ON ADAPTIVE SELECTION OF ESTIMATION BANDWIDTH FOR ANALYSIS OF LOCALLY STATIONARY MULTIVARIATE PROCESSES

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Abstract When estimating the correlation/spectral structure of a locally stationary process, one should choose the so-called estimation bandwidth, related to the effective width of the local analysis window. The choice should comply with the degree of signal nonstationarity. Too small bandwidth may result in an excessive estimation bias, while too large bandwidth may cause excessive estimation variance. The paper presents a novel method of adaptive bandwidth selection. The proposed approach is based on minimization of the crossvalidationatory performance measure for a local vector autoregressive signal model and, unlike the currently available methods, does not require assignment of any user-dependent decision thresholds.

### Stationary multivariate processes

I. Consider a discrete stationary $n$-dimensional random signal

\[ \{y(t), t = 1, \ldots, T\}, \quad y(t) = \{y_1(t), \ldots, y_n(t)\} \]

where $t$ denotes the normalized discrete time. Suppose that the first $n$ autocovariance matrices of $y(t)$ are known.

II. Vector autoregressive (VAR) signal model

\[ y(t) + \sum_{k=1}^{p} A_k y(t-k) = e(t), \quad \text{where} \ A_k = \{A_{1k}, \ldots, A_{nk}\} \]

where $e(t)$ denotes $n$-dimensional white noise sequence with covariance matrix $\Sigma_e$ and $A_k$ denotes matrices of autocorrelation coefficients.

III. Link via the Yule-Walker equations

\[ A_k = \{A_{1k}, \ldots, A_{nk}\} \]

where $A_k$ is a bandwidth parameter.

IV. Maximum entropy spectrum

\[ S_{\hat{f}}(f) = | \hat{A}^{-1}(f) \hat{A}(f)|^{-1} \]

where $\hat{A}(f) = 1 + \sum_{k=1}^{p} A_k \exp(-i2\pi ft)$ is the normalized angular frequency.