Change-point Problems
IMS Lecture Notes – Monograph Series (Volume 23, 1994)

ON STOPPING RULES FOR THE SETS SCHEME: AN APPLICATION OF THE SUCCESS RUNS THEORY

BY GIOVANNA CAPIZZI
University of Padua

A stopping rule is proposed for the SETS scheme (Chen, 1978). The methods of generating functions and partial fractions are applied to the theory of the *success runs*. Under the hypothesis that a change in intensity of a Poisson process occurs very far from the origin of the observations, two different expressions are derived for the average delay in detecting increases in birth defect rates.

Comparisons are made with the CUSUM scheme, which appears to be more efficient than the SETS scheme, in detecting increases in malformation rates.

1. Introduction. Suppose we are monitoring the rate of occurrence of a rare health event in a specified community, e.g. a specific congenital malformation in a single hospital.

Under the null hypothesis H_0 of a homogeneous rate of birth defects, the number of normal births per unit of time is very large and the number of malformed births is small. Therefore the malformed births occur according to a realization of a Poisson process with parameter: λ_0. The constant λ_0 is the *baseline rate* of *failures* under the null hypothesis, i.e. λ_0 represents the expected number of births with the same malformation, per unit of time.

Suppose an epidemic situation occurs at an unknown instant of time and the normal rate is subject to an increase of $\gamma > 1$ times the probability of a birth defect, i.e. $\lambda_1 = \gamma\lambda_0$. Let ν be this change-point. The situations $\nu = 0$ and $\nu = \infty$ correspond to the situations of a change at the initial time of observation and of no-change or stationarity, respectively.

Sequential surveillance systems can make easier the detection of increases in the rare diseases intensity. Since the interarrival times for a homogeneous Poisson process are i.i.d. exponential random variables, inspections schemes with exponentially distributed observations arise naturally in the context of monitoring the occurrence rate of rare events. Therefore let $X_i, (i = 0, 1, 2, ..)$,

---

AMS 1991 Subject Classification: Primary 62L10; Secondary 62N10.

Key words and phrases: Change-point problem, CUSUM Schemes, sequential detection, SETS schemes.