Summary of A Joint Location-Scale Test improves Power to detect Associated SNPs

1. Currently association analysis rarely accounts for GxG and GxE interaction, because of the problem of multiple hypothesis testing and missing information for E.

2. There are some alternatives that accounts for the interaction effects: “percentile method” (distribution method) and LRT method. The percentile method (distribution method) is very robust, however wasting a lot of power when the true underlying model can be parametrized by only a few parameters (eg: normal) and relies on simulation to compute p-value which is computationally hard. LRT method is sensitive to model’s assumption such as normality, so it also relies on permutation method to computes the p-value.

3. The proposed method: JLS method, is an easy to implement joint location-scale testing method that jointly test the null hypothesis of equal mean and equal variance between genotypes by aggregating location-only and scale-only test using Fisher’s method of combining information. Its test statistic has a nice distribution under the null so does not need simulation type of method to compute p-value.

4. In JLS method: It is assumed that Y is quantitative variable with normal distribution. The true model contains E and its interaction: e.g:

But all the information for E is missing, so we are working on the model

Where we can show then that Y’s variance will differ between different group of G.

For the next step, try to learn the following:

1. Levene’s scale test for testing equality of variance

Levene’s test: Is equivalent to an ANOVA test but with response variable replaced by a difference . It tests for equal variance among groups but is more robust to normality assumption than Barlett Test (you no longer need the normality assumption).

2. Fisher’s method to combine P-values.

Fisher’s method is a way to combine two p-values that are used to come from two independent tests(tests using independent test statistics), and check whether it is likely that both of the null hypothesis do not hold. However, if independency between test statistics does not hold, should switch to Brown’test or Harmonic p-values. Brown’s method is an approximation using scale chi-square distribution, which required the covariance of two test statistics being known. Harmonic p-value method is similar to the idea of Bonferroni correction, but to assign weights to each p-value.