TIGP Bio 2024 Spring Syllabus

Advanced Statistical Methods in Bioinformatics (S2)

For the latest syllabus, please visit the BP website: https://idv.sinica.edu.tw/tigpbio/

Place: Room 308, Institute of Statistical Science, Academia Sinica

Time: Thursday 9:00-12:00

Chair: Dr. Grace S. Shieh (gshieh@stat.sinica.edu.tw)

Outline: Introduction to useful and advanced statistical methods in computational biology. The topics include: Analysis of next generation sequencing (NGS) Data (e.g., RNA-Seq and ChIP-Seq), maximum likelihood estimation, the EM algorithm, Bayesian inference, Monte Carlo methods, Resampling (Bootstrap & permutation test), Human Genetics, clustering and classification, dimension-reduction and missing data.

Textbook: N/A

TA: Rodrigo Espinoza Silva   **Email:** rodespinosas93@gmail.com

Office hours: Tuesdays 14:00~16:00 pm

Office location: Room 5021-3, Research Center for Environmental Changes Building (5th floor, ISS), Academia Sinica

Grades: Midterm exam 50%. Final exam 50%.

【**For Non-BP student**】

For Non-BP student to register/sit-in any BP course, it is required to gain course chair's permission:

(1) Basic Enrollment Information form: https://forms.gle/oK7vJzzrx9EvybbT9

(2) TIGP-BP Course Registration Consent Form:

https://idv.sinica.edu.tw/tigpbio/index/TIGP%20Bioinformatics_Class%20Registration%20Consent%20Form.docx

※ Deadline: **the 4th week** of each semester.

※ Signature of the course chair should be collected before submission. Incomplete form will not be accepted.

※Course grade will NOT be given (even class enrollment is completed at school) if fail to follow the above procedures.

Week	Date	Topics/Brief Description	Sub-topics/Detail Descriptions	Lecturers	Evaluation Method	Email
1	2024/2/21 (Wed) 9:00~12:00	Analysis of NGS data I	Analysis of DNA sequencing data	Dr. Shih-Kai Chu	HW with a specified deadline: ▶ April 11th	uhcnivag@gm.ntpu.edu.tw
2	2024/3/1 (Fri) 9:00~12:00	Analysis of NGS data II	Analysis of RNA sequencing data	Dr. Shih-Kai Chu		
3	2024/3/7	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	HW with a specified deadline: ▶ April 11th	ythuang@stat.sinica.edu.tw
4	2024/3/13 (Wed) 9:00~12:00	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang		
5	2024/3/21	Bayesian Statistics	prior dist., conjugate families & applications to genetics	Dr. Grace S. Shieh	In-class exam on midterm exam date	gshieh@stat.sinica.edu.tw
6	2024/3/28	Resampling methods	Bootstrap for hypothesis testing , confidence interval, and Permutation method	Dr. Grace S. Shieh	HW with a specified deadline: ▶ 6:00 PM, April 26th	
7	2024/4/3 (Wed) 9:00~12:00	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	HW with a specified deadline: ▶ April 22nd	syuan@stat.sinica.edu.tw
8	2024/4/11	Midterm Exam	--	--	--	
9	2024/4/18	Prediction of Drug Response	Feature selction, logistic ridge, KNN, ML and transfer learning	Dr. Grace S. Shieh	HW with a specified deadline: To Be announced	gshieh@stat.sinica.edu.tw
10	2024/4/25	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	HW with a specified deadline: To Be announced	wuhm@g.nccu.edu.tw
11	2024/5/2	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu		
12	2024/5/9	Statistics in Human Genetics/Genomics I	Concept of Statistical Genetics, International Genomic Projects, Linkage Analysis, Genetic Association Analysis	Dr. Hsin-Chou Yang	HW with a specified deadline: To Be announced	hsinchou@stat.sinica.edu.tw
13	2024/5/16	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang		
14	2024/5/23	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	HW with a specified deadline: To Be announced	syuan@stat.sinica.edu.tw
15	2024/5/30	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Shin-Sheng Yuan		
16	2024/6/6	Final Exam	--	--	--	