

Assignment MOD 323

To pass the assignment, you shall complete at least one of these exercises.

The three exercises are of increasing complexity, computationally and programming wise. Each one explores one of the problem families of Machine learning. Of course, for a better learning outcome, I would suggest you to complete them all :)

i) Reinforcement learning

In this exercise, you will practise RL by exploring problem design variables.

- In a set of different simulations, make three set of labyrinths:

(1) with no exits, (with an elongated shape and one exit) (3) with multiple exits.

For each of these, try different learning rates and exploration rates. Plot the

- number of iteration required to get a 90% accuracy versus the learning rate
- number of iteration required to get a 90% accuracy versus the exploration rate

At what values do you not experience any difference? What is happening there?

ii) Unsupervised learning

In this exercise you will compare NN vs Linear regression

- Generate a distribution made out of 4 different distributions (use the class sum to generate the data)
- Train a RL and a NN model
- Test the RL and the NN models
- Make a new distribution of data and Validate the RL and NN models on it.
- Compute the residual (sum of square error) for your train, **test** and validation dataset.
- Plot the **test** residual versus the number of total nodes of the NN
- For the best residual found, compute the computational time used by LR and NN.

iii) Unsupervised learning

This exercise will show you how much clustering outcome is sensitive to noise.

Make a data generation class that:

- reads the file 'xeek_train_subset_mini.csv'
- add noise around 'RHOB' and 'GR', normally distributed
- visualise the plot with and without noise
- make a k-means and a GMM, and plot the results as a function of DEPTH.
- make a cross-plot with pairplot
- define a sufficient categorization accuracy
- Determine the level of noise that allows you to have still a good categorization (with a python script even better)