

BIOS785/BCB785 Statistical Methods for Gene Expression Analysis (Spring 2019)

Instructor

Yuchao Jiang

Assistant Professor

Department of Biostatistics & Department of Genetics

4115D McGavran-Greenberg Hall & 5112 Genetic Medicine Building

Email: yuchaoj@email.unc.edu

Classes meet

Tuesday and Thursday, 01/09/2019 - 04/26/2019

11:00 AM - 12:30 PM

1305 McGavran-Greenberg Hall

Course description

This course is designed to provide graduate students interested in statistical genetics and genomics with an opportunity to gain or enhance knowledge in gene expression analysis by next-generation sequencing. The course includes two sections: bulk RNA-seq and single-cell RNA-seq (scRNA-seq). Each section starts with biological background, followed by statistical and computational methods, and finishes with biological interpretations and follow-ups. Topics include: data normalization, measurement of error models, dispersion shrinkage, dimensionality reduction, zero-inflated factor analysis, batch correction, clustering algorithm, deconvolution, pseudotime reconstruction, deep neural network, and autoencoder, etc.

Prerequisites

BIOS 661 and 663 or permission of the instructor.

Course content

The following course content is a tentative plan. We may not strictly follow it.

Week	Date	Topics
1	01/10	Overview of molecular biology with emphasis on gene expression
2	01/15 & 01/17	Introduction to bulk RNA-seq, normalization, differential expression
3	01/22 & 01/24	Allele-specific and isoform-specific expression
4	01/29 & 01/31	Expression quantitative trait loci (eQTL)
5	02/05 & 02/07	Introduction to scRNA-seq
6	02/12 & 02/14	Dimensionality reduction, clustering
7	02/19 & 02/21	Noise modeling, normalization, batch correction
8	02/26 & 02/28	Gene expression distribution, identifying differential distributions
9	03/05 & 03/07	No classes (spring break)
10	03/12 & 03/14	Deep neural network for gene expression
11	03/19 & 03/21	Autoencoder for denoising
12	03/26 & 03/28	Pseudo-time reconstruction
13	04/02 & 04/04	Gene expression deconvolution
14	04/09 & 04/11	scRNA-seq in cancer
15	04/16 & 04/18	Final project presentations
16	04/23 & 04/25	Final project presentations