Covariance and confidence intervals

The asymptotic covariance matrix of $\hat{\boldsymbol{\pi}}$ can be approximated by the inverse of the observed Fisher information matrix, I:

$$I(\boldsymbol{\pi}'|\mathbf{x},\mathbf{y}) = -\frac{\partial^2 \ell(\boldsymbol{\pi}')}{\partial \boldsymbol{\pi}' \partial \boldsymbol{\pi}'^T}$$

$$\mathrm{Cov}(\hat{\pi}_p, \hat{\pi}_q) = \left[I^{-1}(\hat{\boldsymbol{\pi}}')\right]_{pq}$$

with variance and correlation given by

$$\mathrm{Var}(\hat{\pi}_j) = \sigma_j^2 = \left\{\mathrm{Cov}(\hat{\boldsymbol{\pi}})\right\}_{jj}$$

$$\mathrm{Corr}(\hat{\pi}_p, \hat{\pi}_q) = \frac{\mathrm{Cov}(\hat{\pi}_p, \hat{\pi}_q)}{\sqrt{\sigma_p^2 \sigma_q^2}}$$