Looking for (and finding!) hidden additivity in complete block designs with the `hiddenf` package.

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Keywords: Interaction, Additivity, Tukey, Block Designs

A new test of additivity is presented for two-factor experiments with one observation per factor level combination. The hypothesis of additivity, or absence of interaction, is frequently of interest in complete block designs and many tests have been developed in the literature to assess its plausibility in such settings. The new test is based on a search for a 'hidden additivity' structure, where levels of one factors may be grouped such that within a group the effects of both factors are additive. Membership of levels within groups is treated as a latent variable. The computation of the test statistic and pvalue, along with a plotting procedure, are included in a new package under development entitled `hiddenf`.

The `hiddenf` package builds upon another recently developed package called `additivityTests`, which computes test statistics and critical values (but not p-values) from several well-known tests and also a new modification of Tukey's procedure [3]. `hiddenf` can call the functions in `additivityTests` and use them them to compute p-values. It also expands the collection by adding several new tests, including those by [2] and [1]. Lastly, it has plotting functionality that enables the user not only to test for interaction, but to characterize it with graphical assistance.

The methodology and use of the package are illustrated using several datasets taken from the statistics literature on interaction. Additionally, a study of copy number variation in dogs with lymphoma is presented which serves as a rich source of two-factor data with one observation per factor level combination.

References

[1] Franck, C. (2010). *Latent Group-Based Interaction Effects in Unreplicated Factorial Experiments*. Ph. D. thesis, North Carolina State University.

[2] Kharrati-Kopaei, M. and S. Sadooghi-Alvandi (2007). A new method for testing interaction in unreplicated two-way analysis of variance. *Communications in Statistics- Theory and Methods 36*, 2787–2803.

[3] Simecek, P. and M. Simeckova (2013). Modification of tukey's additivity test. *Journal of Statistical Planning and Inference 143*, 197–201.