DOWNLOAD PDF PROBABILISTIC SYSTEMS ANALYSIS AND APPLIED PROBABILITY

Chapter 1 : MIT 0CW - Probabilistic Systems Analysis and Applied Probability

Welcome to /, a subject on the modeling and analysis of random phenomena and processes, including the basics of statistical inference. Nowadays, there is broad consensus that the ability to think probabilistically is a fundamental component of scientific literacy.

The ability to think probabilistically is a fundamental component of scientific literacy. You will learn the relevant models, skills, and tools that are the keys to analyzing data and making scientifically sound predictions under uncertainty. We emphasize the basic concepts and methodologies, and include dozens of examples and applications. Probabilistic Systems Analysis has been offered and continuously refined at MIT for more than fifty years. The class is offered through the Electrical Engineering Department and has, over time, served multiple constituencies from engineering, operations research, and the sciences. Unlike traditional mathematics classes, it aims to develop the skills and intuition that are most useful to practicing engineers and scientists. On campus, it is taken by a large number of students with diverse backgrounds and a broad range of interests. They span the entire spectrum from freshman to beginning graduate students, and from the Engineering School to the School of Management. Prerequisites The prerequisites for this course are It requires a level of comfort with mathematical reasoning, familiarity with sequences, limits, infinite series, and the chain rule, as well as the ability to work with ordinary or multiple integrals. Until quite recently, scientific literacy meant knowing calculus, some physics, and some chemistry. Even with the introduction of computers and computation, this was all that you needed to know in order to make sense of the world. But these days, you cannot understand what is going on around you if you do not understand the uncertainty attached to nearly every phenomenon. This is why probability is now a central component of scientific literacy. What is it that has changed and has caused this shift? There are two main factors: As science and engineering move forward, we end up dealing with more and more complex systems. In a complex system, we cannot expect to have a perfect model of each component or to know the exact state of every piece of the system. So, uncertainty is now at the foreground, and needs to be modeled. We live in an information society. Data and information play a central role both in our individual lives and in the economy as a whole. They are only useful because they can tell us something we did not know. Their reason for existence is to reduce uncertainty. And this is why understanding probability theory and its childrenâ€”statistics and inferenceâ€”is a must. If these arguments sound a bit abstract, just think of any scientific field, and you quickly realize that pretty much everything is subject to uncertainty and calls for probabilistic models. Quantum mechanics has taught us that nature is inherently uncertain. Biological evolution progresses through the accumulation of many random effects such as mutations within an uncertain environment. Biological data is rapidly amassing, and that data needs to be sifted, using statistical tools, to extract useful information. Communications and signal processing are largely a fight against noise. The effort to clean signals from noise that nature has added is essential to successful communication. Customer demand is random, yet you need to be able to model it and predict it. Financial markets are uncertain. Whoever has the best methods to analyze financial data has an advantage. Transportation systems are subject to random disruptions, due to weather or accidents, and are a major concern. Social network trends spread like epidemics and in ways that are hard to predict. The message is clear: The first step in fighting an enemy like randomness is to study and understand it. Course Objectives Master the basic concepts associated with probability models. Be able to translate models described in words to mathematical ones. Understand the main concepts and assumptions underlying Bayesian and classical inference. Obtain some familiarity with the range of applications of inference methods. Become familiar with basic and common probability distributions. Learn how to use conditioning to simplify the analysis of complicated models. Have facility manipulating probability mass functions, densities, and expectations. Understand the power of laws of large numbers and be able to use them when appropriate. Develop a solid understanding of the concept of conditional expectation and its role in inference. Learn how to formulate

simple dynamical models as Markov chains and analyze them. Become familiar with the basic inference methodologies for both estimation and hypothesis testing and be able to apply them. Textbook The text for this course is: Bertsekas, Dimitri, and John Tsitsiklis. Athena Scientific , The on-campus course has three types of class sessions: The lectures and recitations each meet twice a week, and the optional tutorial meets once a week. Lectures introduce new concepts. They have an overview character, but also include some derivations and motivating applications. In recitations, the instructor elaborates on concepts presented in lecture, working through new examples with student participation, and answers questions. In tutorials, students discuss and solve new examples with some help from classmates and the instructor. Tutorials are active sessions designed to help students develop confidence in thinking about probabilistic situations in real time. MIT students who take the corresponding residential class typically report an average of hours spent each week, including lectures, recitations, readings, homework, and exams. The Scholar course has four major learning units. Each unit has been divided into a sequence of lecture sessions that include A lecture video by Professor Tsitsiklis The slides shown in that lecture Suggested textbook readings Recitation Problems and Solutions Tutorial Problems and Solutions To help guide your learning, some of these problems have an accompanying Help Video where an MIT Teaching Assistant solves the same problem. To learn more, visit the Meet the Team page.

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Chapter 2 : MIT Probabilistic Systems Analysis and Applied Probability

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Included in this opening day handout: General Information please digest it before next lecture. This fundamental subject is concerned with the nature, formulation, and analysis of probabilistic situations. No previous experience with probability is assumed. Undergraduates must register for 6. Graduate students must register for 6. Graduate G credit is given for 6. We have three types of class sessions: They have an overview character, but also include some derivations and motivating applications. Lectures are twice a week and 1 hour a session. In recitation, your instructor elaborates on the theory, solves new examples, and answers your questions about them. In tutorial, you discuss and solve new examples with a little help from your classmates and your instructor. Tutorials are active sessions to help you develop confidence in thinking about probabilistic situations in real time. We will also have copies of these assignments on second lecture date. Requests for a change of tutorial hour must include a revised tutorial schedule form, and should be submitted promptly to the Head TA by second lecture date. Be sure your instructor explains a simple way to arrange such meetings during your first recitation and tutorial. If you have already made a reasonable effort, your instructor will be glad to help you with homework problems, before or after they are due. New problems, not homework problems, are discussed in recitations and tutorials. Most matters, such as reasons for missing tutorials, are best discussed with your own instructor. Graded homework problems and exams will usually be returned to you by your instructor. Lectures, recitations, tutorials and homework will be based primarily on the text book: Tsitsiklis, Introduction to Probability. Additionally, the following books will be on reserve in the Barker Engineering Library. They cover many of the topics in this course, although in a different style. You may wish to consult them to get a different perspective on particular topics: Drake, Fundamentals of Applied Probability Theory. Ross, A First Course in Probability. Goodman, Probability and Stochastic Processes. The book by Ross has a fair number of more challenging examples. Solutions will be handed out on the day homework problems are due. We expect you to turn in all homework assignments on time. Late homework will not be accepted. As will be explained in class, we grade homework, but only superficially. We do distribute thorough solutions. Your TA is available to discuss your work with you, both before and after it is due. You may encounter difficulty figuring out where your own solution of a homework problem went astray. There are many ways to approach most probability problems. Please let your instructor help you whenever such issues occur. There will be two quizzes, during regular class hours 1 hour. There will also be a comprehensive final examination during finals week. After all of your tutorials, homeworks, quizzes, and final exam, your instructor has a pretty good idea of your understanding of the material. Final grades are assigned in a meeting by the entire staff. Your instructor is not allowed to discuss likely final grades with you. In order to get the most out of the course, try to stay ahead. During each weekend, review the material covered in the lectures of the preceding week. Read the assigned material, but at a minimum, make sure to review the transparencies handed out at lecture. This way, recitations and tutorials will be much more informative and meaningful. Talking about things is a great way to learn. Regarding homework, the following is a fruitful and acceptable form of collaboration: An unacceptable form of dealing with homework is to copy a solution that someone else has written. Honesty Honesty is important, and the classroom is no exception. We expect students to adhere to basic, common sense concepts of academic honesty. The appropriate authorities at MIT will be notified in cases of academic dishonesty. After an exam has been returned, we give students a limited amount of time to resubmit their quizzes for regrades if they feel that there is a problem with the grading on their exam. If you submit an exam to be regraded, do not write anything at all on the exam booklet. Please write a note on a separate sheet of paper. Any attempt to modify an exam booklet is considered a serious breach of academic honesty. We photocopy a substantial fraction of the exams before they are returned and

the probability of catching a change is high. Additional Help from Staff Members Your recitation instructor will explain how to reach her or him on reasonably short notice. Staff members will also reserve some uninterruptible, safe time for their other activities. Optional quiz reviews are presented uniformly for the entire class, not for individual sections. Similarly, any supplementary handouts will be identical for all sections. Special Personal Situations Special things happen to many of us during the semester. If you have quizzes immediately before or after our quizzes or cannot a quiz, please contact the Head TA as soon as possible.

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Chapter 6 : Probabilistic Systems Analysis and Applied Probability - Aikademi

The OCW Scholar course combines content previously published on the Fall OCW site Probabilistic Systems Analysis and Applied Probability with 51 new videos recorded in by MIT Teaching Assistants. The Scholar course has four major learning units.

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Which one is better to build intuition on probability, Statistics from Harvard or Probabilistic Systems Analysis / from MIT? What is it like to take Statistics (Introduction to Probability) at Harvard?