

# Description of Noise Covariance Model

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This document describes the implementations of class *covModel*.

## 1 Model Description

The class *covModel* implements an iterative method to estimate the (potentially evolving) covariance matrices of applied zero-mean Gaussian noise. In its heart, dedicated NUV priors are constructed to calculate the exact Gaussian message passes through normal nodes of general dimension. This is a generalization of the idea presented in [1] from the scalar to the more general  $D$  dimensional case.

Next to implementing this novel Gaussian message passing method through normal nodes, class *covModel* also provides the framework to use these messages to calculate the MAP estimate of the covariance matrices in question. Thereby, these covariance matrices can either be modelled ‘Constant’ or ‘PWC’ (i.e., piecewise constant). Later case builds on class *PWCModel*, handling the MAP estimates of  $J_i$ ,  $i \in \{1, \dots, N\}$  efficiently (method is explained in the documentation of *PWCModel*). A factor graph visualizing this general concept is shown in Figure 1.

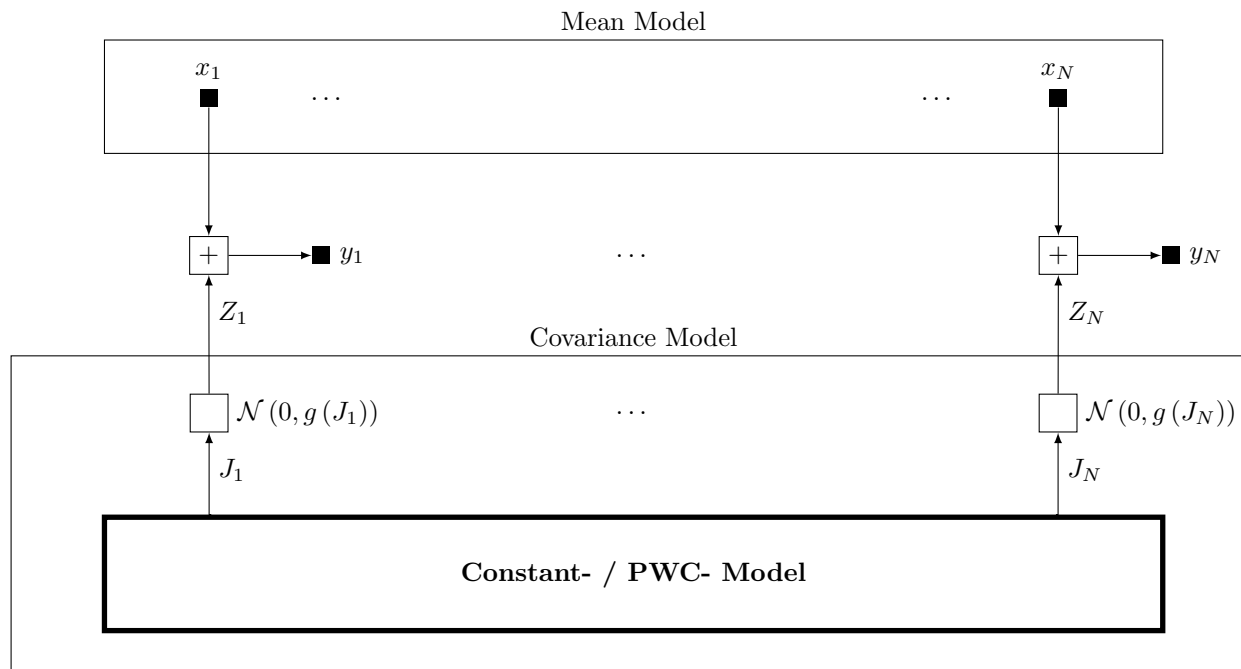


Figure 1: Factor graph of noise covariance matrix estimation model.

## **2 Explanation of Implementations**

### **References**

- [1] H.-A. Loeliger, “On nup priors and gaussian message passing,” 2023.