Robust Bayesian Auto-regression Model

Jan Šindelář

The problem of estimating parameters of an auto-regression model in a Bayesian paradigm has been solved before, when the model has innovations coming from exponential family [3]. The main reason for choosing exponential family was the simplicity of computation and the fact that Gaussian distribution, often found in nature due to existence of limit theorems, is also a member of this family.

Applications of modeling to data, where the distribution of innovations is known to be heavy-tailed calls for a method, more robust with respect to possible outliers. Such methods have been developed in the past [1],[2] often using a likelihood with Huber loss function in the exponent or similar approximations. With the use of such methods a constant specifying the position of the tails has to be chosen, which is often difficult.

Instead, we choose the 1-D innovations of the model to be Laplace distributed, choose a Bayesian conjugate prior to such a model distribution and try to compute the resulting filtration, when new data of a realization of an adjacent random process arrive.

The computation of the resultant posterior distribution of the parameters of the model is still computationally tractable as will be shown [4]. The computation is slower than the classical solution at a ratio 1 : N^k, where N is the number of data used for computation and k is the dimension of the parameter space. An immediate guess would be to use a moving window estimation of the parameters, making the estimation faster and the model adaptive. An efficient algorithm has been proposed to solve the presented problem [5].

References


1Department of Adaptive Systems, Institute of Information Theory and Automation ASCR, jan.sindelar@utia.cas.cz