MSE | MASTER OF SCIENCE IN ENGINEERING

HES-SO

Machine Learning

Practical work 10 - Artificial Neural Networks (ANN)

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Summary for the organization:

- Submit the solutions of the practical work before Monday 27.11.23, 23h59 via Moodle.
- Modality: PDF report (max. 8 pages) (+ code for last exercise)
- The file name must contain the number of the practical work, followed by the names of the team members by alphabetical order, for example 09_dupont_muller_smith.pdf.
- Put also the name of the team members in the body of the notebook (or report).
- Only one submission per team.

0. Notebooks

Download the notebook material from the Moodle platform

1. The Perceptron and the Delta rule

Read each notebook material (see list below), follow the instructions, play with the code, program the proposed problems and answer the questions.

List of notebooks associated with this exercise:

1_activation_function.ipynb
2_perceptron.ipynb
4_1_delta_rule_points.ipynb

Known issue: "MovieWriter ffmeg unavailable"
Solution: install ffmpeg by using the command: conda install -c conda-forge ffmpeg.
If it is still not working, change the flag to SHOW_VIDEO = False.

2. Backpropagation

Read each notebook material, follow the instructions, play with the code, program the proposed problems and answer the questions.
List of notebooks associated with this exercise:

6_backpropagation_MLP.ipynb

4. Crossvalidation

Please, read each notebook material, follow the instructions, play with the code: e.g., modify the number of hidden neurons, the datasets, the number of k for cross-validation, etc.

List of notebooks associated with this exercise:

8_cross_validation.ipynb

5. Model building

When training a neural network to solve a problem, e.g., to develop a classification system, you will need to evaluate diverse models (neural net configurations, complexities, diverse parameters,etc) and select the "best" one. The following notebook presents a methodology iterating over the number of epochs (learning duration) and number of hidden neurons (model complexity). When selecting the final model, that is, defining the number of epochs for training and the number of hidden neurons, you will need to evaluate the performance of the final model, by crossvalidation, and you might also compute the confusion matrix, which illustrates if the system confuses certain inputs while attempting to classify them.

After looking at the procedure for the “blue or red” dataset, implement a similar pipeline for the dataset of the mouse used last week. Compare the results obtained using a Multilayer Perceptron (MLP) with the results obtained last week using random forests.

List of notebooks associated with this exercise:

9_model_selection.ipynb

Summary of work to include in the report

- No need to write a “scientific” report. Just address the following points as clearly and concisely as possible.
- Answer questions 1-3 from the 4_delta-rule notebook and present the resulting plot when the option SHOW_VIDEO is set to False
- Run notebooks 8, provide the final plots *MSE vs spread* and comment the difference between results.
- For the notebook 9, provide the code showing how you chose a final model for the dataset of the mouse. Show the confusion matrix. Comment your results. Compare the results obtained using a Multilayer Perceptron (MLP) with the results obtained last week using random forests.

Comments:

Model selection for mouse dataset: Dur de vous aider sans voir le code en entier. Néanmoins vous avez pensé à changer l'architecture du MLP_N_output_classes([n_features,16,n_classes]) et ça c'est bien. En ce qui concerne la fonction d'activation softmax, elle est habituellement seulement utilisée pour la couche d'output dans le cas d'une classification.

En général: ok

Grade: Pass