

Variational Gaussian-process factor analysis for modeling spatio-temporal data

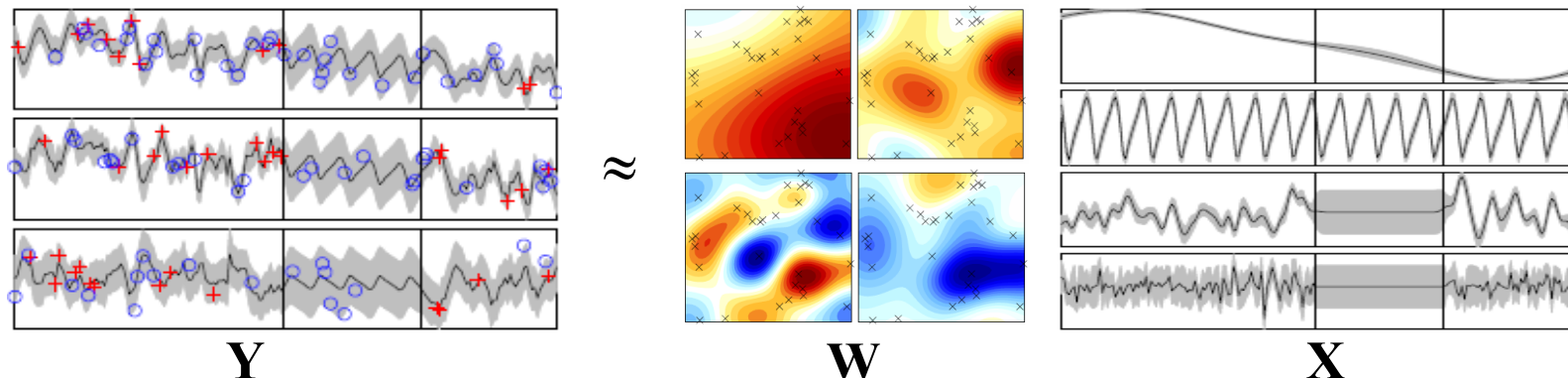
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- Factor analysis (matrix factorization) model:

$$\mathbf{Y} = \begin{matrix} \left[\begin{array}{ccc} \dots & \dots & \dots \\ \dots & y_i(t) & \dots \\ \dots & \dots & \dots \end{array} \right]_{\text{space}} & = & \sum_{d=1}^n \mathbf{w}_{:d} \mathbf{x}_{:d}^T + \text{noise} \end{matrix} \quad \begin{matrix} p(\mathbf{w}_{d:}) = GP(\phi_d) \\ p(\mathbf{x}_{:d}) = GP(\theta_d) \end{matrix}$$

- Gaussian-process prior: assuming prominent spatial (e.g. smoothness) and temporal (e.g. slowness, periodicity) structure



- Variational Bayesian learning to model posterior pdfs of $\mathbf{w}_{:d}$ and $\mathbf{x}_{:d}$
- The model is used to reconstruct historical sea surface temperatures