CLUSTERING IN RNA-Seq DATA USING GRADE of MEMBERSHIP MODELS

Kushal K Dey^{1,2}, Chiaowen Joyce Hsiao, Matthew Stephens¹

Department of Statistics, University of Chicago, Chicago, Illinois 60637, USA;

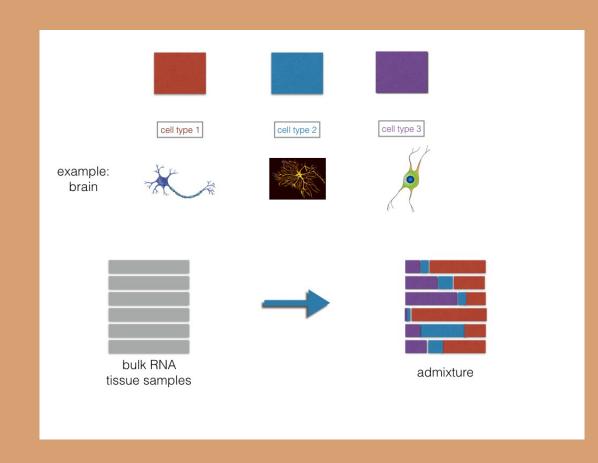
2 Department of Human Genetics, University of Chicago, Chicago, Illinois 60637, USA



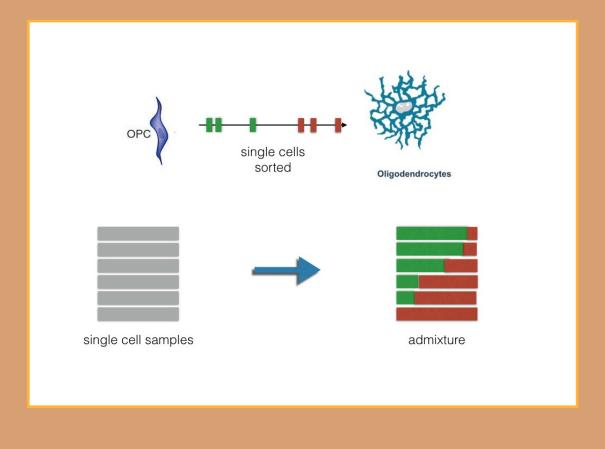
Abstract

We use a model based clustering method, similar to "admixture model" in population genetics for interpreting structure in bulk and single cell RNA-seq read counts data.

Each tissue sample in bulk RNA-seq may have memberships in multiple clusters, which are taken as representatives of different cell types.

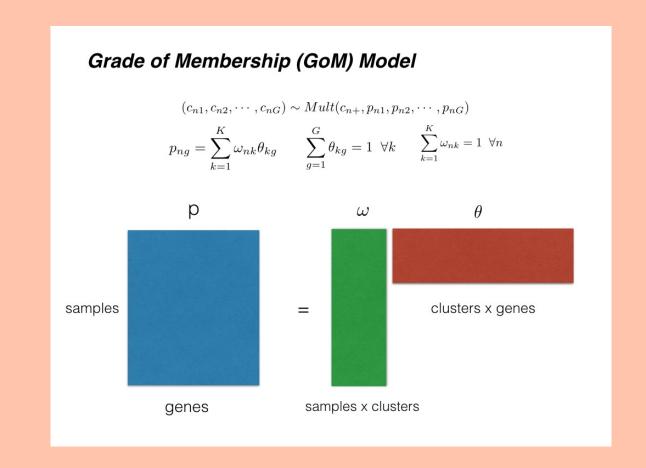


In single cell RNA-seq, each cell may have grades of memberships in the extreme stages of development.



Model

 c_{nq} : reads mapped to gene g for sample n c_{n+} : library size sample n



Applications

- 1. Bulk RNA-seq (GTEx Genotype tissue expression project bulk RNA samples across tissues)
- 2. Single cell RNA-seq (Deng et al 2016 single cell developmental phase data collected from mouse embryo across multiple)

The model fit and the visualization using the Structure plot stacked bar chart

representation is performed by the **Bioconductor** package *CountClust*

3. Guo G, Huss M, Tong GQ, Wang C, Sun LL, Clarke ND, Robson P. Resolution of cell fate decisions revealed by single-cell gene expression analysis

Deng Q, Ramskold D, Reinius B, Sandberg R. 2014. Single-Cell RNA-Seq Reveals Dynamic, Random Monoallelic

4. The GTEx Consortium. 2013. The Genotype-Tissue Expression (GTEx) project. Nature genetics. 45(6): 580-585.

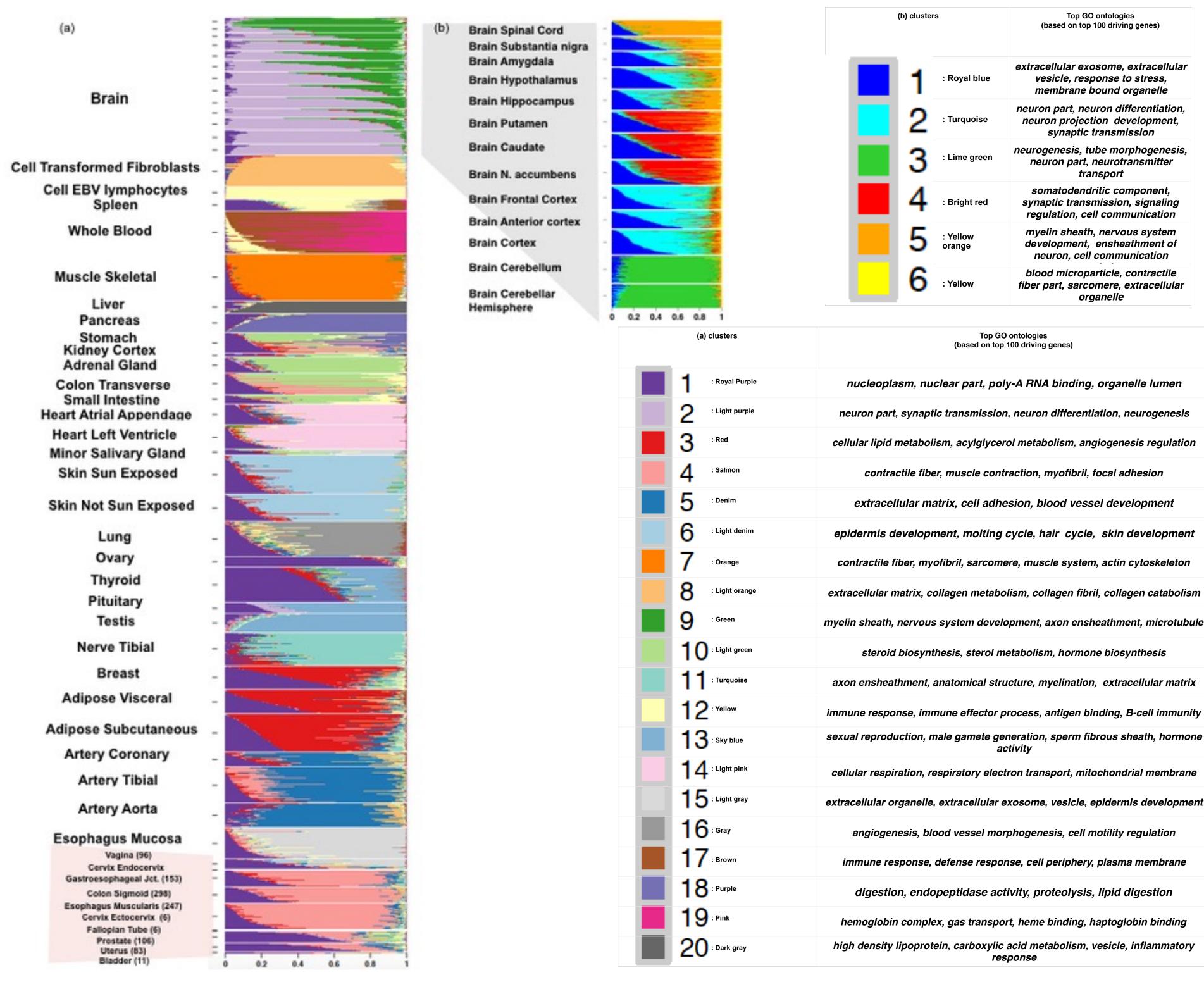
Gene Expression in Mammalian Cells. Science. 343 (6167) 193-196.

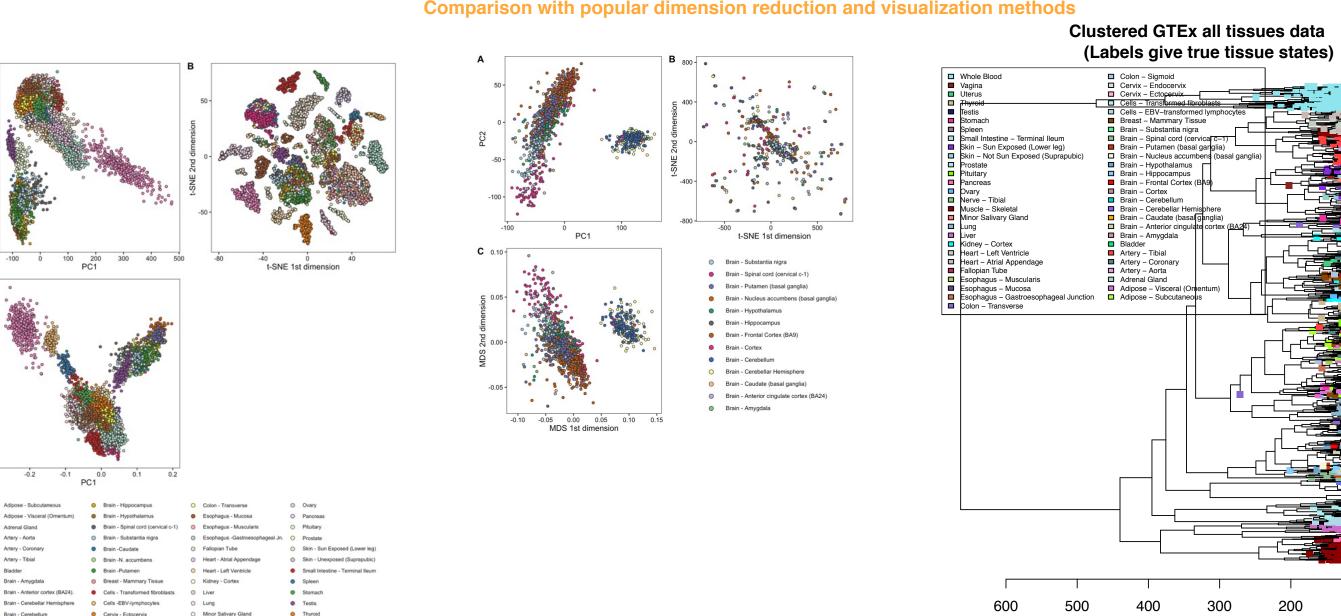
from zygote to blastocyst. Developmental Cell. 18(4), 675-685

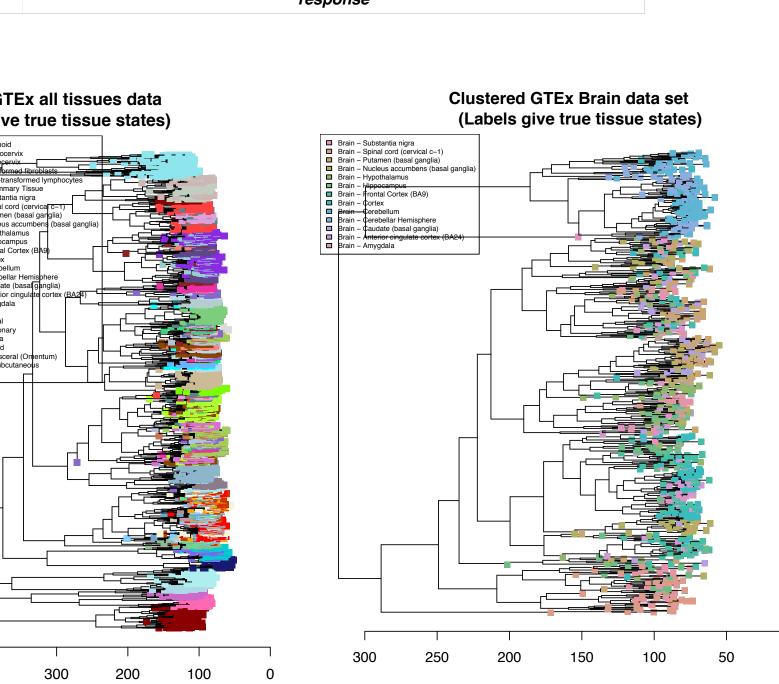
doi:10.1038/ng.2653.

K Dey, C Hsiao, and M Stephens. Clustering RNA-seq expression data using grade of membership model. http://biorxiv.org/content/early/2016/05/03/051631

Bulk RNA-seq (GTEx data) analysis







Single cell RNA-seq analysis (Deng et al 2016)

