Disequilibrium Coefficient: A Bayesian Perspective

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Abstract

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.

References

[1] Ryckman, K. and Williams S. M. (2008), Calculation and Use of the Hardy?Weinberg Model in Association Studies, Current Protocols in Human Genetics 57:1.18.1-1.18.11.

[2] Pereira, C. A. B., Stern, J. M. and Wechsler S. (2008), Can a significance test be genuinely Bayesian? Bayesian Analysis 3(1):79-100.

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