

Levene's Family of Tests for Equality of Variances: historical perspective, impact and modifications

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Abstract: In many applications, the underlying scientific question concerns whether the variances of k samples are equal. The problem of assessing homogeneity of variances has a long history and there exists a substantial number of related tests. Many such tests rely on the assumption of normality and are not robust to its violation. In 1960, Prof. Howard Levene proposed a new approach to the problem of obtaining a valid test for equality of variances which is essentially the F-test computed on the absolute deviations of observations from the group mean. Levene's approach is shown to be a powerful and robust to non-normality test and quickly became a very popular tool for assessing homogeneity of variances. The practical relevance and importance of Levene's approach is demonstrated by the fact that Levene's (1960) article has been cited over 750 times in the scientific literature. The test has been used in a wide variety of applications, e.g. clinical trials, astronomy, marine pollution, business, auditing and law cases.

This talk reviews the original statistic proposed by Levene and various modifications which replace the group means by robust measures of location. We also propose a new Levene-based test for assessing monotonic trends in variances. The new test can be useful when one concerns with an increasing or decreasing variability, for example, increasing volatility of stocks in financial time series, "open or closed gramophones" in regression residual analysis and patterns of anisotropy in spatial statistics. This is a joint work with Professors Joseph L. Gastwirth and Weiwen Miao.