Shanghai Jiao Tong University

MA967 Statistics of Stochastic Processes

Instructor Information:	Xiaojun Zhu Home Institution: Xi'an Jiaotong-Liverpool University Email: Xiaojun.Zhu@xjtlu.edu.cn Office Hours: Determined by Instructor		
Term:	December 16, 2019 - January 7, 2020	**Credits:**	4 units
Class Hours：	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2 hours each week, conducted by teaching assistant(s)		
Total Contact Hours:	64 contact hours (1 contact hour = 45 mins, 2880 mins in total)		
Required Texts (with ISBN):	Unit information, summary lecture notes, assignments, exercises, marks, all handouts and all announcements are made available during class. Mathematical Statistics and Stochastic Processes, Denis Bosq, Wiley.		
Prerequisite:	Students need to finish one of the three courses below: Mathematics of Uncertainty Mathematical Statistics Probability and statistical inference for economics and business		

Course Overview

Standard statistical methods always assume that the sampling data are independent and identically distributed. However, in practice, it is quite common that the observed data are correlated, for example in chemistry, economics, biology and so on. Stochastic Processes are ways of modelling this relationship. This course aims to familiarize students with such statistical processes.

The following topics will be covered in this course: Review of probability and mathematical statistics; convergence of random variables and measures; Decision theory: loss function, Bayesian statistics; Classical theory of estimation: bias, consistency, sufficiency, completeness, efficiency, maximum-likelihood estimation, Bayesian estimator, likelihood ratio test; Stochastic processes: Stationary processes, Markov processes, Poisson processes, Square-integrable processes, Diffusion processes, ARMA; Prediction.

Learning Outcomes

On completion of this subject students should be able to

1. Familiar with the maximum likelihood estimation, likelihood ratio test;
2. Clear the principle of Bayesian analysis and use it for parameter estimation and model selection;
3. Understand the basic concepts of common random processes;
4. Estimate the unknown parameter(s) and derive the corresponding properties of the estimator(s) for a given model;
5. Perform model selection (and verification) for stationary, ARMA and diffusion processes;
6. Construct statistical predictor for ARMA.

Grading Policy

Assignment	24%
Quiz	10%
Participation	6%
Final exam	60%

Grading Scale

Number grade	Letter grade	GPA
90-100	A	4.0
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3.0
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2.0
62-64	C-	1.7
60-61	D	1.0
≤59	F (Failure)	0

Class Schedule

Date	Lecture	Readings
Day 1	Probability and Mathematical Statistics Revision & (Measure Theory based) Convergence	Chapter 1 Teaching Materials
Day 2	(Measure Theory based) Convergence & Decision Theory	Chapter 2 Teaching Materials
Day 3	Decision Theory & Estimation	Chapters 2 & 5 Teaching Materials
Day 4	Estimation & Likelihood Ratio Test	Chapters 5 & 7 Teaching Materials
Day 5	Linear Models	Teaching Materials
Day 6	Introduction to Stochastic Processes	Chapter9 Teaching Materials
Day 7	Introduction to Stochastic Processes & Quiz	Chapter9 Teaching Materials
Day 8	Weakly Stationary Processes	Chapter 10 Teaching Materials
Day 9	Poisson processes	Chapter 11 Teaching Materials
Day 10	Square-integrable processes	Chapter 12 Teaching Materials
Day 11	Diffusion Processes	Chapter 13 Teaching Materials
Day 12	ARMA Processes	Chapter 14 Teaching Materials
Day 13	Prediction	Chapter 15 Teaching Materials
Day 14	Revision	
Day 15	**Final exam**	