Author Guidelines and template for ML project report

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1. Introduction

In this report we describe some *image classification* experiments performed on the Fashion-MNIST dataset using machine learning techniques. Our main focus were on the deep learning tools like Convolutional Neural networks(CNNs), in particular, we set up a neural network architecture based on *InceptionResnet* presented in [3], with some modification in term of network size, since here we are dealing with low resolution and gray scale images. This *InceptionResnetFashion* model gave us quite satisfactory results with low *missclassification error* .....

2. Dataset

Our data come from the novel image dataset *Fashion-MNIST*, mainly used for benchmarking machine learning algorithms. Each data is a 28×28 gray scale image, associated with a label from *10 classes*. More details about this dataset (how and why is build) are well-illustrated in [4], here we want to mention that this new dataset aims to replace the old MNIST dataset which is *too easy and overused* (classic ML algorithms can also achieve 97 percent of accuracy).
In our experiments we rearranged this dataset in the following way:

- **Training set:** it consists in 5000 samples of shape 28×28 along with the respective labels.
- **Validation set:** it includes 1000 images and labels with same shape to the training set.
- **Test set:** it's composed of other 1000 images with *no labels* and the purpose of this set of images is to participate to a open Kaggle Competition program[1].

2.1. Data preprocessing and augmentation:

we visualized some data and it turned out that the images belong to same class are well captured and positioned (for instance, no significant rotations are observed). Thus, the only reasonable data augmentation operation, during the training phase of the models, was to randomly flip the images in *horizontal direction.* As preprocessing operation we *normalized* (dividing each pixel value by 255, the default maximum value) the input data in order to accelerate the training and to have best model performance, this is what proved in [2].

2.2. Suggested Structure

The following is a suggested structure for your report:

- Introduction (20%): describe the problem you are working on, why it's important, what are your goals, and provide also an overview of your main results.
- Dataset (20%): describe the data you are working with for your project. What type of data is it? Where did it come from? How much data are you working with? Did you have to do any preprocessing, filtering, etc., and why?
- Method (30%): discuss your approach for solving the problems that you set up in the introduction. Why is your approach the right thing to do? Did you consider alternative approaches? It may be helpful to include figures, diagrams, or tables to describe your method or compare it with others.
- Experiments (30%): discuss the experiments that you performed. The exact experiments will vary depending on the project, but you might compare with prior work, perform an ablation study to determine the impact of various components of your system, experiment with different hyperparameters or architectural choices. You should include graphs, tables, or other figures to illustrate your experimental results.

2.3. Type-style and fonts

Wherever Times is specified, Times Roman may also be used. If neither is available on your word processor, please use the font closest in appearance to Times to which you have access.

MAIN TITLE. Center the title 1-3/8 inches (3.49 cm) from the top edge of the first page. The title should be

[1] https://www.kaggle.com/c/image-classification-fashion-mnist

in Times 14-point, boldface type. Capitalize the first letter of nouns, pronouns, verbs, adjectives, and adverbs; do not capitalize articles, coordinate conjunctions, or prepositions (unless the title begins with such a word). Leave two blank lines after the title.

AUTHOR NAME(s) and AFFILIATION(s) are to be centered beneath the title and printed in Times 12-point, non-boldface type. This information is to be followed by two blank lines.

The ABSTRACT and MAIN TEXT are to be in a two-column format.

MAIN TEXT. Type main text in 10-point Times, single-spaced. Do NOT use double-spacing. All paragraphs should be indented 1 pica (approx. 1/6 inch or 0.422 cm). Make sure your text is fully justified—that is, flush left and flush right. Please do not place any additional blank lines between paragraphs.

Figure and table captions should be 9-point Roman type as in Table 1. Short captions should be centred.

Callouts should be 9-point Helvetica, non-boldface type. Initially capitalize only the first word of section titles and first-, second-, and third-order headings.

FIRST-ORDER HEADINGS. (For example, **1. Introduction**) should be Times 12-point boldface, initially capitalized, flush left, with one blank line before, and one blank line after.

SECOND-ORDER HEADINGS. (For example, **1.1. Database elements**) should be Times 11-point boldface, initially capitalized, flush left, with one blank line before, and one after. If you require a third-order heading (we discourage it), use 10-point Times, boldface, initially capitalized, flush left, preceded by one blank line, followed by a period and your text on the same line.

2.4. Footnotes

Please use footnotes[2] sparingly. Indeed, try to avoid footnotes altogether and include necessary peripheral observations in the text (within parentheses, if you prefer, as in this sentence). If you wish to use a footnote, place it at the bottom of the column on the page on which it is referenced. Use Times 8-point type, single-spaced.

2.5. References

List and number all bibliographical references in 9-point Times, single-spaced, at the end of your paper. When referenced in the text, enclose the citation number in square brackets, for example [1]. Where appropriate, include the name(s) of editors of referenced books.

[2]This is what a footnote looks like. It often distracts the reader from the main flow of the argument.

Method	Frobnability
Theirs	Frumpy
Yours	Frobbly
Ours	Makes one's heart Frob

Table 1. Results. Ours is better.

References

[1] Authors. The frobnicatable foo filter, 2014. Face and Gesture submission ID 324. Supplied as additional material `fg324.pdf`.

[2] Sergey Ioffe and Christian Szegedy. Batch normalization: Accelerating deep network training by reducing internal covariate shift, 2015.

[3] Christian Szegedy, Sergey Ioffe, Vincent Vanhoucke, and Alex Alemi. Inception-v4, inception-resnet and the impact of residual connections on learning, 2016.

[4] Han Xiao, Kashif Rasul, and Roland Vollgraf. Fashion-mnist: a novel image dataset for benchmarking machine learning algorithms, 2017.