SOME TECHNIQUES OF SUMMARY EVALUATIONS OF SEVERAL INDEPENDENT EXPERIMENTS

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1. Introduction

Because of the notorious frequency with which rain stimulation experiments fail to yield statistically significant results it is important to develop efficient methods for summary evaluations. In the present note two related but distinct problems are treated. In both cases a number s of independent experiments $E_1, E_2, \cdots, E_s$ are considered, each conducted to investigate the presence of certain effects. Specifically, the ith experiment is concerned with a parameter ξ_i which is a measure of a certain effect. The first problem is the summary test of the hypothesis, H_0 say, that all the parameters ξ_i are zero; that is,

$$\xi_1 = \xi_2 = \cdots = \xi_s = 0. \tag{1.1}$$

The second is to test the hypothesis, H_1 say, that all the parameters ξ_i have the same value ξ which however the hypothesis H_1 does not specify; that is,

$$\xi_1 = \xi_2 = \cdots = \xi_s = \xi. \tag{1.2}$$

The first test of the hypothesis H_0 has been proposed by R. A. Fisher [1] and later studied by E. S. Pearson [2] and used by J. Neyman and E. L. Scott [3] in the present *Proceedings*. Obviously the efficiency of the test of H_0 must depend upon the information regarding the experiments $E_1, E_2, \cdots, E_s$ that the test utilizes. Fisher's test is very broad and is based only on the exact significance probabilities resulting from the individual experiments. It is therefore plausible that an alternative summary test using more information about the experiments covered might be more powerful.

The problem of testing H_1 is familiar in the general domain of the analysis of variance, also due to Fisher. Here the separate experiments $E_1, E_2, \cdots, E_s$ are equivalent to "blocks" and the hypothesis H_1 is that of no block-treatment interaction. As is well known, the analysis of variance tests are applicable when the observable variables are normal with fixed variance. The test given below is deduced for a particular situation where these assumptions do not hold.

All formulas given in the present note are specializations of the results of

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