Pattern Recognition and Machine Learning: Homework 4

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Problem 1

(1)

Use the linear property of expectation and expand the square of E_{COM}:

$$E_{COM} = \frac{1}{M^2}(\sum_{m=1}^{M} \mathbb{E}_x[\epsilon(x)]^2 + 2\sum_{m\neq l}^{M} \mathbb{E}_x[\epsilon_m(x)\epsilon_l(x)])$$

All prediction model errors are zero-mean and uncorrelated, so the latter part disappears:

$$E_{COM} = \frac{1}{M^2}\sum_{m=1}^{M} \mathbb{E}_x[\epsilon(x)]^2$$

We notice:

$$E_{AV} = \frac{1}{M}\sum_{m=1}^{M} \mathbb{E}_x[\epsilon(x)]^2$$

Therefore:

$$E_{COM} = \frac{1}{M}E_{AV}$$

Problem 2