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Exercise 5

Understanding Nonparametric Density Estimation: Super Learning of a Density

1. Why might we be interested in estimating a density?

2. Local smoothing provides a way to estimate a density at a particular point *x* in a nonparametric model. How?

3. One way to understand the stochastic behavior of an estimator at a particular point is to learn its bias and variance. Define both bias and variance **conceptually and mathematically**. Describe the "trade-off" that exists between them. [Hint]

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4. We care about minimizing the MSE. What is the MSE?

5. What is a loss function? Provide an example of a functional parameter and a valid loss function for it. For example, the conditional mean minimizes the risk of the squared error loss. Thus, it is a valid loss function when estimating the conditional mean.

6. How does the super learner adapt to underlying smoothness?