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An alternative procedure for performing a power analysis of Mantel's test

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This study proposes a simple way to perform a power analysis of Mantel's test applied to squared Euclidean distance matrices. The general statistical aspects of the simple Mantel's test are reviewed. The Monte Carlo method is used to generate bivariate Gaussian variables in order to create squared Euclidean distance matrices. The power of the parametric correlation *t*-test applied to raw data is also evaluated and compared with that of Mantel's test. The standard procedure for calculating punctual power levels is used for validation. The proposed procedure allows one to draw the power curve by running the test only once, dispensing with the time demanding standard procedure of Monte Carlo simulations. Unlike the standard procedure, it does not depend on a knowledge of the distribution of the raw data. The *simulated power* function has all the properties of the power analysis theory and is in agreement with the results of the standard procedure.

Keywords: permutation test; type II error rate; matrices' relation; empirical distribution; correlation

1. Introduction

Mantel's [15] test is a permutation test that can be used to verify a linear relation between distance matrices. Furthermore, there are some variations of the test: Mantel's correlogram and the partial correlations and regressions. One advantage of Mantel's test is that, because it proceeds from distance matrices, it can be applied to variables of different logical types (categorical, rank, or interval-scale data) [21].

In order to study whether infant leukemia cases tend to be close in space and time, Mantel proposed this permutation test, based on distance matrices of time and space. This is the most common use of Mantel's test, i.e. to evaluate the relation between geographic distances and genetic divergence. However, Rodrigues *et al.* [19] stated that it is possible to compare genetic distances using discrete matrices (often called model matrices) in which the elements are one

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