Lab / Homework
[Artificial Neural Network (ANN)]
Feedforward Neural Network (FFNN)

Jae Yun JUN KIM*

October 21, 2020

Homework due: Before the next lab session. See the due date and hour indicated in the course website (campus.ece.fr)
Evaluation: Submit your code and explanation about the code through the course website campus.ece.fr (in groups of 2 or 3 people (preferably 3))
Remark:

- Only groups of two or three people accepted (preferably three).
- Before you leave today lab session, you need to show the lab task results to the professor.
- **No late lab/homework will be accepted.**
- No plagiarism. If plagiarism happens, both the "lender" and the "borrower" will have a zero.
- Code yourself from scratch. No lab/homework will be considered if any ML library is used.
- Do thoroughly all the demanded tasks.
- Study the theory.

---

1. Download the data stored in the file `data_ffnn_3classes.txt` available on the course website. This dataset consists of three columns: $x1$, $x2$, $x3$ and y. Notice that this is a multi-class problem (in particular 3 classes).

2. Implement the forward propagation of a feedforward neural network (FFNN) consisting of three layers, in which the hidden layer has K neurons (at your choice). Remember you need to arrive to show the error results. Use all the data available in the file as training examples.

3. Implement the back propagation of the above FFNN with the purpose to optimize the model parameters. That is, train your model to learn how to solve the above multi-classification problem.

4. Show that your algorithm converges by illustrating the error reduction at each iteration.

5. What are the optimal parameter values for the hidden layer (v) and for the output layer (ω)?

6. Show that your classifier works properly by comparing the predicted output values to the actual training output values.

7. Test your optimized model by doing forward propagation over the following test data set: (x_1, x_2, x_3)=$(2, 2, -3)$, (x_1, x_2, x_3)=$(3, 4, 3)$, and (x_1, x_2, x_3)=$(4.5, 1.5, 0)$.

*ECE Paris Graduate School of Engineering, 37 quai de Grenelle 75015 Paris, France; jae-yun.jun-kim@ece.fr