FINAL PROJECT: Deep Learning for Image Analysis

3 students per group maximum

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Introduction to Intelligent Systems – 2019-II

The goal of this project is to build a deep learning model to classify selfie images. The idea is to apply the concepts studied in the Coursera Specialization. In particular, you should apply the concepts covered on the "Structuring Machine Learning Projects" course. Additionally, even if you were not required to take the "Convolutional Neural Networks" course, it is a good idea to review the contents since it will be useful for this project.

There are four main tasks which are detailed next.

1. Data exploration and analysis

(a) Dataset download

i. Download the selfie dataset from this webpage.

(b) Dataset exploration

i. Explore the Selfie Dataset content in terms of the number of images, resolution, depth, among others. Likewise, take a look over the available labels contained in the repository.

Tip: Bar-graph, Box-graph, and t-SNE analysis among others could help you to explore the dataset in a visual way. Take a look at this post.

2. Dataset annotation

The dataset already have some labels such as genre, age, race, etc. We will add four new attributes: image quality, image type, image filter and brightness. The idea is to collectively annotate this attributes. The details of this task will be provided on or before December 9th. However, you can start annotating a subset of the images.

The four new attributes are explained next.

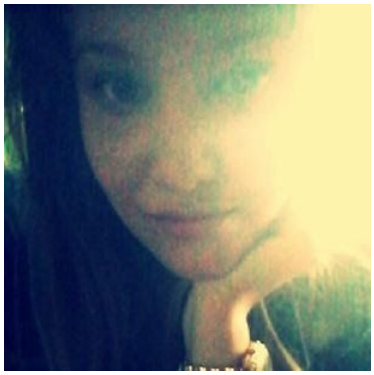
(a) Selfie Image Quality

A good quality image can be defined as an image that has a correct illumination, adequate focus, good sharpness, minimum noise, minimum presence of artifacts and an adequate contrast, among other factors. Below you will find some examples of good and bad quality images.

Good quality



Bad quality


(b) Selfie Image Type:

A selfie image type, in this case, will be considered in selfie type terms: only face/upper body/full body. Below you will find some examples of selfie type.

Only face



Upper body



Full body



(c) Selfie Image Filter Identification

There exist several types of commonly used filters for selfie images used to change the image characteristics.

Among them, you can find:

- Black and white
- Vintage
- Sepia
- Contrast
- Blur
- Weather
- Focus

(d) Selfie Image Brightness

The brightness is a visual perception attribute in which a source appears to be radiating or reflecting light. This is an important factor for image quality assurance. You could classify images according to the brightness level (low, adequate, high).

Below you will find some examples of brightness.

Low

Adequate

High

3. Project planning

Following the indications from the "Structuring Machine Learning Projects" design a project for the task of building an automatic image classification system for the 4 new attributes. Detailed the phases, activities and aspects to take into account. It is important to try different strategies for instance: transfer learning, fine tuning, multi-task learning, data augmentation, combination of images and the 36 original attributes, etc.

4. Project execution

(a) Clearly describe the data preparation phase and the experimental setup

(b) Describe the training process and discuss the learning curves for both training and validation.

(c) Describe the results of the hyperparameter exploration process

(d) Report and discuss your results over the test dataset, using different performance metrics.

(e) Discuss the conclusions of the project and how to improve it in a future work.

Submission:

The submission will be done in two phases:

Phase 1: Kaggle competition participation

You should train a model for the task (b) (Selfie Image Type) and use it to participate in this Kaggle competition: https://www.kaggle.com/c/iis-2019-2-project/overview/evaluation. This competition will help to evaluate the performance of your model in a restricted test data set (this dataset is only intended for evaluation, you will need to annotate new images to train your model). The final evaluation will be done on February 7th with a bigger test dataset. Even if you have done previous submissions, you will need to do a final submission on this date. Further instructions will be given.

In addition to participate in the competition you must submit a .zip file that includes: `script.py`, network weights (in your preferred format) and `README.txt`. You shouldn't need additional files.

The script must perform the following steps:

- define the architecture of your network and load its weights.
- execute a sample prediction pipeline (load, process and make prediction of input data).
- The script should accept input.csv in the same format as test.csv that is available in the data tab, for example:

```
import pandas as pd
df_input = pd.read_csv('./input.csv')
```

The script should write to a the file `output.csv` in the same format as the sample submission.

The files must be submitted as a zip file through the following Dropbox file request (https://www.dropbox.com/request/vhsaikdOVpkhLiEySC2V), before midnight of the February 7th 2020. The file must be named as `isi-competiton-unalusername1-unalusername2-unalusername3.ipynb`, where `unalusername` is the user name assigned by the university (include the usernames of all the members of the group).

Phase 2: Project report

A zip file with the final report through the following Dropbox file request (https://www.dropbox.com/request/vhsaikdOVpkhLiEySC2V), before midnight of the February 7th 2020. The file must be named as `isi-proj-report-unalusername1-unalusername2-unalusername3.zip`, where `unalusername` is the user name assigned by the university (include the usernames of all the members of the group).

The zip file must include the following files:

- **Report**: a pdf document presenting the results of the exploratory analysis, the project plan, the model details, the experimental setup, the results, the discussion and the conclusions.
- **Notebook**: a jupyter notebook with the code of the model, the training and the evaluation. Make sure that the notebook renders correctly and is free of errors before submitting.

Additionally, we will have a poster session to present the results. For this you have to prepare a poster that summarizes the report.