

Math 6070-1, Spring 2014; Assignment #4

Assigned on: Friday February 7, 2014
Due: Wednesday February 19, 2014

1. Complete reading the Density estimation module at <http://www.math.utah.edu/~davar/math6070/2014/DensityEstimation.pdf>, up to and including Section 5.
2. Generate 1,000 samples from a $N(0, 1)$ distribution, or use your simulation from the last assignment, if you still have it.
 - (a) Produce a kernel density estimate of the $N(0, 1)$ pdf using your sample, using the following different kernels. If you are using last assignment's work, then simply attach the same work [and do not redo the work]. Else, redo the assignment for purposes of comparison.
 - i. $K(x) := (2\pi)^{-1/2} \exp\{-x^2/2\}$ [the standard normal kernel];
 - ii. $K(x) := \frac{1}{2} \mathbf{I}\{|x| < 1\}$ [the Unif(-1, 1) kernel];
 - iii. $K(x) := \mathbf{I}\{0 < x < 1\}$ [the Unif(0, 1) kernel];
 - iv. $K(x) := \exp(-x) \mathbf{I}\{x > 0\}$ [the one-sided exponential kernel];
 - v. $K(x) := \frac{1}{2} \exp(-|x|)$ [the double-exponential kernel];
 - vi. $K(x) := \pi^{-1} \{1 + x^2\}^{-1}$ [the Cauchy kernel].

Do this for an array of different bandwidths in each case. Experiment until you find a satisfactory choice of K and h . Be sure that you do not use the optimal bandwidth methods in this portion.

- (b) Redo the preceding with several bandwidths of the form $\alpha n^{-1/5}$, as you vary the quantity α . Compare these works with one another, and with the earlier ones from part (a).
- (c) Use the kernel of Example 9 [p. 25 of the Density Estimation module] in place of the preceding, and experiment with various choices of h . Compare the resulting density estimator to the previous ones.
- (d) Use the kernels of Example 10 [p. 25 of the Density Estimation module] in place of the preceding, and experiment with various choices of parameters ν and h . Compare the resulting density estimator to the previous ones.