TIGP Bio 2023 Spring Syllabus

Advanced Statistical Methods in Bioinformatics (S2)

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

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: N/A (Please refer to the lectures respectively shall you have any questions for each class)

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/dbthaUe77GeNziNw5)

(2) TIGP-BP Course Registration Consent Form (http://bit.ly/3ubl2Bs)

※ 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	2023/2/16	Analysis of NGS data I	N/A	Dr. Hao Ho	HW with a specified deadline: ▶April 6th	hho@stat.sinica.edu.tw
2	2023/2/23	Analysis of NGS data II	N/A	Dr. Hao Ho		hho@stat.sinica.edu.tw
3	2023/3/2	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	HW with a specified deadline: ▶April 13th	ythuang@stat.sinica.edu.tw
4	2023/3/9	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang		ythuang@stat.sinica.edu.tw
5	2023/3/16	Bayesian Statistics (was Prediction of Drug Response I)	prior dist., conjugate families & applications to genetics (was Applications of Penalized regression: lasso, ridge & logistic ridge regression)	Dr. Grace S. Shieh	In-class exam on midterm exam date	gshieh@stat.sinica.edu.tw
7	2023/3/30	Resampling methods (was Prediction of Drug Response II)	Bootstrap and Permutation method (was Applications of K-Nearest Neighbor and transfer learning)	Dr. Grace S. Shieh	HW with a specified deadline: ▶April 20th	gshieh@stat.sinica.edu.tw
7	2023/3/30 14:00-17:00	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	HW with a specified deadline: ▶April 13th	shinshengyuan@gmail.com
8	2023/4/6	Midterm Exam	--	--	--	--
9	2023/4/13	Prediction of Drug Response (was Resampling methods)	Feature selction, Penalized regression, KNN and transfer learning (was Bootstrap and Permutation method)	Dr. Grace S. Shieh	No exam. (was HW with a specified deadline)	gshieh@stat.sinica.edu.tw
10	2023/4/19 (Wed) 9:00-12:00	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	HW with a specified deadline: ▶June 1st	wuhm@g.nccu.edu.tw
11	2023/4/26 (Wed) 9:00-12:00	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu		wuhm@g.nccu.edu.tw
12	2023/5/4	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: ▶June 11th	hsinchou@stat.sinica.edu.tw
13	2023/5/11	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang		hsinchou@stat.sinica.edu.tw
14	2023/5/18	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	HW with a specified deadline: ▶June 1st	shinshengyuan@gmail.com
15	2023/5/25	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Hao Ho	HW with a specified deadline: ▶June 9th	hho@stat.sinica.edu.tw
16	2023/6/1	Final Exam	--	--	--	--