Exercise 3, Machine Intelligence II

Group 1

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1 Comments

Our task was to approximate/estimate the probability distribution of pixel values in an image, given the assumption that the pixels are iid distributed. Therefore we draw a sample from the image and compute its histogram which is afterwards smoothed by a gaussian kernel of a certain width h. This can be done by summation of gaussian kernels (each centered on a pixel value) or by a convolution of the histogram with the kernel. We chose the first method because we had some problems with the right indexing when we used the convolution variant. In both cases the resulting function has to be normalized in order to become a distribution. The optimal kernel width h which gives the best estimate of the original distribution (evaluated on the pixels not used for the estimation) is then determined by measuring the log-likelihood of this parameter.

In 3 out of 4 cases the kernel with width h = 10 gave the best result with respect to the likelihood.

2 Results

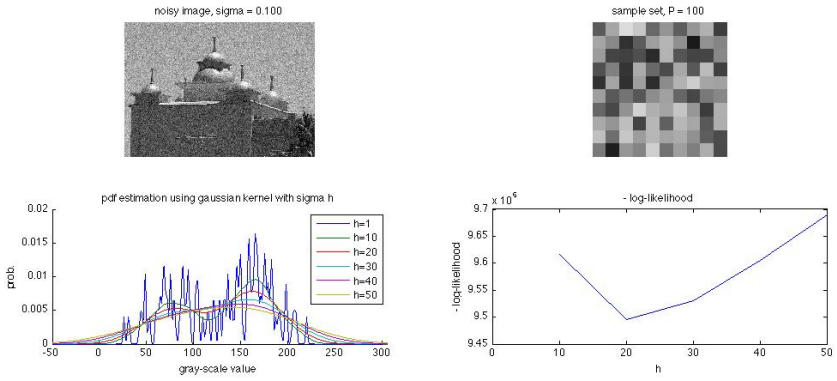

Figure 1: P = 100, sigma = 0.1

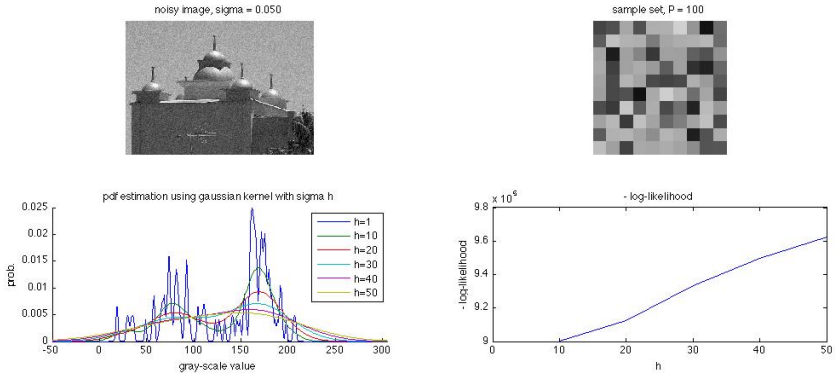

Figure 2: P = 100, sigma = 0.05

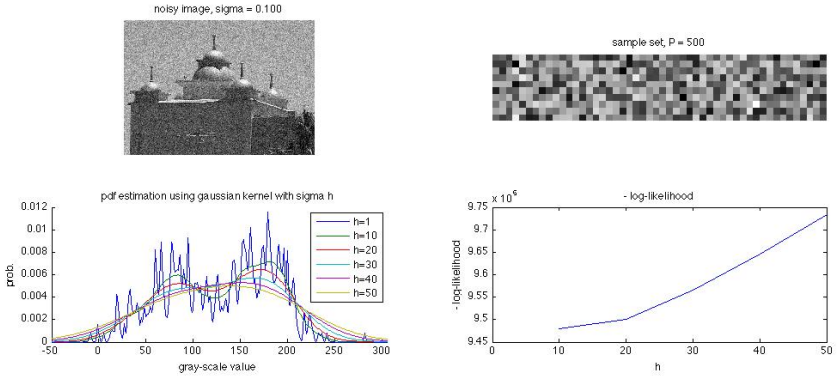

Figure 3: P = 500, sigma = 0.1

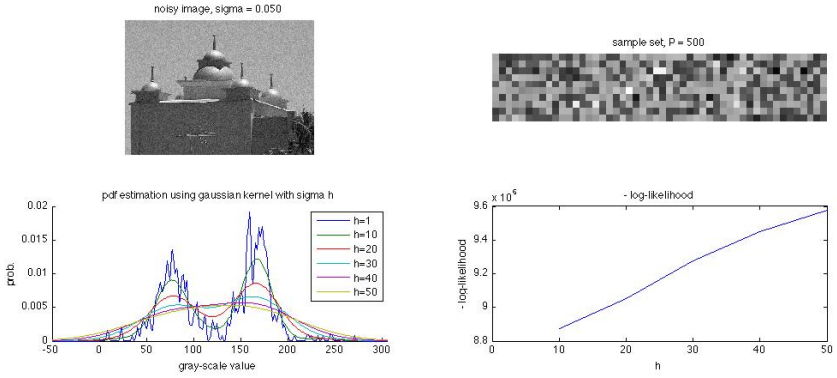

Figure 4: P = 500, sigma = 0.05

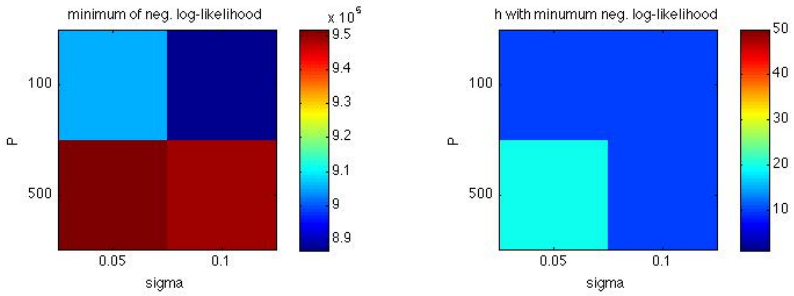

Figure 5: The plot on the left shows the value of the negative log-likelihood for different sigmas and sample sizes. While on the right its shown the value of h which minimizes the negative log-likelihood for all the combinations of sigmas and sample size, which appears to be h=10 for all.