

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

6.s077

Spring 2018

Reading pointers for Lectures 5-6 (Bayesian methods)

Sources:

- The lecture slides should be your primary point of departure. Please make sure you understand everything on there. If something feels unclear, please ask, during office hours, or by appointment.
- [BT] Bertsekas & Tsitsiklis, *Introduction to Probability*. Chapter 8 is pretty well aligned with the material covered in these two lectures, and has many more examples than we had time to cover.
- [W] Wasserman, *All of Statistics*, is available for online reading through the MIT library. It is an excellent and concise text, but does not have much material on Bayesian methods.
- Lectures 14-17 of 6.041x contain all of the material on Bayesian inference in our Lectures 5-6, with some more details and examples.

List of topics covered and pointers.

- 5.1. **Optimality property of conditional expectation.** Pages 430-431 of [BT].
- 5.2. **The Bayesian framework and posterior distributions.** Section 8.1 of [BT]. See also Section 3.6 of [BT] for the derivations of the different variants of Bayes' rule. A brief discussion is provided in Sections 11.1 and 11.2 of [W].
- 6.1. **MAP estimation.** Section 8.2 of [BT]. You can skip the material on MAP for Hypothesis Testing for now.
- 6.2. **Examples and properties of LMS estimation.** Section 8.3 of [BT].
- 6.3. **Linear least mean squares estimation.** Section 8.4 of [BT].
- 6.4. **Multidimensional linear normal models.** These are models where all random variables of interest (unknowns, noise, observations) are linear functions of a fundamental underlying set of **independent** normal random variables. They have beautiful properties: conditional expectations are always linear functions of the data; posterior distributions are always normal. However, a full study of such models is beyond our scope.

- 6.4. **Trajectory estimation.** Linear normal models are very common in signal processing, filtering, tracking, navigation, and many other applications. The example in lecture was just a glimpse. A writeup of a simpler variant of trajectory estimation is posted under Materials, and corresponds to a video clip in Lecture 15 of the EdX version, 6.041x.