POWER STUDY OF CIRCULAR ANOVA TEST AGAINST NONPARAMETRIC ALTERNATIVES

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Abstract

This study compares circular ANOVA against bootstrap test, uniform scores test and Rao's test of homogeneity which are considered nonparametric alternatives. Circular ANOVA is one-way analysis of variance method to test the equality of mean directions in circular data analysis, but it requires some assumptions. The main assumption for circular ANOVA is that all r-independent samples must come from von Mises distribution with equal directional means and equal concentration parameters. On the other hand, nonparametric alternatives are distribution free methods and, therefore, does not require having von Mises distribution or equality of parameters. Literature of circular statistics is very limited on the comparison of these tests; therefore, a power simulation study is performed to compute the power of circular ANOVA against the nonparametric alternatives under assumptions of von Mises and non-von Mises populations. Power simulation study shows that bootstrap and uniform scores tests perform slightly better than circular ANOVA if the common concentration parameter, κ, is less than 1 under the assumption of von Mises distribution. If $\kappa \geq 2$, then bootstrap and circular ANOVA perform better than the other alternatives. Rao's test of homogeneity requires very large samples in order to reach the same power levels of competitive tests in this study. Finally, uniform scores tests performs better than circular ANOVA and bootstrap test if the sample sizes are small and the data comes from mixed von Mises distributions or wrapped Cauchy.

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