Acceleration Material Project
Project Description

Image Treatment Track
(5PMSPAM1)
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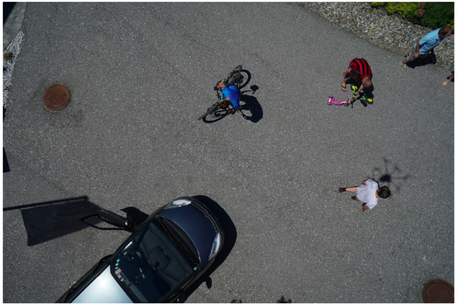
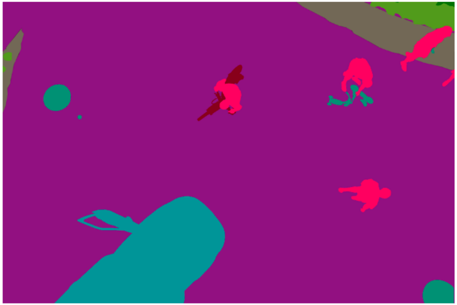
Project Idea

Segmentation

- Build a **Semantic Segmentation Model**.
  - Associates a label or category (car, building, ...) with every pixel in an image.
  - Give all pixels belonging to a particular class have been assigned a single color.

Dataset

- **Semantic Drone Dataset**[1]
  - Focuses on semantic understanding of **urban scenes**.
  - It contain **images** acquired by a **drone** at an altitude of 5 to 30 meters above ground.
  - High image resolution with 6000 × 4000 pixels.
  - Around 5GB.

tree	rocks	dogs	fence
gras	water	car	fence-pole
other vegetation	paved area	bicycle	window
dirt	pool	roof	door
gravel	person	wall	obstacle

Table: Semantic Classes

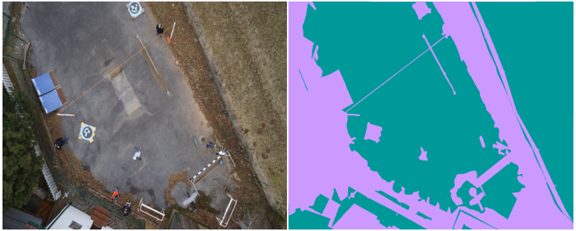
[1] https://www.tugraz.at/index.php?id=22387

Dataset

- You can **download** it via `https://www.kaggle.com/datasets/bulentsiyah/semantic-drone-dataset`
- Use the **first 400 images** for **training** and the **last 200 images** for **test**.
- As the dataset is kind of small, you will have to look on some **data augmentation strategies.** We will see that in the **Pytorch Tutorial** and how to do it.

You can start with Binary Segmentation!

- If it is too hard, you can start with Binary Segmentation. Here, we only have **2 classes**.



Available Computational Materials

- You are going to **use Gricad**[2].
  - It is a **HPC** (High Performance Computing) cluster.
  - It contain **several machines** (nodes). Where each machine has **multiple GPUs.**

- We will **setup your account**.
- But first **go to** `https://perseus.univ-grenoble-alpes.fr/` and **create account.**

[2] `https://gricad-doc.univ-grenoble-alpes.fr/hpc/`

Project Sessions Organisation

- **Session 1**: Present the Project, Fundamentals of Acceleration Materials, Distributed Parallel Training, Pytorch Tutorial, etc...
- **Session 2**: A presentation on how to use Gricad, followed by guided session where you try a connect and run a toy problem code so that you get comfortable. Then you start working on manipulating the data.
- **Session 3, 4, 5, 6, 7**: you work on solving the problem. BUT not restricted! you can start from the 1st session already, which is very recommended.
- **Session 8**: Soutenance.

Metric Evaluation

You have to report the following evaluation Metrics:

- Precision-Recall Curve.
- Confusion Matrix.
- mean Average Precision (mAP).
- F1-score.
- Computation Time.

Expected Outcomes

1. **Build a Semantic Segmentation Model** that work.
2. Train using a **single GPU** and compute the training time it took.
3. Perform parallel computation over **multiple GPUs** and compute the training time it took.
4. **Report** a complete set of **Metric Evaluation**.
5. Provide a **report** that present the problem, describe its challenges, model, result.
   - Please focus on the result analysis where you have to look deep into the metrics, display some examples that are correctly segmented and those that has error, etc.
6. If you find Semantic Drone Dataset too easy, go ahead with the dataset **COCO-2017**. It is a large scale dataset, or you can mix both data!

Project Evaluation Mode

1. 25% QCM on Distributed Parallel Training (today Session).
2. 25% Soutenance.
3. 25% Model Implementation and Parallelism.
4. 25% Report.

Remark

- You are **not supposed to implement everything from scratch.**
- You are **allowed and must use libraries** that already for example implemented metrics, etc.
- You can **adapt existing models**, such as **UNet** and modify it. But please cite every source.

Pytorch Framework for Implementing DL Models

Tutorial Website

Go to :

- `https://github.com/udacity/deep-learning-v2-pytorch`

and then clone or download the content. After please focus only on:

- intro-to-pytorch
- convolutional-neural-networks
- convolutional-autoencoder

which is basically what you need to know to implement the project.

Local Working Environment

You will not need to work on Gricad directly. So, make sure you can work either on your own machine, or from your own machine connect to :

- `https://colab.research.google.com/`

Anaconda

- It is preferable to download and use anaconda.
- Within anaconda, create an environment and call it torch.
- once the env torch is activated, you can use pip to install any related library.