

CSM denoising

Probabilistic Factor Analysis

Décembre 2018

Probabilistic Factor Analysis

- Matrix decomposition using statistical properties:
 - signal CSM : low-rank matrix
 - TBL CSM : diagonal CSM

Statistical model

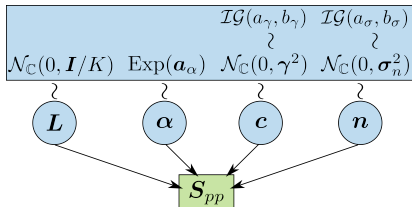
$$M(\theta)$$

$$S_{pp} = L[\alpha] S_{cc}[\alpha] L' + [\sigma_n^2]$$

$$= \underbrace{\begin{array}{c} \text{Diagram: } (M \times K) \text{ tall rectangle} \\ (M \times K) \end{array}}_{\text{Low-rank matrix}} \underbrace{\begin{array}{c} \text{Diagram: } (K \times K) \text{ small square} \\ (K \times K) \end{array}}_{\text{matrix}} \underbrace{\begin{array}{c} \text{Diagram: } (K \times M) \text{ wide rectangle} \\ (K \times M) \end{array}}_{\text{matrix}} + \underbrace{\begin{array}{c} \text{Diagram: } (M \times M) \text{ square with diagonal line} \\ (M \times M) \end{array}}_{\text{Uncorrelated noise}}$$

Probabilistic Factor Analysis

Probability distribution for each parameters



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Optimization process : maximize the posterior distribution

Find the parameter set that best fit the data

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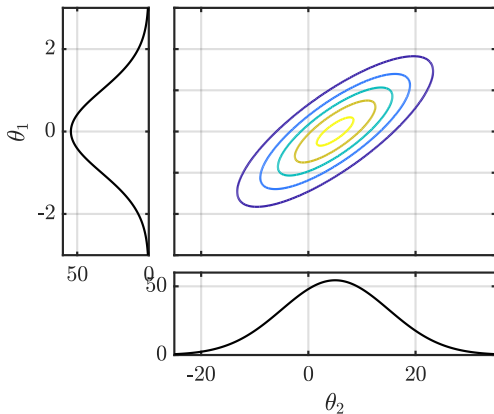
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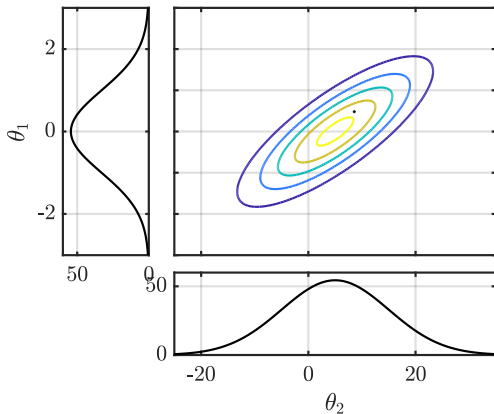
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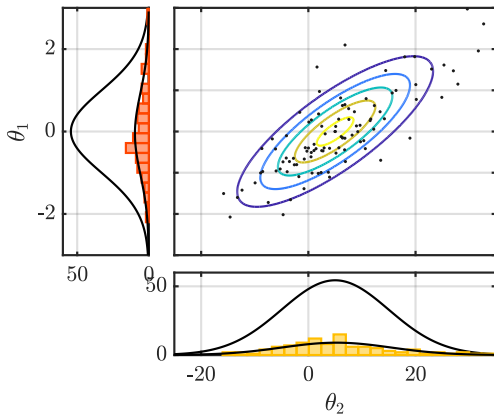
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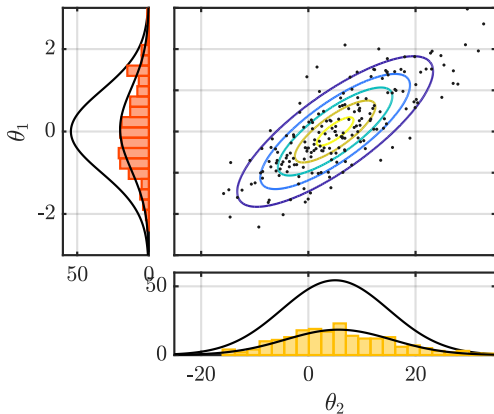
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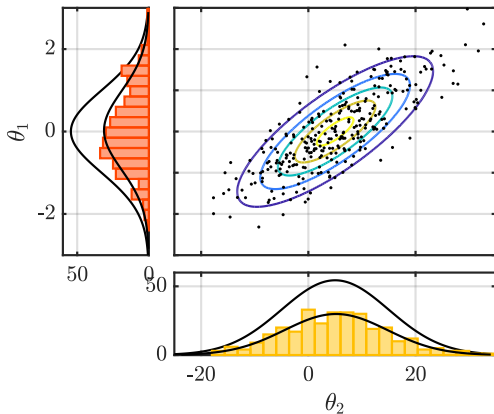
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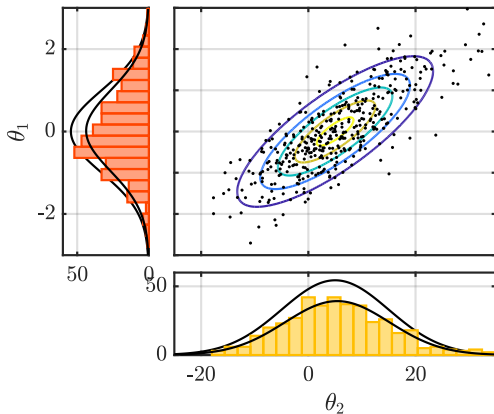
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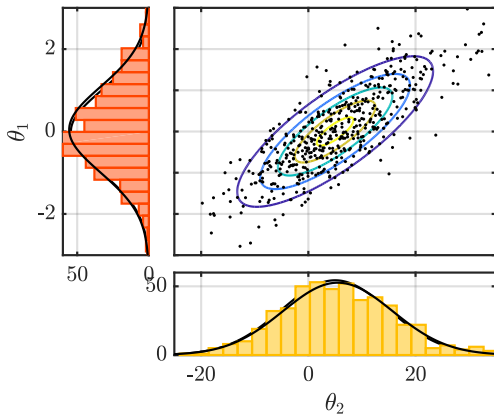
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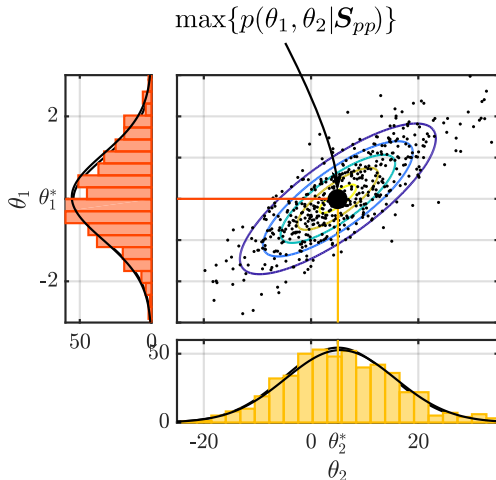
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Optimization process : maximize the posterior distribution

Find the parameter set that best fit the data



Probabilistic Factor Analysis



- MCMC:
 - prior knowledge is part of the model
 - gives credible interval
- PFA:
 - preserves CSM positivity
 - reduces data dimension
 - no input parameters
 - adaptable model

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- Sensitive to prior choices
esp. for ill-posed problem
- Computationally expensive