



COURSEWORK

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES

QUANTUM LEAP AFRICA

Foundations of Machine Learning

Instructions

This assignment has both writing and coding components. The coding part must be done in python. We will give you a template for your coding answers.

You are not permitted to use any symbolic manipulation libraries (e.g. `sympy`) or automatic differentiation tools (e.g. `tensorflow`, `pytorch`) for your submitted code (though, of course, you may find these useful for checking your answers). You should not need to import anything other than `numpy` for the submitted code for this assignment.

The writing assignment requires plots, which you can create using any method of your choice. You should not submit the code used to create these plots.

No aspect of your submission may be hand-drawn. You are strongly encouraged to use LaTeX to create the written component.

In summary, you are required to submit the following:

- A file `gmm_write_up_<your-name>.pdf` for your written answers.
- A file `gmm_coding_answers_<your-name>.py` that implements all the methods for the coding exercises.

Please create a zip-file and send it to mdeisenroth@aimsammi.org.

The submission deadline is

November 13, 23:59.

Density Estimation with Gaussian Mixture Models

Task 1

Complete the code skeleton for parameter estimation on Gaussian mixture models.

Task 2

You are given a two-dimensional dataset of about 30 geolocations (latitude/longitude) of birthplaces. Model the data as well as possible. Describe your approach, justify your choices and interpret your results.