

**TIGP Bio 2022 Spring Syllabus**  
**Advanced Statistical Methods in Bioinformatics (S2)**

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

**Place:** Room 107, New Building of the Institute of Information 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:** Yu-Ching Hsu (ychsu20130517@gmail.com)  
**Office hours:** Friday 8:00 am-10:00 am  
**Office location:** Room 108, Institute of Statistical Science, Academia Sinica (changed to online format since 5/3)  
**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 (<http://bit.ly/3g22mfl>)  
 (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
1	2022/2/17	Analysis of NGS data I	N/A	Dr. Hao Ho	HW with a specified deadline
2	2022/2/24	Analysis of NGS data II	N/A	Dr. Hao Ho	HW with a specified deadline
3	2022/3/3	Maximum likelihood estimates and the EM algorithm I	Maximum likelihood estimates	Dr. Yen-Tsung Huang	HW with a specified deadline
4	2022/3/10	Maximum likelihood estimates and the EM algorithm II	The EM algorithm	Dr. Yen-Tsung Huang	HW with a specified deadline
5	2022/3/17	Prediction of Drug Response I	Applications of Penalized regression: lasso, ridge & logistic ridge regression	Dr. Grace S. Shieh	In-class exam on midterm date
6	2022/3/24	Monte Carlo Markov Chains	Monte Carlo Markov Chains	Dr. Shin-Sheng Yuan	HW with a specified deadline
7	2022/3/31	Prediction of Drug Response II	Applications of K-Nearest Neighbor and transfer learning	Dr. Grace S. Shieh	In-class exam on midterm date
8	2022/4/7 @N101	Midterm Exam	--	--	--
9	2022/4/14	Resampling methods	Bootstrap and Permutation method	Dr. Grace S. Shieh	<a href="#">HW with a specified deadline</a>
10	<a href="#">2022/4/20 (Wed) @O108</a>	Cluster Analysis	K-Means, Hierarchical Clustering, Heatmap, Cluster Validation	Dr. Han-Ming Wu	HW with a specified deadline
11	<a href="#">2022/4/27 (Wed) @Webex</a>	Classification and Its Assessment	ROC Curve, Decision Tree, Ensemble Methods	Dr. Han-Ming Wu	HW with a specified deadline
12	<a href="#">2022/5/12 @Webex</a>	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
13	<a href="#">2022/5/18 (Wed) @Webex</a>	Statistics in Human Genetics/Genomics II	Genome-Wide Association Study, Gene-Gene Interaction, Rare Variant Analysis, Polygenic Risk Score	Dr. Hsin-Chou Yang	HW with a specified deadline
14	<a href="#">2022/5/19 @Webex</a>	Advanced regression and dimension reduction I	Sliced Inverse Regression and PHD	Dr. Shin-Sheng Yuan	HW with a specified deadline
15	<a href="#">2022/5/26 @Webex</a>	Advanced regression and dimension reduction II	Liquid Association and related developments	Dr. Hao Ho	HW with a specified deadline
16	2022/6/2	Final Exam	--	--	--