



TECHNISCHE
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DRESDEN

SSDBM 2011

Efficient In-Database Maintenance of ARIMA Models

Technische Universität Dresden
Database Technology Group

Frank Rosenthal, Wolfgang Lehner



DRESDEN
concept
Exzellenz aus
Wissenschaft
und Kultur



- *Parameter Estimation*
 - numerical optimization → select parameters that provide the best “fit”
- *Objective Function*
 - minimize/maximize value with respect to parameters
- *ARIMA*
 - conditional maximum likelihood

$$a_i(\phi, \theta) = x_i - \sum_{j=1}^p \phi_j x_{i-j} - \sum_{j=1}^q \theta_j a_{i-j}(\phi, \theta)$$

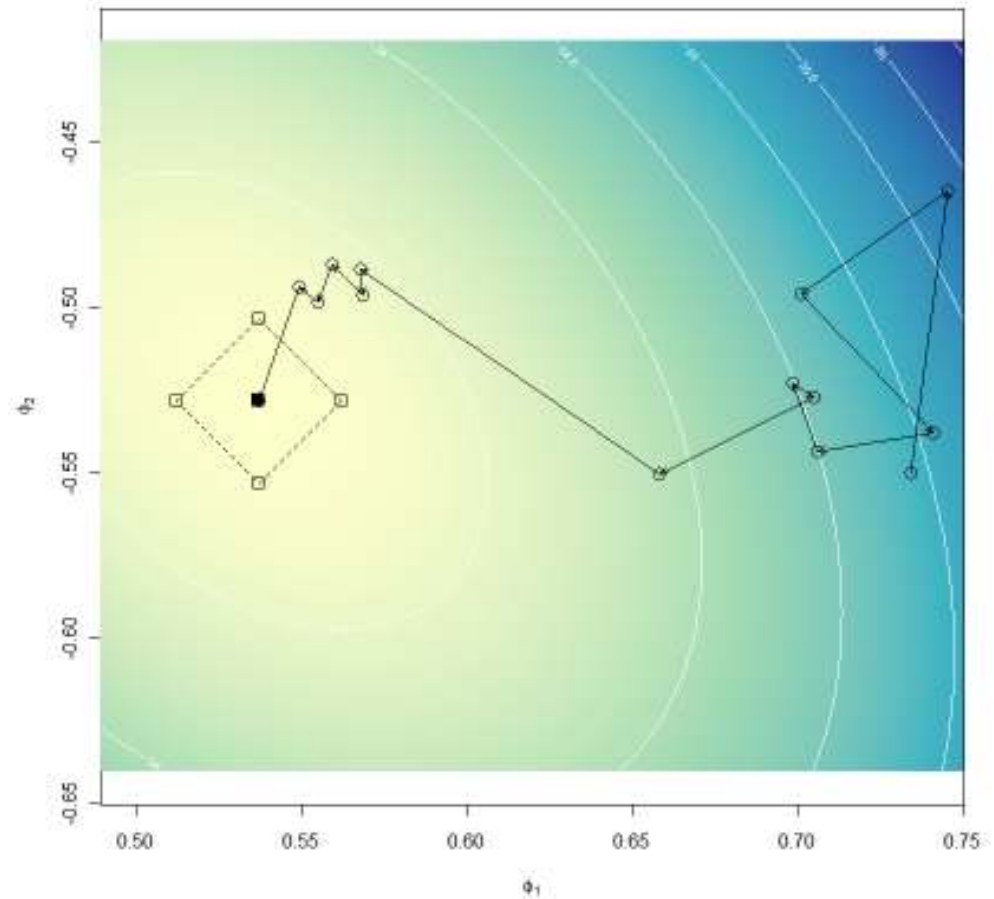
$$cSS(\phi, \theta) = \sum_{i=p}^t (a_i(\phi, \theta))^2$$

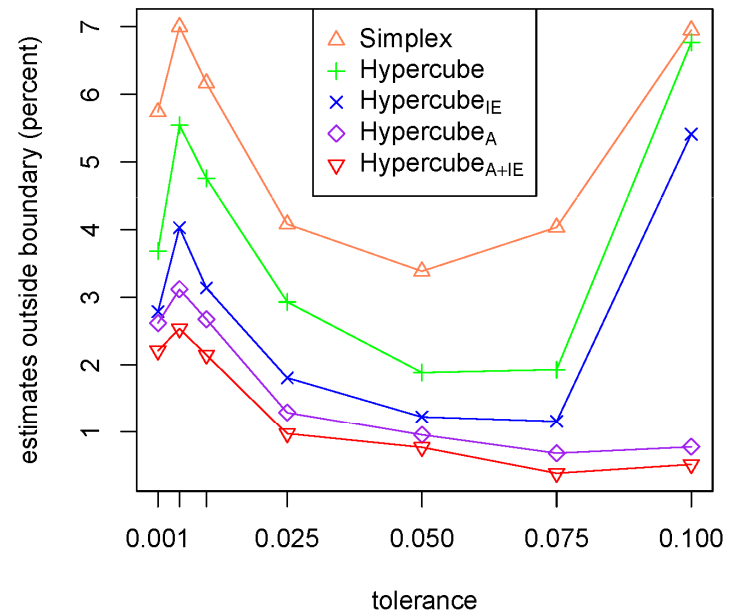
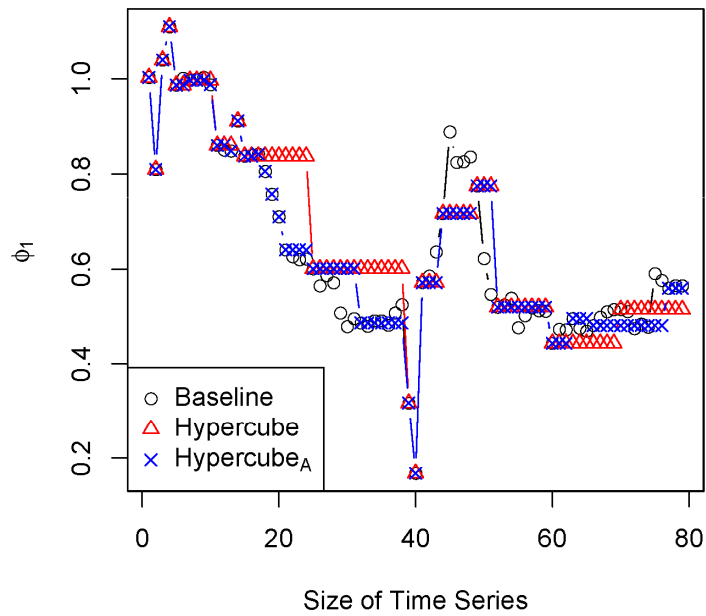
- *Small changes*
 - waste of resources

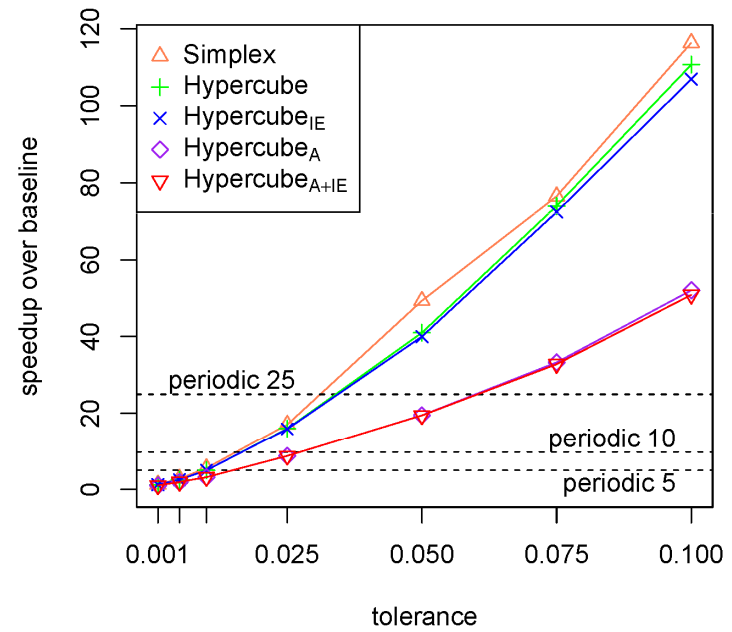
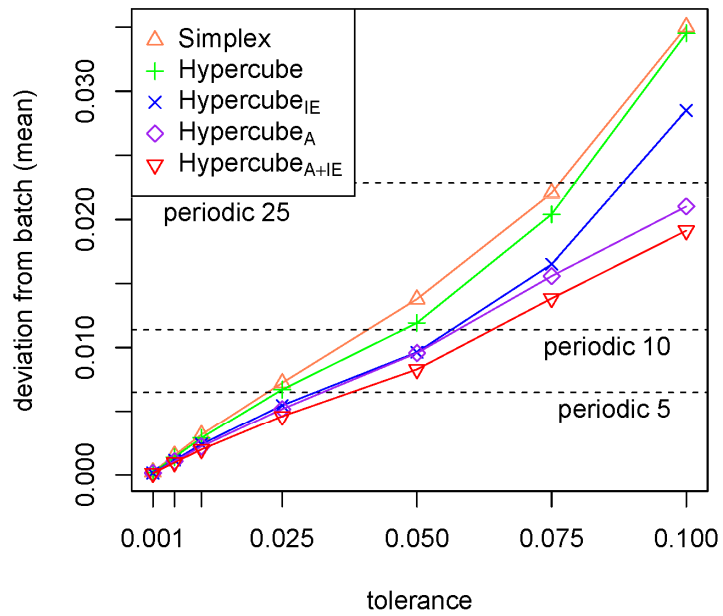
- *Basic data structure*
 - boundary synopsis
 - skip estimation as long as optimum stays inside boundary

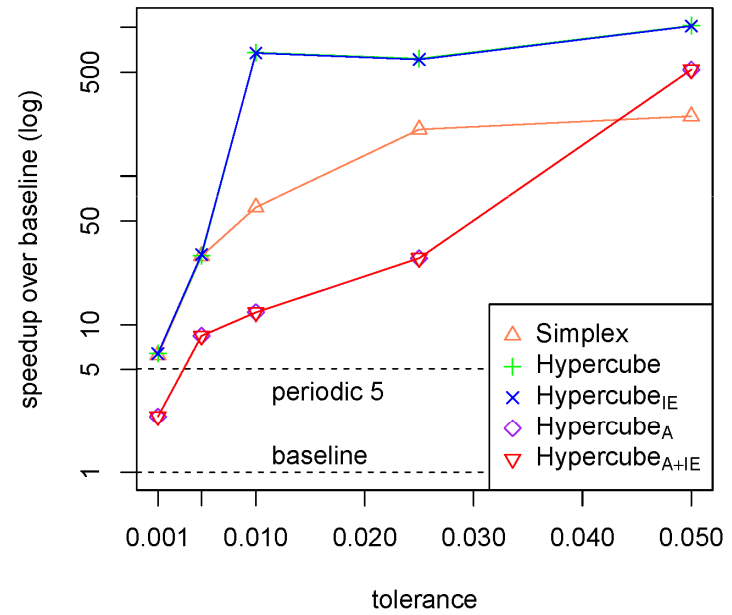
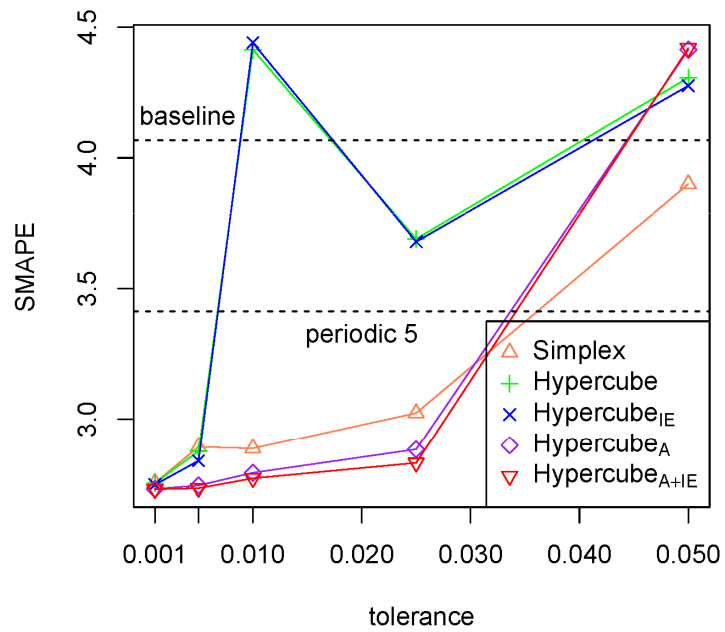
- *Decide on impact*
 - check whether objective function at center has smaller value than at all vertices

| | | | | | | | |
|-------|-----|-------|-------|----------|-----|----------|----------|
| x_1 | ... | x_8 | x_9 | x_{10} | ... | x_{13} | x_{14} |
|-------|-----|-------|-------|----------|-----|----------|----------|











- On-demand estimation
 - maintenance strategy for ARIMA models
 - estimation only when necessary
 - assessed using the likelihood function

- Results
 - smaller error and/or
 - less runtime

- What else is in the paper
 - adaptation of boundary synopsis
 - internal estimation heuristic



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