Resampling methods for the change analysis of dependent data

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Abstract

The fundamental question in change-point analysis is whether an observed stochastic process follows one model or whether the underlying model changes at least once during the observational period. This talk focuses on detecting an abrupt mean change in a sequence of dependent data.

In change-point analysis critical values for testing procedures are usually obtained by distributional asymptotics. These critical values, however, do not sufficiently reflect dependency. Moreover it is a well-known fact that convergence rates especially for extreme-value statistics are very slow. Using resampling methods we obtain better approximations, which take possible dependency structures more efficiently into account.

We focus on a block permutation method which splits the observations $X(1), \ldots, X(n)$ into L blocks of length K. Instead of resampling $X(\cdot)$, we resample the blocks $X(Kl+1), \ldots, X(K(l+1)), l = 0, \ldots, L-1$, but keep the order within the blocks. Then we prove that the original statistics and their resampling counterparts follow the same distributional asymptotics, thus we can use the quantiles of the bootstrap distribution as critical values.

Some simulation studies illustrate that the permutation tests usually behave better than the original tests if performance is measured by the $\alpha-$ and $\beta-$errors, respectively.

References

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