EE 660 **Homework Week 6** Posted Fri., 10/4/2019

v3 Due: Fri., 10/11/2019, 2:00 PM

1. AML Problem 2.24 (page 75), except

   >> Replace part (a) with:

   (a.1) For a single given dataset, give an expression for $g^{(\mathcal{D})}(x)$ (AML notation).

   (a.2) Find $\bar{g}(x)$ analytically; express your answer in simplest form.

   >> For parts (b) and (c), obtain $\mathrm{E}_{\mathcal{D}}\{E_{out}\}$ by direct numerical computation, not by adding bias and var.

2. AML Problem 4.4 (a)-(c), plus additional parts (i)-(iii) below.

   >> For part (c), assume both $g_{10}(x)$ and $f(x)$ are given as functions of *x*, and you can express your answer in terms of them; and define $E_{out}(g_{10}) = \mathrm{E}_{x,y}\left\{\left[g_{10}(x) - y(x)\right]^2\right\}$.

   (i) In Fig. 4.3(a), set $\sigma^2 = 0.5$, and traverse the horizontal line from $\mathrm{N} \approx 60$ to $\mathrm{N} \approx 130$. Explain why $\mathcal{H}_{10}$ transitions from overfit to good fit (relative to $\mathcal{H}_2$).

   (ii) Also in Fig. 4.3(a), set $\mathrm{N} = 100$, and traverse the vertical line from $\sigma^2 = 0$ to $\sigma^2 = 2$. Explain why $\mathcal{H}_{10}$ transitions from good fit to overfit (relative to $\mathcal{H}_2$).

   (iii) In Fig. 4.3(b), set $\mathrm{N} \approx 75$, and traverse the vertical line from $\mathrm{Q_f} = 0$ to $\mathrm{Q_f} = 100$. Explain the behavior.

Reading

Regularization (AML perspective)

AML 4.2 (pp. 126-137).

Problems on reading

4. AML Exercise 4.5 (p. 131).