PROJECT 3*: Object classification using Neural networks*

LEARNING OBJECTIVES:

In this project you are going to

- Prepare you to apply an artificial neural network, either traditional networks or deep networks to real-world tasks (for object classification)

DESCRIPTIONS:

- You are asked to implement an artificial neural network, either traditional networks or deep networks, for object classification on some prepared datasets. This requires you to research knowledge related to the problem of image object classification and solutions using neural networks to deal with this problem.
- The more challenging data set(s) and/or the more sophisticated neural network(s) you consider, the higher credits you will achieve. Of course, your results must be comparable to works using similar architectures.

A. Datasets:

1. The MNIST dataset of handwritten digits:
   http://yann.lecun.com/exdb/mnist/
2. The EMNIST dataset of handwritten characters and digits
   https://www.nist.gov/itl/products-and-services/emnist-dataset
3. The Fashion-MNIST dataset of Zalando's article images (clothes, bags, shoes,etc.)
   https://github.com/zalandoresearch/fashion-mnist
4. The Kaggle dataset of cats and dogs.
   https://www.kaggle.com/c/dogs-vs-cats

B. Neural networks

1. Traditional neural networks: Perceptron, MLP, SOM, RNN, etc

2. Simple convolutional neural networks: LeNet and its variants, AlexNet, etc.
3. Advanced convolution neural networks/deep neural networks: those with more sophisticated architectures

C. Libraries, resources

You can use any libraries that you are most familiar with (e.g., scikit-learn, TensorFlow, etc.)

You also may consult any papers, books, online references, or publicly available implementations for ideas and code that you may want to incorporate into your project, so long as you clearly cite your sources in your code and your writeup.

REQUIREMENTS:

1. Collaboration Policy

You can work individually or in groups. Each group has maximum 3 students.

2. Requirements:

a. Implement an artificial neural network, either traditional networks or deep networks, for object classification.

You can choose one (or more) of the listed data sets in Part A. and an suggested appropriate neural network architecture in Part B. to fulfill the above requirements.

b. Show your understandings on the analysis of experimental results. The experimental results should include tables and figures demonstrating the training loss, accuracies, successful and/or failure cases.

c. Examine the effects of hyperparameters and parameters of the neural network in consideration to its performance and accuracy.

3. Submitted documents

In order to demonstrate the results you have done in the project (corresponding to the requirements above), you need to submit documents with specific requirements as follows:

a. Group Roster: Who are the group members? What did each person do? Completion of how many percent of the work is assigned?

b. Final Reports

The following is a suggested structure for the report:

- Title, Author(s)
- Abstract: It should not be more than 300 words
- Introduction: this section introduces your problem, and the overall plan for approaching your problem
- Background/Related Work: This section discusses relevant literature for your project
- Approach: This section details the framework of your project. Be specific, which means you might want to include equations, figures, plots, etc
- Experiment: This section begins with what kind of experiments you're doing, which dataset(s) you're using, How do you understand about it? and what is the way you measure or evaluate your results. Quantitatively, what kind of analysis will you use to evaluate and/or compare your results (e.g. what performance metrics or statistical tests)? It then shows in details the results of your experiments. By details, we mean both quantitative evaluations (show numbers, figures, tables, etc) as well as qualitative results (show images, example results, etc).
- Conclusion: What have you learned? Suggest future ideas.
- References: You need to state all references used in your implementation. This is absolutely necessary. Note that, without this list, your work may be considered as plagiarism.

c. Source code

All the code you have done. If it's complicated, you can attach an instruction file (readme. txt) to guide.

d. Demo video

This video is to demonstrate the training and test procedures. You do not need to record everything, choose the moments that you think it is worth for the Lab Instructor to watch it and thus he/she can grade you best.

Note: Please upload your video on Youtube and submit only the link. The google drive link will not be accepted.

Grading Policy:

We have some rubric for assessing your work.

1. Technical Implementation

Score	Model	Dataset
10	Traditional ANN	MNIST
20	MLP or RNN	EMNIST or Fashion-MNIST
	Simple CNN (trained from scratch)	MNIST
30	Simple CNN (trained from scratch)	EMNIST or Fashion-MNIST
	Advanced CNN (pretrained)	EMNIST or Fashion-MNIST
40	Advanced CNN (trained from scratch)	EMNIST or Fashion-MNIST
	Advanced CNN (pretrained)	Kaggle dataset of cats and dogs
50	Advanced CNN (trained from scratch)	Kaggle dataset of cats and dogs

2. Final Report

No.	Criteria	%
1	**Write-up:** clarity, structure, language, references (5%) good understanding of the problem (5% good insights and discussions of methodology, analysis, results (10%)	20%
2	**Technical:** As technical implementation rubric table above	50%
3	**Evaluation and results:** understanding evaluation metric used (5%) thoroughness in analysis and experimentation (10%) comparing results and performance (5%) Examine the effects of hyperparameters and parameters (10% bonus)	20 % + (10% bonus)
4	Comply with the regulations of submission requirements	10%

Note:

- *0 points will be given for the same content submissions.*
- *Only submissions on the Moodle link are accepted.*
- *All submission files are packaged in a compressed file (except for demo video)*

If you have any question about this project, please contact email: htttuyen@gmail.com (Ms.Tuyến)