



工程概率统计

Probability and Statistics for Engineering

课程引言

Course Introduction

Opening remarks

■ Instructors



Cong Xu (徐匆) xuc6@sustech.edu.cn

- Lecturer, Department of Statistics and Data Science
- **Office hour: Friday 16:00-18:00, Business School Building 322**
- Ph.D. in Statistics, University of California, Davis
- Research interest: Survival Analysis, Clinical Trial Design



Yuxin Tao (陶宇心) taoyx@sustech.edu.cn

- Assistant Professor, Department of Statistics and Data Science
- **Office hour: Wednesday 10:00-12:00, Business School Building 352**
- Ph.D. in Statistics, Tsinghua University
- Research interest: Financial Statistics, Time Series Analysis, Network Data Analysis



Opening remarks

■ Teaching Assistants



Lang Mo (莫浪)

商学院336

周二 19:00-21:00

12332894@mail.sustech.edu.cn



Yue Zhou (周玥)

商学院336

周一 20:00-22:00

12432285@mail.sustech.edu.cn



Jianjie Zheng (郑剑杰)

商学院336

周二 15:00-17:00

12432284@mail.sustech.edu.cn



Peng Lai (赖鹏)

商学院336

周二 10:00-12:00

12432270@mail.sustech.edu.cn



Xiaodong Lao (劳晓东)

商学院336

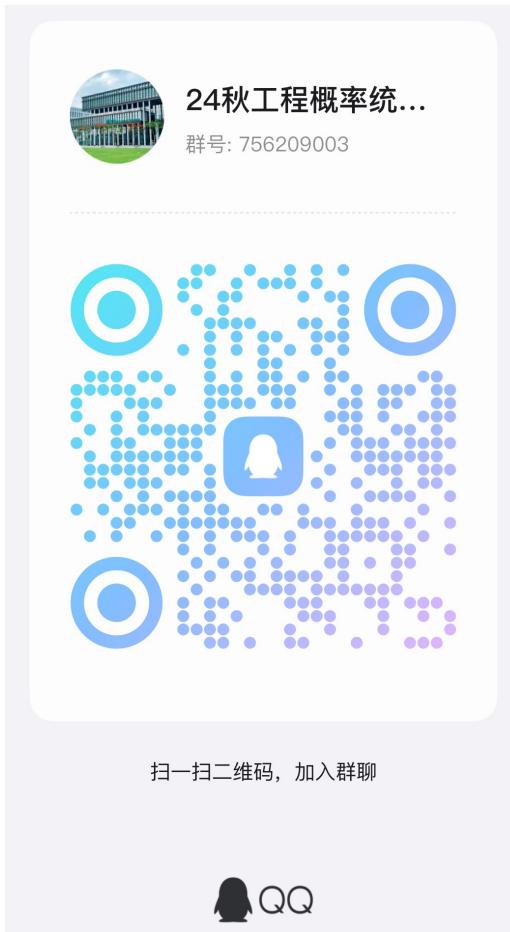
周四 15:00-17:00

12432271@mail.sustech.edu.cn



Opening remarks

■ Course Information



Course evaluation:

- 20% Assignments
- 30% Midterm Exam (**第8周周日, November 3rd, 10:00-12:00**)
- 50% Final Exam
- No adjustment will be made if your final grade is just below the cutoff grade for the next GPA level (卡绩不调整)

Assignment regulation:

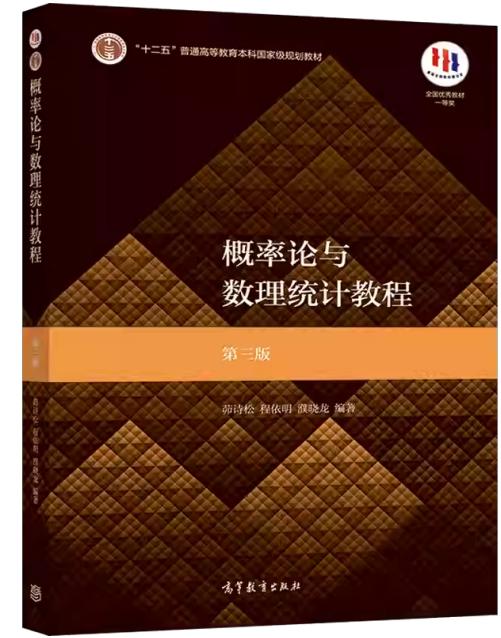
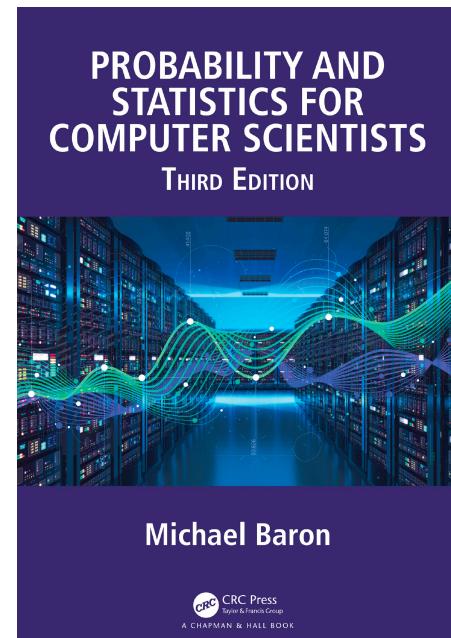
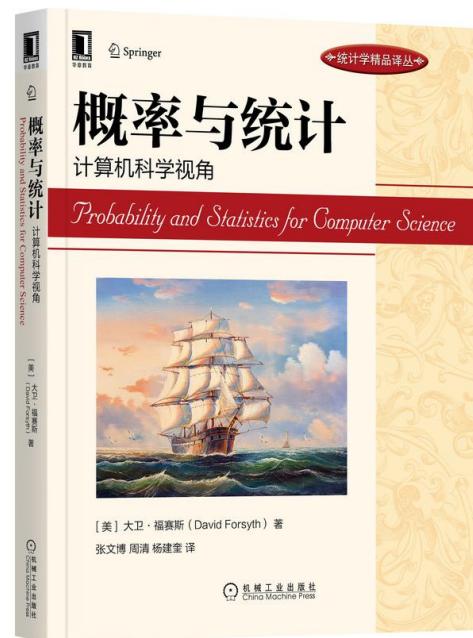
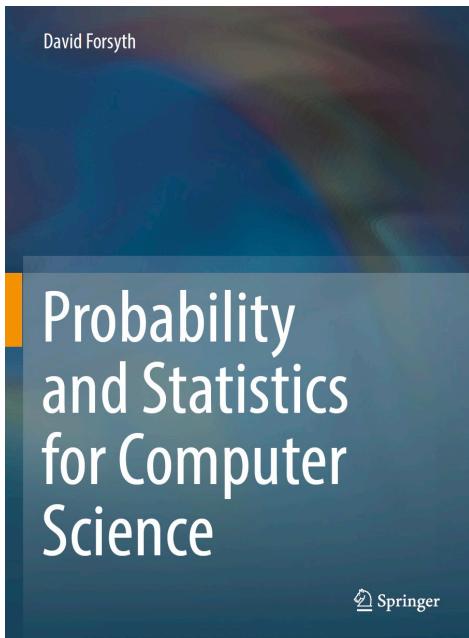
- Assignments will be released and submitted on BB.
- Assignments should be submitted before the deadline (DDL).
- If submitted within 1 day after the DDL, multiply the score by 0.8.
- If submitted within 2 days after the DDL, multiply the score by 0.6.
- If submitted within 3 days after the DDL, multiply the score by 0.4.
- If submitted beyond 3 days after the DDL, the score will be 0.



Opening remarks

■ Course Information

The course will be primarily based on our lecture slides (will be uploaded to BB), we will not follow exactly any one of the following books, but they can be used as references.



Chinese version, not
very well translated



What are probability and statistics?

Probability Theory

- Probability theory is a branch of mathematics that focuses on the study of probability and random phenomena, primarily dealing with random events, random variables, and stochastic processes.



Deterministic Phenomenon



Random Phenomenon



What are probability and statistics?

Statistics

- Statistics are data or other information that describe/summarize a certain phenomenon.
- Statistics involve the collection, processing, and analysis of data related to a certain phenomenon.

Descriptive Statistics

- Focus on summarizing and describing the features of a dataset.
- Include computing measures such as **mean** (均值), **median** (中位数), **variance** (方差), **standard deviation** (标准差), etc.
- Also include the creation of graphical representations like **histograms** (直方图), **bar charts** (柱状图), etc.

Inferential Statistics

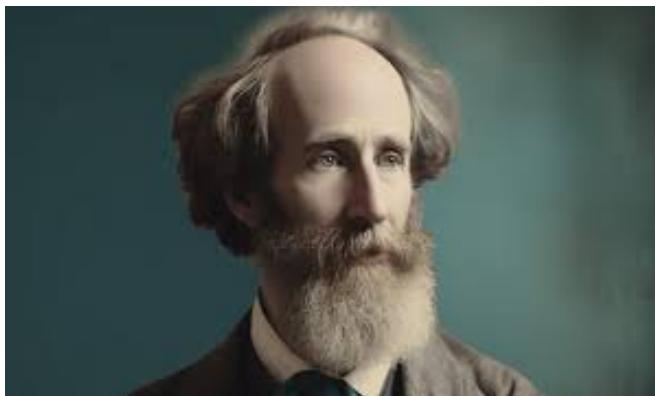
- Focus on making predictions or inferences about a population based on a sample.
- Include the use of probability theory to estimate population parameters, test hypotheses, and make decisions.
- Techniques such as **confidence intervals** (置信区间), **hypothesis tests** (假设检验), and **regression analysis** are commonly used.



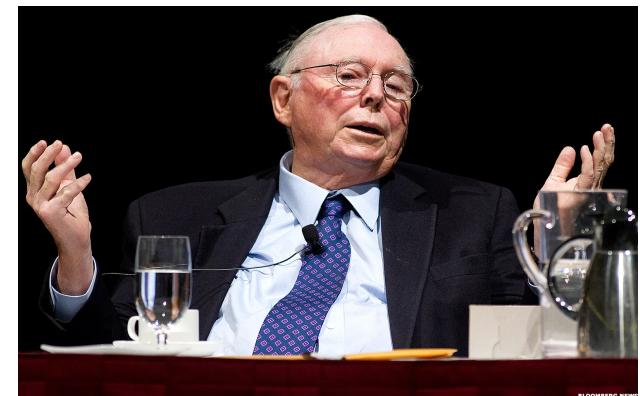
Why learn probability and statistics?



The most important questions of life are indeed, for the most part, really only problems of probability.



The true logic for this world is the Calculus of Probabilities, which takes account of the magnitude of the probability.



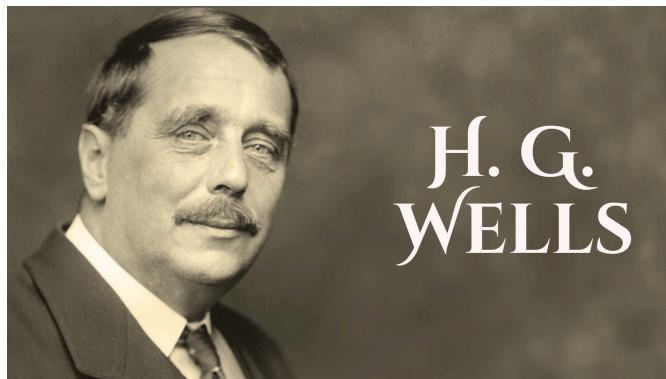
If you don't get this elementary, but mildly unnatural, mathematics of elementary probability into your repertoire, then you go through a long life like a one-legged man in an ass-kicking contest.



Why learn probability and statistics?



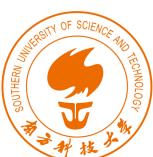
To understand God's thoughts we must study statistics, for these are the measure of His purpose.



Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.



人工智能的本质是统计学。
The essence of artificial intelligence is statistics.



Why learn probability and statistics?

- Probability and statistics have permeated every aspect of daily life, socio-economic activities, and scientific research:
 - **Insurance:** use probability theory and statistical analysis to assess risk and determine premiums.
 - **Lotteries and gambling games:** designed based on probability theory, involving the calculation of winning probability.
 - **Financial investment:** employ probability and statistics to assess potential returns and risks of investments, helping to optimize investment strategies.
 - **Market analysis:** use probabilistic and statistical models to forecast market trends, consumer behavior, and sales performance, aiding in marketing and product development.
 - **Medical research:** apply statistical methods to evaluate the effectiveness of new drugs or treatments in clinical trials, determining their efficacy across different patient groups.
 - **Weather forecasting:** use probabilistic and statistical models to predict weather patterns, including the likelihood of rain, storms, and other natural phenomena.
 - **Physics:** in quantum mechanics, probability theory is fundamental to understanding the behavior of microscopic particles, such as the probability distributions of particle positions and velocities.



Why this course?

- This course is a prerequisite for subsequent courses such as [Machine Learning](#) and [Artificial Intelligence](#), which require a solid foundation in mathematics, particularly in areas like Linear Algebra, Optimization, and Probability and Statistics.
- What's the difference between this course and the traditional Probability and Statistics course?
- This course more comprehensively covers the knowledge required in the field of machine learning.
 - Besides traditional topics like random variables and distributions, parameter estimation and hypothesis testing, we supplement topics on [stochastic processes](#), [Monte Carlo methods](#), [sampling techniques](#), etc.
- This course not only emphasizes calculation but also places greater importance on understanding the underlying logic and applications behind the knowledge.
- This course uses Python as a tool to demonstrate the course content, reinforcing knowledge comprehension and achieving seamless integration with engineering applications.



How to excel in this course?

- Preview before class.
- Listen carefully in class.
- Practice after class.
- Think independently first, then proactively seek help when encountering a problem.



End of Course Introduction

