}}\widehat{\mathbf{P}}^f) = \mathsf{E}\,\mathrm{tr}(\boldsymbol{\Gamma}^\mathsf{T}\widehat{\mathbf{P}}^f\boldsymbol{\Gamma}\boldsymbol{\Gamma}^\mathsf{T}\widehat{\mathbf{P}}^f\boldsymbol{\Gamma}) = \mathsf{E}\,\mathrm{tr}(\widehat{\boldsymbol{\Lambda}}\,\widehat{\boldsymbol{\Lambda}}) = \dots$$