南方科技大学 SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

课程详述
COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	**课程名称 Course Title**	贝叶斯统计 Bayesian Statistics
2.	**授课院系 Originating Department**	统计与数据科学系 Department of Statistics and Data Science
3.	**课程编号 Course Code**	STA306
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业核心课 Major Core Courses **（请保留相应选项 Please only keep the relevant information）**
6.	**授课学期 Semester**	春季 Spring
7.	**授课语言 Teaching Language**	中英双语 English & Chinese **（请保留相应选项 Please only keep the relevant information）**
8.	**授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）**	焦熙云， 统计与数据科学系，email: jiaoxy@sustech.edu.cn Xiyun Jiao, Department of Statistics and Data Science, email: jiaoxy@sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	待公布 To be announced **（请保留相应选项 Please only keep the relevant information）**
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
学时数 Credit Hours	48	0	0		48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	数理统计（MA204） Mathematical Statistics（MA204）
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 None
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程介绍贝叶斯统计的基本理论和方法，包括引入先验分布，推导后验分布并针对后验进行统计推断。本课程还将重点介绍贝叶斯分析中的统计计算方法，并引导学生利用 R 语言进行贝叶斯模拟和推断。此外，本课程还将简要介绍高斯过程、贝叶斯网络等贝叶斯统计中的热点进阶问题。本课程的目标是使已经修读经典的概率统计（频率学派）课程的学生了解贝叶斯统计的基本思想，掌握贝叶斯统计的基本方法，为在实际中使用和研究贝叶斯统计打下良好的基础。

The course will introduce the basic concepts and methods in Bayesian statistics, including specifying the prior distribution, deriving the posterior distribution and conducting statistical inference based on the posterior. This course will also focus on the statistical computing methods in Bayesian analysis, and teach the students to use R to perform Bayesian simulation and inference. Moreover, the course will briefly introduce some advanced hot-spot topics in Bayesian statistics, such as Gaussian process, Bayesian network, etc. The aim of this course is to provide the students who have already got the knowledge of frequentist's statistics with the core philosophy and fundamental methods of Bayesian statistics, and help them lay a solid foundation for further exploration in this area.

16. 预达学习成果 Learning Outcomes

学习本课程之后，学生应了解贝叶斯与频率统计的区别与联系，熟练掌握贝叶斯统计的基本理论方法，包括能够在各类不同模型下引入先验分布、推导后验分布以及针对后验分布进行统计推断。学生还应掌握常见的贝叶斯后验抽样方法，并能将它们应用在解决实际问题中。

After studying this course, the students should know the connection and difference between the Bayesian and frequentist's statistics, and also have a good mastery of the basic concepts and methods in Bayesian statistics, including specifying the prior distribution, deriving the posterior distribution and conducting statistical inference based on the posterior under various models. The students should also have a good knowledge of the commonly used Bayesian posterior sampling methods and be able to use them to solve real problems in practice.

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Week 1: Introduction: general concepts in Bayesian analysis; prior and posterior distributions; Bayesian inference. (2 hours)

Week 2: Single-Parameter Models: methods of computing posterior distributions for single-parameter models; various types of prior distributions. (4 hours)

Week 3-4: Multi-Parameter Models: methods of computing posterior distributions for multi-parameter models. (4 hours)

Week 4-6: Hierarchical Models: hierarchical model settings and inference. (6 hours)

Week 6-8: Model Checking: goodness-of-fit; Posterior Predictive p-value. (6 hours)

Week 8-10: Model Comparison: Bayesian hypothesis testing; model comparison criterion. (6 hours)

Week 10-12: Bayesian Computation: numerical integration; distributional approximations; various sampling methods. (6 hours)

Week 12-14: Markov Chain Simulation: Gibbs sampler; Metropolis-Hastings algorithms; convergence diagnostics; R demonstration session. (8 hours)

Week 15-16: Advanced topics: Gaussian process, Bayesian network, etc.

18. 教材及其它参考资料 Textbook and Supplementary Readings

教材（Texbook）：

Gelman, A., Carlin, J. B., Stern, H. S, Dunson, D. B., Vehtai, A. and Rubin, D. B. (2013). Bayesian Data Analysis(3rd edition). Chapman & Hall/CRC, New York.

其他参考资料（Supplementary Readings）：

1. Robert, C.P. and Casella, G. (2005). Monte Carlo Statistical Methods (2nd edition). Springer, New York.
2. Gilks, W.R., Richardson, S. and Spiegelhalter, D.J. (1996). Markov Chain Monte Carlo in Practice. Chapman & Hall, London.
3. Congdon, P. (2001). Bayesian Statistical Modelling. Wiley, New York.

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				

课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		20		
平时作业 Assignments		40		
期中考试 Mid-Term Test				
期末考试 Final Exam		40		
期末报告 Final Presentation				
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 **GRADING SYSTEM**

☑ A. 十三级等级制 **Letter Grading**
☐ B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. **本课程设置已经过以下责任人/委员会审议通过**
This Course has been approved by the following person or committee of authority