
# Abstracts

## Friday, February 19th 2010: 9.00-10.30 a.m.

### *Approaching Change-Point Detection via Renewal Theory*

**Allan Gut (Uppsala University, Sweden)**

The typical analysis in change-point theory is based on samples of fixed size. About 10 years ago Josef Steinebach lurked me into an alternative view point. Namely, instead one observes the random phenomenon in question sequentially in order to "take action" as soon as one observes some statistically significant deviation from "normal" behaviour. Based on this idea we have analyzed the counting process related to the (various) original process(es) observed at equidistant time points, the strategy being that action is taken or not depending on (i) the total number of observations so far, or (ii) the number of observations between those time points.

In this talk I will review some results of our joint efforts over the years. The main ingredients in the proofs are strong invariance principles for renewal processes and extreme value asymptotics for Gaussian processes.

#### References

Gut, A., and Steinebach, J. (2002). Truncated sequential change-point detection based on renewal counting processes. *Scand. J. Statist.* **29**, 693-719.

Gut, A., and Steinebach, J. (2004). EWMA charts for detecting a change-point in the drift of a stochastic process. *Sequential Anal.* **23**, 195-237.

Gut, A., and Steinebach, J. (2005). A two-step sequential procedure for detecting an epidemic change. *EXTREMES* **8**, 311-326.

Gut, A., and Steinebach, J. (2009). Truncated sequential change-point detection based on renewal counting processes II. *J. Statist. Plann. Inference* **139**, 1921-1936.

Gut, A., and Steinebach, J. (2009). Asymptotics for increments of stopped renewal processes. *U.U.D.M. Report* **2009:21**, *Statist. Probab. Lett.* (to appear).

### *Sequential Change-Point Detection for Diffusion Processes*

**Stefan Mihalache (University of Cologne, Germany)**

In this talk, the problem of sequential detection of changes in the drift of diffusion processes will be considered under the assumption that the processes can be observed continuously. The proposed solution is a procedure which is similar to the CUSUM one for discrete-time processes. For constructing the statistics the one-step approach of Le Cam is used with the method of moments estimator as a starting estimator. The asymptotic distribution under the null hypothesis as well as an asymptotic normality of the stopping time under the alternative will be presented. Key tool is an approximation of certain stochastic integrals by Wiener processes in the manner of a strong invariance principle with rate.

## Friday, February 19th 2010: 11.00-12.30 a.m.

### *Sequential Testing for the Stability of High Frequency Portfolio Betas*

**Siegfried Hörmann (Free University of Brussels, Belgium)**

Despite substantial criticism, variants of the capital asset pricing model (CAPM) remain until today the primary statistical tools for portfolio managers to assess the performance of financial assets. In the CAPM, the risk of an asset is expressed through its correlation with the market, widely known as the beta. There is now a general consensus among economists that these portfolio betas are time-varying and that, consequently, any appropriate analysis has to take this variability into account. Recent advances in data acquisition and processing techniques have led to an increased research output concerning high-frequency models. Within this framework, we introduce in this paper a modified functional CAPM that incorporates microstructure noise, as well as sequential monitoring procedures to test for the constancy of the portfolio betas in this setting. As our main results we derive the large-sample properties of these monitoring procedures. In a simulation study and an application to S&P100 data we show that our method performs well in finite samples.

### *On Hierarchical Epidemic Changes in Dependent Functiona Data*

**Claudia Kirch (Karlsruhe Institute of Technology, Germany)**

Recently, change-point analysis has been highlighted as a useful technique in psychological experiments performed with functional Magnetic Resonance Imaging (fMRI) where different subjects react differently to stimuli such as stress or anxiety.

While current methodology is applied pointwise across spatial locations, our approach is based on recently developed change-point procedures for functional data. Of specific interest are procedures for dependent data and epidemic changes. Because of the very high-dimensionality (usually $10^6$ observations) an approach based on a general covariance structure is computationally not feasible. Therefore, a special case, that of multidimensional functional covariance structures will be considered.

In the above application multiple subjects are usually scanned, indicating a hierarchical nature of the change-points within the experiments, with the empirical distribution of the change points over all subjects an item of interest. If the change-points are assumed to come from a hierarchical structure, then it is possible to estimate the empirical distribution of the change-points using the usual estimators from functional data analysis.

The talk is based on joint work with John Aston (Warwick University).

## Friday, February 19th 2010: 14.00-14.45 p.m.

### *Change-Point in Trending Regression*

**Marie Hušková (Charles University Prague, Czech Republic)**

The talk will concern test procedures for detection of changes in regression models with "trending regressors". Theoretical part will focus on behavior of max type test statistics whose limit distribution belongs to extreme value type.

Approximations to critical values based on limit null distribution and bootstrap will be discussed. Results of a simulation study together with application to the real data sets ( will be presented.

The talk will be mostly based on the paper: *Segmenting mean-nonstationary time series via trending regressions* written jointly with A.Aue and L. Horváth.

## Saturday, February 20th 2010: 9.00-10.30 a.m.

### *$L_1$-detectors in Sequential Change Point Analysis*

**Alena Cernikova (Prag, Czech Republic)**

The talk concerns the change-point problem in sequentially coming data. We assume that stable historical data are available, and our target is to decide after each new nonhistorical observation is coming, whether a change already occurs or not. We concern on linear regression models and assume changes only in regression parameters. We focus on the situation, when the data are not normally distributed and propose to use a detector based on $L_1$-residuals $\widetilde{e}_i = \text{sign}(Y_i - \mathbf{X}_i \widetilde{\boldsymbol{\beta}}_m)$, where $Y_i$ are the observed data, $\mathbf{X}_i$ is matrix of regressors and $\widetilde{\boldsymbol{\beta}}_m$ is the $L_1$-estimator of regression parameters based on historical data.

### *On the Monitoring of Structural Changes in Linear Models with Dependent Errors*

**Alexander Schmitz (University of Cologne, Germany)**

Chu et al. (1996) proposed a CUSUM monitoring for the sequential detection of a parameter change in linear models with martingale difference errors. In this talk, we consider these linear models with one-dimensional regressors. We present some related (regressor weighted) CUSUM detectors and illustrate the use of certain early-change weight functions in the sense of Horváth et al. (2004). Furthermore, under one-time parameter shift alternatives, we derive the asymptotic power one for the sequential test using the regressor weighted CUSUM detector.

## Saturday, February 20th 2010: 11.00-12.30 a.m.

### *Equity Location Problem with Rectilinear Distance and in Networks*

**Zuzana Prášková (Charles University Prague, Czech Republic)**

Consider a random coefficient autoregression (RCA) model of order $p$,

$$X_t = \sum_{i=1}^{p} (\beta_i + B_{ti}) X_{t-i} + Y_t,$$

where $\beta_i$ and $B_{ti}, i = 1, \ldots, p$, are constant and random components of autoregressive coefficients, respectively, and $Y_t$ are error terms. Model can be represented as

$$X_t = \sum_{i=1}^{p} \beta_i X_{t-i} + u_t$$

with new errors $u_t$, that exhibit a kind of conditional heteroscedasticity.

In this contribution we discuss a class of estimators of parameters $\beta_i$ originally proposed by Schick [5] for RCA(1), with standard least-squares estimators and the quasi-maximum estimators as special cases, and study asymptotic and bootstrap distribution of such estimators (see also [2], [3] for solving similar problems). We propose estimators that preserve the computational simplicity of the least-square estimators and, as numerical studies show, see [4], [6], they behave well under quite general conditions and without requiring prior knowledge of other parameters of the model. A possibility to use this estimators for testing the stability in RCA models as an analogy to [1] can be therefore considered.

## Literatur


[1] Aue, A. (2006): Testing for parameter stability in RCA(1) time series. *Journal of Statistical Planning and Inference* 13, 3070–3089.

[2] Aue, A., Horváth, L. and Steinebach, J. (2006): Estimation in random coefficient autoregressive models. *Journal of Time Series Analysis* 27, 60–67.

[3] Prášková, Z. (2003): Wild bootstrap in RCA(1) model. *Kybernetika* 39, 1–12.

[4] Prášková, Z., Vaněček, P. (2009: On a class of estimators in multivariate RCA(1) model.*Submitted.*

[5] Schick, A. (1996): $\sqrt{n}$-consistent estimation in a random coefficient autoregressive model. *The Australian Journal of Statistics* 38, 155–160.

[6] Vaněček P. (2008): *Estimation of Random Coefficient Autoregressive Models.* PhD Thesis, Charles University, Prague.


## *CUSUM, Trimming and Heavy Tails*


**Lajos Horváth (University of Utah, USA)**


It is well-known that the CUSUM process converges weakly to a stable bridge if the observations have heavy tails. The limit depends on the unknown tail parameter so the distribution of functionals of the stable bridge cannot be computed. The bootstrap version of the CUSUM process with heavy tails does not converge to the limit of the CUSUM computed from the observations. However, the CUSUM process converges to the Brownian bridge if the very large and very small observations are removed from the sample. The result is based on the weak convergence of sums of trimmed observations.
The talk is based on joint work with István Berkes and Johannes Schauer. The latter algorithm is based on fact that at least one middle point of the edges solves the EP to optimally.