[Lab/Homework] Feedback Neural Network (a.k.a. Recurrent Neural Network)

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Lab due: Today
Homework due: Before the next lab session, submit your .ipynb files on campus.ece.fr.

- Group 1: Before Tuesday March 9th, 2021, 09h30
- Group 2: Before Wednesday March 10th, 2021, 09h30
- Group 3: Before Tuesday March 9th, 2021, 14h
- Group 4: Before Wednesday March 10th, 2021, 14h

Evaluation: Code and explanation about the code (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 for the questions.

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1 Lab Task

1. Generate some input data (X) consisting of 40 sequences of 10 binary numbers, following a uniform distribution, where the probability of generating a "0" is the same as that of generating a "1". Make the output (y) for each sequence be the sum of its elements. Use 30 first sequences for training and the rest (10 sequences) for testing.

2 Homework Tasks

1. Implement a sequential `adder` using the `Elman recurrent neural network (RNN)` with
   a) backpropagation,
   b) resilient propagation,
   c) gradient clipping.
2. Show the results by comparing the outputs of your model to the actual output values for all three methods (backpropagation, resilient propagation and gradient clipping).
3. Now, choose some (reasonably) large initial values for the model parameters and see the convergence for all three methods.
4. Test your model with all three methods (backpropagation, resilient propagation and gradient clipping) using the test data and compare the results.

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