# Detection of Gauss-Markov random fields with nearest-neighbor dependency

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**Abstract**

The problem of hypothesis testing against independence for a Gauss-Markov random field (GMRF) is analyzed. Assuming an acyclic dependency graph, a closed-form expression for the log-likelihood ratio is derived, in terms of the coefficients of its covariance matrix and the edges of the dependency graph. Assuming random placement of nodes over a large region according to the Poisson or uniform distribution, the error exponent of the Neyman-Pearson detector is derived using large-deviations theory. The error exponent is expressed as a dependency graph functional and the limit is evaluated through a special law of large numbers for *stabilizing* graph functionals. The exponent is analyzed for different values of the variance ratio and correlation. It is found that a more correlated GMRF has a higher exponent at low values of the variance ratio whereas the situation is reversed at high values of the variance ratio.

**Index Terms**

Detection and Estimation, Gauss-Markov random fields, large deviations, Error exponent, Graph theory.

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