

Disequilibrium coefficient: A bayesian perspective

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Hardy-Weinberg Equilibrium (HWE) is an important genetic property that populations should have whenever they are not observing adverse situations as complete lack of panmixia, excess of mutations, excess of selection pressure etc. HWE for decades has been evaluated; both Frequentist and Bayesian methods are in use today. While historically the HWE formula was developed to examine the transmission of alleles in a population from one generation to the next, use of HWE concepts has expanded in human diseases studies to detect genotyping error and disease susceptibility (association); Ryckman and Williams (2008). Most analyses focus on trying to answer the question of whether a population is in HWE. They do not try to quantify how far from the equilibrium the population is. In this paper, we propose the use of a simple disequilibrium coefficient to a locus with two alleles. Based on the posterior density of this disequilibrium coefficient, we show how one can conduct a Bayesian analysis to verify how far from HWE a population is. There are other coefficients introduced in the literature and the advantage of the one introduced in this paper is the fact that, just like the standard correlation coefficients, its range is bounded and it is symmetric around zero (equilibrium) when comparing the positive and the negative values. To test the hypothesis of equilibrium, we use a simple Bayesian significance test, the Full Bayesian Significance Test (FBST); see Pereira, Stern and Wechsler (2008) for a complete review. The disequilibrium coefficient proposed provides an easy and efficient way to make the analyses, especially if one uses Bayesian statistics. A routine in R programs (R Development Core Team, 2009) that implements the calculations is provided for the readers.

Biography

Carlos Alberto de Braganca Pereira is a Professor and Head of the Statistics Department, São Paulo University - USP, Brazil. He was President of the Brazilian Statistical Society (1988/90), Director of the Institute of Mathematics and Statistics, IME-USP (1994/98), Director of the Bioinformatics Scientific Center BIOINFO-USP (2006/09) and a member of the International Statistical Institute. He has authored and co-authored more than 150 papers and 4 books, including Bayesian Analysis (1982), the 1st Bayesian book (in Portuguese) published in Latin America. His Ph.D. is from FSU, 1980, from which he has received the Ralph Bradley award.

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