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MAP: Cancer prediciton and Python implementation -- Problem Set 5 -- Chapter 18. Maximum Likelihood Estimation (MLE) -- Chapter 19. MLE: Law of large numbers -- Chapter 20. MLE: Gaussian distribution -- Chapter 21. MLE: Gaussian distribution estimation and Python implementation -- Chapter 22. Central limit theorem -- Problem Set 6 -- Part III. Information Technology Applications -- Chapter 23. Communication: Probabilistic modeling -- Chapter 24. Communication: MAP principle -- Chapter 25. Communication: MAP under multiple observations -- Chapter 26. Communication: Repetition coding and Python implementation -- Problem Set 7 -- Chapter 27. Social networks: Probabilistic modeling -- Chapter 28. Social networks: ML principle -- Chapter 29. Social networks: Community detecition and Python implementation -- Problem Set 8 -- Chapter 30. Speech recognition: Probabilistic modeling -- Chapter 31. Speech recognition: MAP principle -- Chapter 32. Speech recognition: Viterbi algorithm -- Chapter 33. Speech recognition: Python implementation -- Problem Set 9 -- Appendix A: Python basics -- Bibliography -- Index.

Sommario/riassunto

This book introduces probabilistic modelling and to study its role in solving a wide variety of engineering problems that arise in Information Technology (IT). The book consists of three parts. The first introduces the basic concepts of probability: sample space, events, conditional probability, independence, total probability law, random variables, probability mass functions, density functions and expectation. In the second part, we study the concept of random processes, as well as key principles such as Maximum A Posteriori (MAP) estimation, Maximum Likelihood (ML) estimation, law of large numbers and central limit theorem. Using the language and principles acquired in the prior parts, the last discusses IT applications chosen from communication, social networks and speech recognition. The book puts a special emphasis on “probability in action”: probabilistic concepts are taught through many running examples, killer applications and Python coding exercises. One defining feature of this book is that it succinctly relates the “story” of how the key principles of probability play a role, via classical and trending IT applications. All the key “plots” involved in the story are coherently developed with the help of tightly-coupled exercise problem sets, and the associated fundamentals are explored mostly from first principles. Another key feature is that it includes programming implementation of toy examples and various algorithms inspired by fundamentals. It also provides a brief tutorial of the used programming tool: Python. This book does not follow a traditional book-style organization, but is streamlined via a series of lecture notes that are intimately related, centered around coherent storylines and themes. It serves as a textbook mainly for a sophomore-level undergraduate course, yet is also suitable for a junior or senior-level undergraduate course. Readers benefit from having some mathematical maturity and exposure to programming. But the background can be supplemented by almost self-contained materials, as well as by numerous exercise problems intended for elaborating on non-trivial concepts. In addition, Part III for IT applications should provide motivation and insights to students and even professional engineers who are interested in the field.