Exercises for
Pattern Analysis Programming
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Task 1: May 3 – May 5

Pattern Recognition Lab

Warmup: Sampling from a Closed-Form Distribution

Our goal in Pattern Analysis is to analyze data. However, let us first look into ways to *create* data, that we can represent then in later steps. Hence, this exercise is about drawing sample data from a closed-form probability density function (PDF). This process is oftentimes just called "sampling".

Sampling has different applications. In the fields of computer graphics and computer vision, a currently popular example is to invent visual data like human faces. A nice demo for artificial faces is at `http://thispersondoesnotexist.com`. A cool drive through their distribution for sampling (the "latent space") is shown in `https://www.youtube.com/watch?v=6E1_dgYlifc`.

This exercise is intended as a warmup. It does not involve a lot of code, but it is an opportunity to setup your exercise environment:

(a) Make sure that your python environment works

(b) Get familiar with the type of problem statement in this exercise

(c) Set up your communication logistics, establish contact to your group members

Exercise 1 Implement a function that draws 1000 samples from an univariant gaussian distribution with mean 1 and a standard deviation of 0.2. Plot the experimental distribution using 30 bins. In order to compare it with the ground truth distribution, generate also the plot of such. An example is shown in Fig. 1

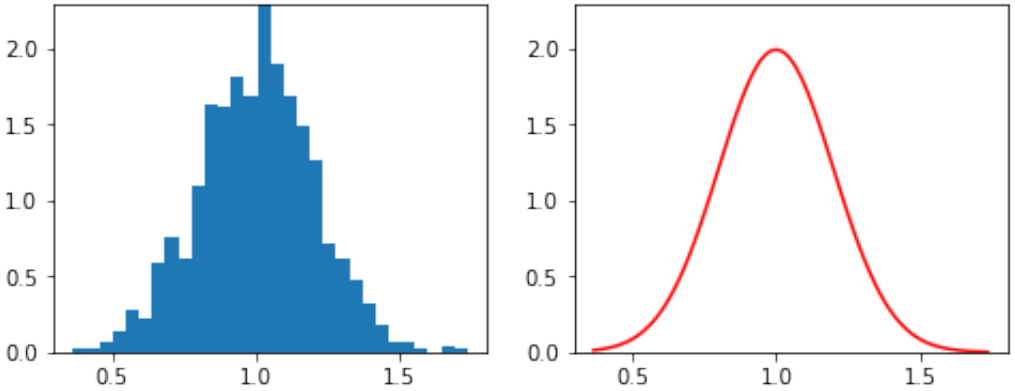

Figure 1: Experimental and Ground Truth Distribution in 1D.

Exercise 2 Implement a function that draws 10000 samples from a multivariant gaussian distribution (2D in this case) with mean mean vector $[0.5, -0.2]$ and covariance matrix $[[2.0, 0.3], [0.3, 0.5]]$. Plot the experimental distribution using 30 bins (30x30). In order to compare it with the ground truth distribution, generate also the plot of such. An example is shown in Fig. 2

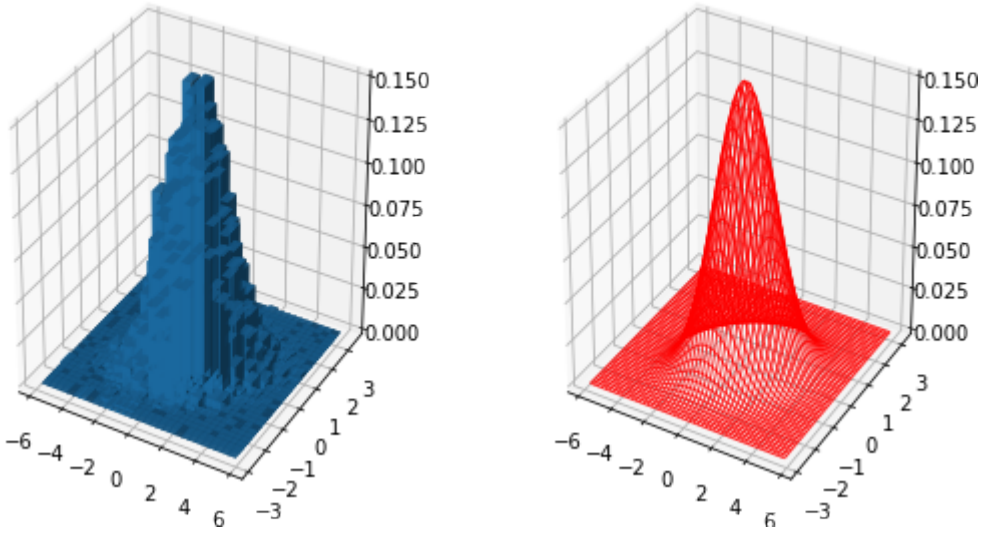

Figure 2: Experimental and Ground Truth Distribution in 2D.

Exercise 3 Play with the amount of drawn samples and of the bins. What happens when you increase/decrease both? What happens when you increase one and decrease the other? Are observations from these past two questions the same for the 1D and 2D cases? What about changing the parameters of the ground truth distributions? Observe the plots and select the one which turned the most interesting for you; Please create a figure with the respective 1D and 2D distributions and post it on the forum (Thread: 'Warmup') and comment why you chose it.

Comments:
Submit your results in the respective studon forum. We ask for only one figure per group. Please also state your group name.