On Identification Of Probabilistic Mixture Models with Dynamic Weights

Josef Andrýsek

Department of Adaptive Systems, Institute of Information Theory and Automation
Academy of Sciences of the Czech Republic, Prague, Czech Republic

E-mail: andrysek@utia.cas.cz

Abstract:

The choice of a suitable system model is essential for both control and decision making when dealing with complex real-life problems. Their complexity, however, makes detailed system modelling unfeasible. This orients us to use simplified gray box models, which learns its parameters from the measured data and evolve during their use. Classical LQG controllers can be mentioned as an example of such approaches. More sophisticated models are the probabilistic mixture models [1]. Such models can be interpreted as switching of multiple simpler models (components). The probabilistic mixtures provide a universal approximation of almost any probabilistic density function [2] and thus can be successfully used in modelling of complex systems.

To be able to perform decision making operations on the mixture model, its parameters have to be estimated from measured data using Bayesian approach [3]. Unfortunately, exact Bayesian approach can not be used here. Some approximations must be used instead. The quasi-Bayes algorithm [4] [1] or the projection based (PB) algorithm [5] are examples of approximate algorithms facing this problem.

Although the probabilistic mixtures serves well as universal approximators and are applicable to real live problems [6], the assumption on constancy of the mixture weights is restrictive. We can expect that models with dynamic weights will give even better results, but their estimation is much more difficult. This paper tries to improve the probabilistic mixture model with introducing data dependent component weights. The improved model will be estimated with a modification of the PB estimation algorithm [5].

References

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