# INF436 Machine Learning / Homework 2

# Artificial Neural Network (ANN): Feed-Forward Neural Network (FFNN) Image classification

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**Due**: Before the next lab session.
**Evaluation**: Interrogation during the next lab session about:

- code (in group of up to 3 people)
- (theoretical, practical) questions (individual)

**Remark**:

- Only groups of one/two/three people accepted. Forbidden groups of larger number of people.
- No late homework will be accepted.
- No plagiarism. If plagiarism happens, both the "lender" and the "borrower" will have a zero.
- Code yourself from scratch. No homework will be considered if you solve the problem using any ML library.
- Do thoroughly all the demanded tasks.
- Study the theory for the interrogation.

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## 1 Tasks

1. Download 5000 digit images and their respective labels available on campus.ece.fr. Notice that the images are store in two different formats: `images_0.txt` and `images_1.txt`. The content is the same, and, therefore, use the one that convenes you the most. The image dataset consists of 5000 images of 400 pixels in gray scale ranging from -1 to 1. The labels represent 0 to 9. In the `label.txt`, you will see 10's, which in fact they represent 0.

2. Separate the dataset in two parts: training and test datasets.

3. Implement an image classifier using the feed-forward neural network (FFNN) by learning its parameter values using the training dataset. This FFNN should consist of three layers. Choose the number of hidden neurons that suits the best for the problem.

4. Optimize the FFNN parameters by repeating until convergence the forward propagation and back propagation.

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

6. Test your classifier with the test dataset by predicting their respective labels.

7. Evaluate the performance of your algorithm (ex: confusion matrix).

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