

EE613 — Nonlinear regression I — Exercises — Dec. 13, 2017

The main folder contains nine examples `demo_Gaussian_product01.m`, `demo_Gaussian_conditioning01.m`, `demo_Gaussian_conditioning_noisyInput01.m`, `demo_Gaussian_lawTotalCov01.m`, `demo_LWR01.m`, `demo_GMR01.m`, `demo_GMR_polyFit01.m`, `demo_DMP01.m` and `demo_DMP_GMR01.m`. These codes can be run either from Matlab or from GNU Octave. First run the examples, visualize the results and try to change the parameters.

Exercise 1: Gaussian conditioning computed with covariance or precision matrices

- Modify `demo_Gaussian_conditioning01.m` so that it can be used with a problem of higher dimension. You can select your own dataset, or generate random datapoints of any desired dimensions.
- Implement a version of the program computing the conditional distribution by using precision matrices instead of covariance matrices.
- Test the computation speed for different types of problems, with inputs and outputs of different dimensions. What do you observe?

Exercise 2: Differences between product of Gaussians, weighted sum of Gaussians and Gaussian approximation of a GMM

The script `demo_Gaussian_product01.m` displays the Gaussian that results from the computation of a product of three Gaussians.

- Modify the script so that it also displays the Gaussian resulting from a weighted sum of Gaussians (with equal weights summing to one), and an approximation of a GMM with a single Gaussian by exploiting the law of total mean and total covariance. What do you observe?

Exercise 3: Locally weighted regression Vs Gaussian mixture regression

- Modify `demo_LWR01.m` and `demo_GMR_polyFit01.m` so that it loads the dataset contained in `data/1.mat`, corresponding to 2D movement recordings to draw the digit “1”.
- Set the parameters `nbStates=2` and `nbVarIn=1` in `demo_LWR01.m` and `demo_GMR_polyFit01.m`.
- Run the two examples and observe the results. What do you observe?

Exercise 4: What is the difference between `demo_DMP01.m` and `demo_DMP_GMR01.m`?