

Estimation of Changepoints in Two Independent Bernoulli Sequences

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Abstract

Statistical study of output quality for several production lines which independently produce the same kind of products in a workshop can be regarded as dealing with a changepoint problem in two or more independent sequences of random variables. Due to some drawbacks of estimating the changepoints for two Bernoulli sequences separately, in this paper, we propose two different methods for estimating the common changepoint of two independent Bernoulli sequences. First of all, two sequences are combined to form one trinomial sequence, and then the joint estimators $(\hat{r}_{M_1}, \hat{r}_{M_2})$ and $(\hat{r}_{C_1}, \hat{r}_{C_2})$, which are derived by means of the maximum likelihood method and the cumulative sum method, respectively, are applied. When the two original sequences have the same changepoints, Monte Carlo simulation results show that the cumulative sum estimator has a higher ability in detecting the common changepoint correctly. Also, it can be shown that under some conditions, the cumulative sum estimator of constructed trinomial sequence has a lower bias square than the estimator from two individual Bernoulli sequences. The probability of \hat{r}_{C_1} correctly detecting the true changepoint is given.

Keywords: Changepoint, Bernoulli Sequence, Cumulative Sum, Carlo Study.