Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.432 STOCHASTIC PROCESSES, DETECTION AND ESTIMATION

Recitation 5 Outline

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Bayes' Least Squares Estimation

1. Iterated expectation: $E[x] = E\left[E[x|y]\right]$

2. Useful implications for Bayes' least squares estimation:

$$E[x] = E[\hat{x}_B(y)]$$
$$E[xy] = E[y\hat{x}_B(y)]$$
$$\lambda_B = E[x^2] - E[\hat{x}_B(y)x]$$

3. Sample Bayes' least squares problem: Use of iterated expectation

Vector Spaces and Linear Least Squares

1. Comparison: $\mathbb{R}^n$ versus $\mathcal{RV}$ (zero mean, finite variance random variables)

   - Inner products
   - Norms
   - Orthogonality
   - Pythagoras
   - Linear approximation / estimation

2. Orthogonal projection theorem

3. Linear least squares estimation example

$$\underline{y} = H\underline{x} + \underline{v}$$
$$\underline{x} \sim N(\underline{m}_x, \Lambda_x)$$
$$\underline{v} \sim N(0, R) \qquad \text{(uncorrelated with } \underline{x})$$