COLLOQUIUM

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On distribution free tests for discrete distributions and an extension to continuous time

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Abstract

The basic message of this talk could have been delivered a long ago, may be even soon after the time of publication of classical papers of K. Pearson (1900) and R. A. Fisher (1922, 1924). However, the tradition of using the chi-square goodness of fit statistic became so widely spread, and the point of view that, for the case of discrete distributions, statistics "have to" have their asymptotic distributions dependent on the individual probabilities, became so predominant and "evident", that it required several decades before the situation was examined again.

We recall that for continuous distributions on real line, the idea of time transformation $t = F(x)$ of Kolmogorov (1933), along with subsequent papers of Smirnov (1936) and Wald and Wolfowitz (1937), and at least since the paper of Anderson and Darling (1952), was always associated with a *class* of goodness-of-fit statistics. The choice of statistics invariant under this time transformation became an accepted principle in goodness-of-fit theory for continuous distributions. Unlike this, for discrete distributions, everything became locked on a single statistic, the chi-square goodness-of-fit statistic. The idea of a *class* of asymptotically distribution free tests, to the best of our knowledge, was never considered in any serious and systematic way. This is a pity, because unlike the probability transformation, which is basically a tool for one-dimensional time, the idea behind the K. Pearson's chi-square is applicable to any measurable space. The potential of its generalization seems, therefore, worth of investigation.

We will show recent results of one such investigation. Namely, we will suggest a class of asymptotically distribution free goodness of fit tests for discrete distributions. Then we show the extension of this approach to the case of empirical processes in m-dimensional time. Thus, we hope to demonstrate that geometric insight behind the papers of K.Pearson (1900) or R. A. Fisher (1924) goes considerably further than one goodness-of-fit statistic.

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