**fastGWA-BB**

**fastGWA-BB: a fastGWA-GLMM Burden test for Binary tratis**

The fastGWA-BB is a burden test based on the fastGWA-GLMM framework in GCTA for gene-based tests of rare variants. FastGWA-BB is an extension of the single-variant test in fastGWA-GLMM to assess the association of a weighted rare allele count of all the tested rare variants in or around a gene with the phenotype, conditioning on the sparse genetic relationship matrix (sparse GRM). The variants weighting method follows that in SAIGE-Burden (Zhou et al. 2020 Nat Genet). Credits: [Zhili Zheng](mailto:zhili.zheng@uq.edu.au) (method and software), [Longda Jiang](mailto:longda.jiang@uq.edu.au)(simulation), and [Jian Yang](http://researchers.uq.edu.au/researcher/2713) (overseeing).

**References**

Jiang L., Zheng Z., Yang J. (2021). FastGWA-GLMM: a generalized linear mixed model association tool for biobank-scale data, 12 February 2021, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-128758/v1](https://europepmc.org/article/PPR/PPR283012)

--burden  
Perform burden tests based on the estimated components from the standard [fastGWA-GLMM step 1](file:///Users/uqljian5/Documents/gcta2_doc_Westlake/build/index.html" \l "fastGWA-GLMM).

--load-model  
To load a saved model from fastGWA-GLMM step 1 to perform burden tests. See [fastGWA-GLMM page](file:///Users/uqljian5/Documents/gcta2_doc_Westlake/build/index.html" \l "fastGWA-GLMM) for details.

--set-list gene\_list.txt  
Input gene list with gene start and end positions.

Input file format  
gene\_list.txt (columns are gene ID, chromosome, left and right boundary of the gene region, and strand)

gene chr start end strand

DDX11L1 1 11873 14409 +

WASH7P 1 14361 29370 +

MIR6859-1 1 17368 17436 +

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Please click the link below to download the gene list file. This is slightly different from the format used by [ACAT-V](file:///Users/uqljian5/Documents/gcta2_doc_Westlake/build/index.html#ACAT-V)

Gene list (hg19): [hg19-gene.list](file:///Users/uqljian5/Documents/gcta2_doc_Westlake/build/res/hg19-gene.list)

--max-maf 0.01  
The maximum minor allele frequency (MAF) allowed for a variant to be included in the ACAT test. Any variant with MAF larger than this value will be excluded.

Examples

# first to obtain the estimated model parameters from fastGWA-GLMM step 1

gcta64 --mbfile geno\_chrs.txt --grm-sparse sp\_grm --fastGWA-mlm-binary --model-only --pheno phenotype.txt --qcovar pc.txt --covar fixed.txt --threads 10 --out geno\_assoc\_mdl

# then to perform fastGWA-BB test for rare variants

gcta64 --burden --bfile geno\_chr1 --load-model geno\_assoc\_mdl.fastGWA --set-list hg19-gene.list --extract rare.snplist --max-maf 0.01 --maf 1e-7 --out burden\_test\_assoc\_chr1

Output file format (columns are gene ID, left- and right- side boundary of the gene region, number of qualified variants in the gene region, average MAF of the qualified variants, fastGWA-BB score statistic, standard error of the score statistic, raw p-value, effect size or log(odds ratio), standard error for the estimated effect size after the SPA correction, p-value after the SPA correction, and an indicator for whether the SPA correction is converged for the gene)

GENE START END VAR\_N MAF\_MEAN T SE\_T P\_noSPA BETA SE P CONVERGE

SAMD11 861120 879961 51 0.0039 -4718.44 6418.35 0.462249 -0.00011453 0.000155803 0.462249 1

PLEKHN1 901876 910484 24 0.0023 -342.052 1266.68 0.787131 -0.00021318 0.000789464 0.787131 1

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