Final Project

Due date: <u>July 10th 2020</u>

3 students per group maximum

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1. QR code object detection

The goal of this project is to build a deep learning model to detect QR codes in products.

There are three main tasks that are detailed next.

1.1. Data exploration and analysis

(a) Dataset download

      i. Download the QR dataset from [here](#).

(b) Dataset exploration

      i. Explore the QR code Dataset content in terms of the number of images, resolution, depth, number of objects per image, among others.

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](#).

1.2. Dataset annotation

You have to annotate the images in the database using one annotation tool such as:

[LabelBox](#)

[LabelImg](#): which can be downloaded from [here](#).

[VoTT](#)

Since the idea is to detect QR codes in images, you will need to annotate any QR code that appears in the images in the dataset. This is done by drawing a bounding box around the QR code as it is shown in the following images:

The above tools help you to draw the bounding boxes and to export the annotations in a convenient format.

In order to submit your annotations as part of the project submission, you have to create a unique file with all the annotations with the following format:

image_name	x	y	width	height
./train/image1.jpg	540	288	113	19
./train/image1.jpg	542	300	58	60
./val/image2.jpg	552	299	44	31
./test/image3.jpg	730	211	47	33

Depending on the model you use as a base, it is possible that you need to transform your annotations to different formats. There are diverse deep learning methods that address object detection such as: YOLO, R-FCN, Faster R-CNN and MaskRCNN.

1.3. Performance evaluation

The object detection performance is evaluated according to two criteria: classification and localization.

Classification: if an object is present in the image and the class of the object (in our problem we only have one class).

Localization: predict the coordinates of the bounding box around the detected object if it is present in the image.

You need to evaluate your model performance according to different evaluation metrics. Check this [repository](#) and use the code provided there to evaluate the performance of your model on training, validation and test datasets.

2. Project planning

Following the indications from the "Structuring Machine Learning Projects" design a project for the task of building an automatic QR code object detector. 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, a combination of images, etc.

3. 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 validation and test datasets, using different performance metrics.

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

4. Test dataset evaluation

On July 10th a test dataset will be released and you have to evaluate your model on it.

5. Final submission

You have to submit zip file with the final report and related files through the following Dropbox file request (https://www.dropbox.com/request/xaYPWdtDhUQlDxbBzO7M), before noon of the deadline date. 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:

- **Jupyter Notebook**: a Jupyter Notebook with the code of the model as well as the respective additional files of the model (if there exists), the training, and the evaluation. Make sure that the notebook renders correctly and is free of errors before submitting.
- **Annotations:** a .csv file with your annotations and additional images if were used.
- **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.
- **Poster**: A pdf file with a poster presenting your results.

Please don't include images or binary files different from the ones requested.

In addition, all the members of the group must record a video presenting the poster. The video has to be uploaded to YouTube and the link has to be included in the report document. The maximum duration of the video is 6 minutes.