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STATISTICAL CLASSIFICATION ALGORITHMS FOR MULTIVARIATE REGIME-SWITCHING MODELS

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Regime-switching models (RS-Models) are convenient for analysis of complex systems with cyclic changes of states [1]. The models with independent states are thoroughly studied in [2, 3]. This research is devoted to multivariate regressive and vector autoregressive models with Markov-switching states [4, 5]. The object of the study is a vector autoregressive model with Markov-switching states and exogenous variables (MS-VARX) allowing multivariate linear regressive model (MS-MLR) as its special case.

Let a random vector of observable variables $y_t = (x'_t, z'_t)' \in \mathfrak{R}^n$ be described by a RS-VARX (p) $(p \ge 1)$ model:

$$x_t = \sum_{i=1}^p A_{d(t),i} x_{t-i} + B_{d(t)} z_t + \eta_{d(t),t}, \quad t = 1, \dots, T,$$

where $x_{1-p}, \ldots, x_0 \in \Re^N$ — the initial values; $\eta_{d(t),t} \in \Re^N$ — a vector of random disturbances at the discrete-time period t; $d(t) \in S(L) = \{0, \ldots, L-1\}$ — a discrete-time random process describing the state of a system modeled, L $(2 \leq L < s+1)$ — the number of classes of states, where $s \geq 1$ — the number of turning points $1 < \tau_1 < \ldots < \tau_s < T$.

Main model assumptions:

1) $\mathbf{E}\{\eta_{l,r}\} = 0_N \in \mathfrak{R}^N$, $\mathbf{E}\{\eta_{l,r}\eta'_{l,s}\} = \delta_{r,s}\Sigma_l$ $(r, s = 1, \ldots, T, l \in S(L))$, where $\delta_{r,s}$ — the Kronecker delta;



2) $A_l \neq A_k$ and (or) $B_l \neq B_k \quad \forall k \neq l, \ k, l \in S(L);$

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3) $\{d_t\}$ (t = 1, ..., T) — ahomogeneous ergodic Markov chain.

Main results. The algorithms of classification based on classified and non-classified training samples are suggested both for multivariate regressive and vector autoregressive models with markov-switching states. Accuracy of the algorithms is examined by means of computer simulation experiments. The applications of the algorithms to economic cycle analysis are presented. Moreover, a statistical procedure that allows to eliminate short-term (acyclic) fluctuations in states of a system modeled is proposed [5].

References

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