Empirical Investigation of Type 1 Error Rate of Univariate Tests of Normality

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Abstract

Normality assumption is important in univariate parametric statistical tests. Either the variables or
the error terms in the model have to be normally distributed before valid statistical conclusions
could be made. Various tests of univariate normality including that of Pearson, Kolmogorov–Smirnov, Anderson-Darling, Shapiro–Wilk, Lilliefors, D’Agostino and Pearson, Jarque-Bera, Shapiro-Francia, Energy and Cramer-von Mises tests have been developed. However, when applied in practice, they hardly give the same result. Thus, this research work aims at investigating the Type 1 error rate of these tests so as to identify the best one and suggest the same for statistics users. The tests were compared by conducting Monte Carlo experiments five thousand (5000) times with six sample sizes at three pre-selected levels of significance. A test was adjudged good at a particular level of significance if its empirical Type 1 error rate approximated the true error rates most often. It is best if its number of counts at which it was good over the sample sizes and levels of significance was the highest. Results reveal that Type 1 error rate of all the univariate tests are good except that of Kolmogorov–Smirnov,
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Pearson Unadjusted and Jarque-Bera. Moreover, those of Anderson-Darling, Shapiro-Wilk, Energy and Cramer-von Mises tests are relatively best. They are therefore recommended for testing the assumption of normality in any univariate data set.

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Index Terms

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Keywords

Parametric test statistics, Monte Carlo experiments, Type 1 error rate, Inferential statistics tests, Levels of significance.