MA 506 Probability and Statistical Inference

Instructor: Prashant Shekhar, PhD

Tentative Schedule for Fall 2022

Week Number: Starting Date (days)	Topic	Homework	Learning Outcome
Unit I: Course Basics			
1: 29th Aug (M,W,F)	Course introduction Python basics Python basics		1 1,2 1,2
2: 5th Sept (W,F)	Probability Statistical inference		1,2,16 1,2,16
Unit II: Regression Inference			
3: 12th Sept (M,W,F)	Regression I Regression II Regression diagnostics	HW1 released	4,5,6,7 4,5,6,7 7
4: 19th Sept (M,W,F)	Confidence Intervals I Confidence Intervals II Regularized regression: Lasso		4,5,7 4,5,7 5,6,12,14,15
5: 26th Sept (M,W,F)	Regularized regression: Ridge Probabilistic regression I Probabilistic regression II	HW1 due HW2 released	4,5,6,12, 15 5,12,13 5,12,13
Unit III: Regression Model Selection			
6: 3rd Oct (M,W,F)	t-statistic, p-value and R^2 F-statistic AIC and BIC		7, 13 7, 13 7, 13
7: 10th Oct (M,W,F)	CV and GCV K-fold CV: I K-fold CV: II	Project details due HW2 due	7, 12, 13 7, 11,12,13 7, 11,12,13
8: 17th Oct (M,W)	Test 1: review Test 1	HW3 released	
Unit IV: Classification Inference			
9: 24th Oct (M,W,F)	Introduction Logistic regression Regularized classification		8 8,9 12,13
10: 31st Oct (M,W,F)	Probabilistic classification I Probabilistic classification II Probabilistic classification III	HW3 due	10,11,12 10,11,12 10,11,12
Unit V: Classification Model Selection			
11: 7th Nov (M,W)	Metrics of performance Threshold metrics	HW4 released	3, 10 3, 10
12: 14th Nov (M,W,F)	Ranking metrics Probability metrics Choosing metric of performance		3, 10 3, 10 3, 10
13: 21th Nov (M)	Test 2 review	HW4 due	
Thanksgiving break			
Course Conclusion			
14: 28th Nov (M,W,F)	Test 2 Project presentation I Project presentation II		 16 16
15: 5th Dec (M,W)	Project presentation III Project presentation IV	Project due	16 16

Learning outcome: After successful completion of this course, you will acquire knowledge to:

1. Understand the basics of statistical learning and its relation to machine learning.

2. Understand the basics of python and using it as a tool to solve problems in statistical learning.

3. Assess the quality of various statistical learning approaches based on various available metrics

4. Understand different problems in supervised learning.

5. Delve deeper into various aspects of linear regression.

6. Understand and implement multiple linear regression

7. Better understand various issues one might face while using linear regression as a tool to understand different properties of data.

8. Understand basics of classification and its relation to regression.

9. Use logistic regression as a tool to solve classification problems.

10. Compare different classification models for your own problem.

11. Use various resampling approaches to make an intelligent choice of a model for your own data science related problem.

12. Use regularization as a way to produce better models.

13. Understand various ways of controlling the complexity of your statistical learning model.

14. Use dimensionality reduction as a tool to simplify your model to achieve better generalization.

15. Interpret data and models in higher dimensions.

16. Apply the concepts learnt in class to problems of practical importance.