**Maximum Likelihood Estimation of Two Variance Components in a Random Effects Model**

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The code presented below contains functions for evaluating the likelihood of a random effects model using the eigenvalue decomposition of the co-variance matrix associated to a random effect. Several authors have explited the equivalence between Gaussian processes and reandom regressions on eigenvectors, a few examples of these are: [de los Campos et al. (2010)](http://www.ncbi.nlm.nih.gov/pubmed/20943010) , [Zhou and Stephens (2012)](http://www.ncbi.nlm.nih.gov/pubmed/22706312?dopt=Abstract&holding=npg) and [Janss et al., (2012)](http://www.genetics.org/content/192/2/693.full.pdf).

**Model**

**Likelihood Function**

Let be the eigenvalue decomposition of G, where is a matrix with eigenvectors, satisfying and is a diagonal matrix with the eigenvalues of G in the diagonal. Using and we have

Further, using and

where: .

Furthermore, the determinant of is simply the product of it’s eigenvalues, therefore,

Combining the above results we have

Therefore, becomes,

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where: .