

(Robust) Online Filtering in Regime Switching Models and Application to Investment Strategies for Asset Allocation

Christina Erlwein¹, Peter Ruckdeschel^{1,*}

Fraunhofer ITWM, Dept. of Fin. Mathematics, Fraunhofer-Platz 1, 67663 Kaiserslautern, Germany

*Contact author: peter.ruckdeschel@itwm.fraunhofer.de

Keywords: robustness, Hidden Markov Models, filtering, substitutive outliers, asset allocation

We implement to *R*, an online filtering algorithm for Hidden Markov Models with conditionally Gaussian observations by Elliott (1994), and are currently about to package this functionality to a new *R* package **robHMM**.

This algorithm consists of several steps: It involves a change of measure to an equivalent measure under which we have independence as well as a filtering and a (ML-) parameter estimation step where the last two steps form an EM-algorithm.

The algorithm is modularized correspondingly such that in each step the respective function realizing it may easily be replaced by a suitable alternative (robust) function.

We study the vulnerability of each of these steps against substitutive outliers and propose corresponding robust alternatives extending Ruckdeschel (2010).

In a similar setting as in Erlwein et al. (2009), we apply this robustified algorithm to investment strategies for asset allocation with the rationale to better handle possible peaks or missings in asset returns, limiting their impact on optimal parameter estimates. The parameter estimates obtained are in turn used to make investment decisions within a regime-switching framework.

References

- Elliott, R. (1994). Exact adaptive filters for markov chains observed in gaussian noise. *Automatica* 30, 1399–1408.
- Erlwein, C., R. Mamon, and M. Davison (2009). An examination of hmm-based investment strategies for asset allocation. *Applied stochastic models in business and industry*. DOI: 10.1002/asmb.820.
- R Development Core Team (2011). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. ISBN 3-900051-07-0. <http://www.R-project.org>.
- Ruckdeschel, P. (2010, May). Optimally Robust Kalman Filtering. Technical Report 185, Fraunhofer ITWM Kaiserslautern, Fraunhofer Platz 1, 67663 Kaiserslautern, Germany. http://www.itwm.fraunhofer.de/fileadmin/ITWM-Media/Zentral/Pdf/Berichte_ITWM/2010/bericht_185.pdf.