
DISCUS Challenge

Semantic Image Segmentation

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- Schedule for this challenge
- Introduction to Semantic Segmentation
- Tools
 - Google Colab
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- Starter Kit
- Assigning of Teams

What's the problem?

Competition



1st ACRE Cascade Competition

Organized by acre_account - Current server time: Dec. 11, 2020, 3:42 p.m. UTC

Current	Next	End
Development	Final	Competition Ends
Oct. 17, 2020, midnight UTC	Jan. 19, 2021, midnight UTC	Jan. 22, 2021, midnight UTC

Learn the Details Phases Participate Results Forums Team

Overview Evaluation Data Terms and Conditions FAQ Contacts

Welcome to the 1st ACRE Cascade Competition!

In this competition, ACRE organizers ask you to segment RGB images to distinguish between crop, weeds, and background.



Overview

ACRE is the Agri-food Competition for Robot Evaluation, part of the METRICS project funded by the European Union's Horizon 2020 research and innovation program under grant agreement No 871252. Autonomous robots compete to demonstrate their ability to perform agricultural tasks (such as removing weeds or surveying crops down to individual-plant resolution). At field campaigns, participants collect data that are then made available for online competitions (Cascade Campaigns) like the one you are seeing. For more information about ACRE and METRICS visit the [official website](#).

<https://competitions.codalab.org/competitions/27176>

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The Data

Collection Team

- Bipbip
- Pead
- Roseau
- Weedelec

Crop

- Haricot Beans
- Maize

Number of *training* images (per team per crop): 90

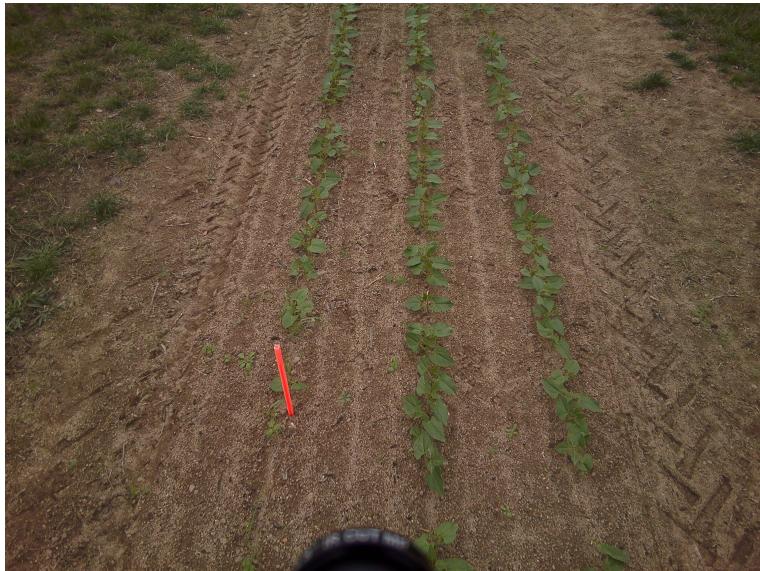
Bipbip - Haricot Beans



Bipbip - Maize



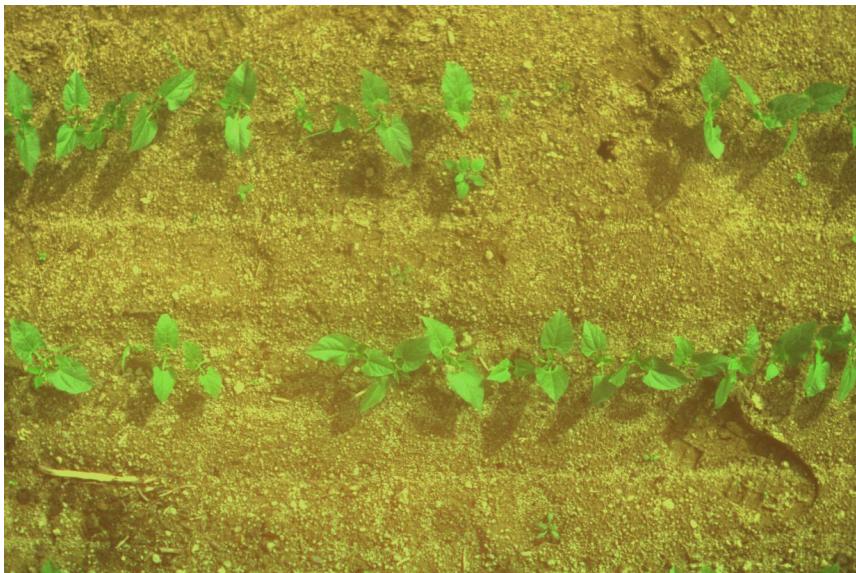
Pead - Haricot Beans



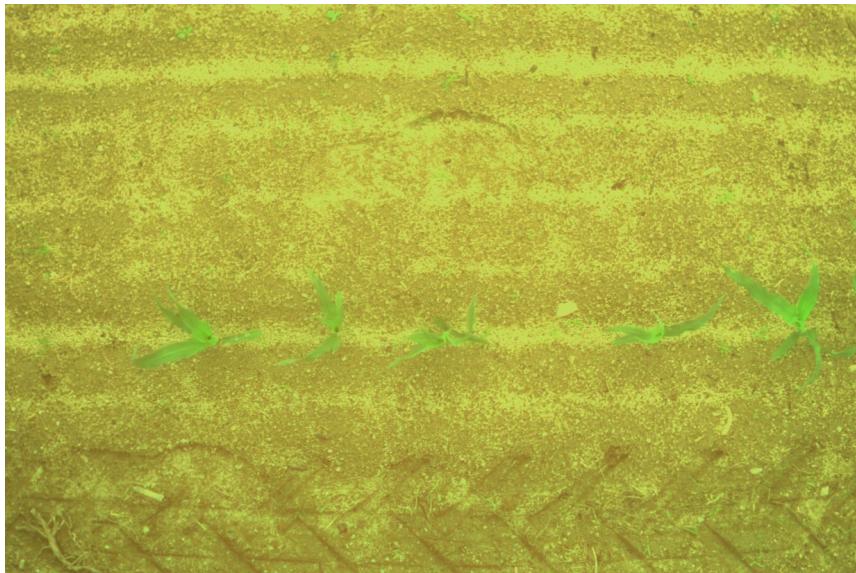
Pead - Maize



Roseau - Haricot Beans



Roseau - Maize



Weedelec - Haricot Beans



Weedelec - Maize



Schedule

Schedule

Monday (today): 10:30 - 12:00 Kick-off

Wednesday: Mid-week update - 5min

- Each team should prepare a single slide summarising their current progress and future directions

Next Monday: 4pm Competition End. 10min

- Each team should be ready to give a 10 minute presentation outlining and justifying their final approach

Next Tuesday: Winners announced

Evaluation

Main Prize

- Based on CodaLab Leaderboard
 - Next Monday 4pm
 - Actual competition leaderboard continues to 17th January
- Evaluation based on IoU metric (intersection over union)

Communication Prize

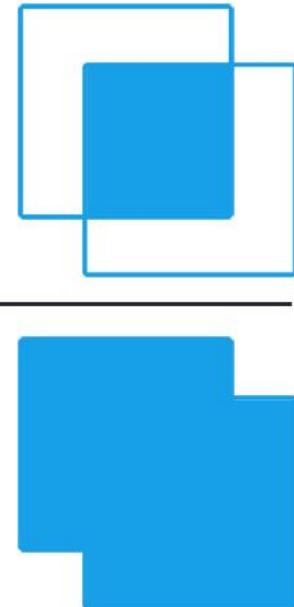
- Based on the presentation
- What's the solution you've used?
- What challenges did you face?
- How did you overcome them?

Evaluation - IoU Metric

Intersection over Union (IoU)

IoU is typically used in segmentation tasks and it essentially quantifies the percentage of overlap between predicted and target segmentations

$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$



Semantic Segmentation

Semantic Segmentation

"What's in this image, and where in the image is it located?"





Input

segmented →

- 1: Person
- 2: Purse
- 3: Plants/Grass
- 4: Sidewalk
- 5: Building/Structures

3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
5	5	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	5	5	5	5	5
4	4	3	4	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	5	5	5	5
4	4	3	4	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4	5
4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4
3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4
3	3	3	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4
3	3	3	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4

Semantic Labels



0: Background/Unknown

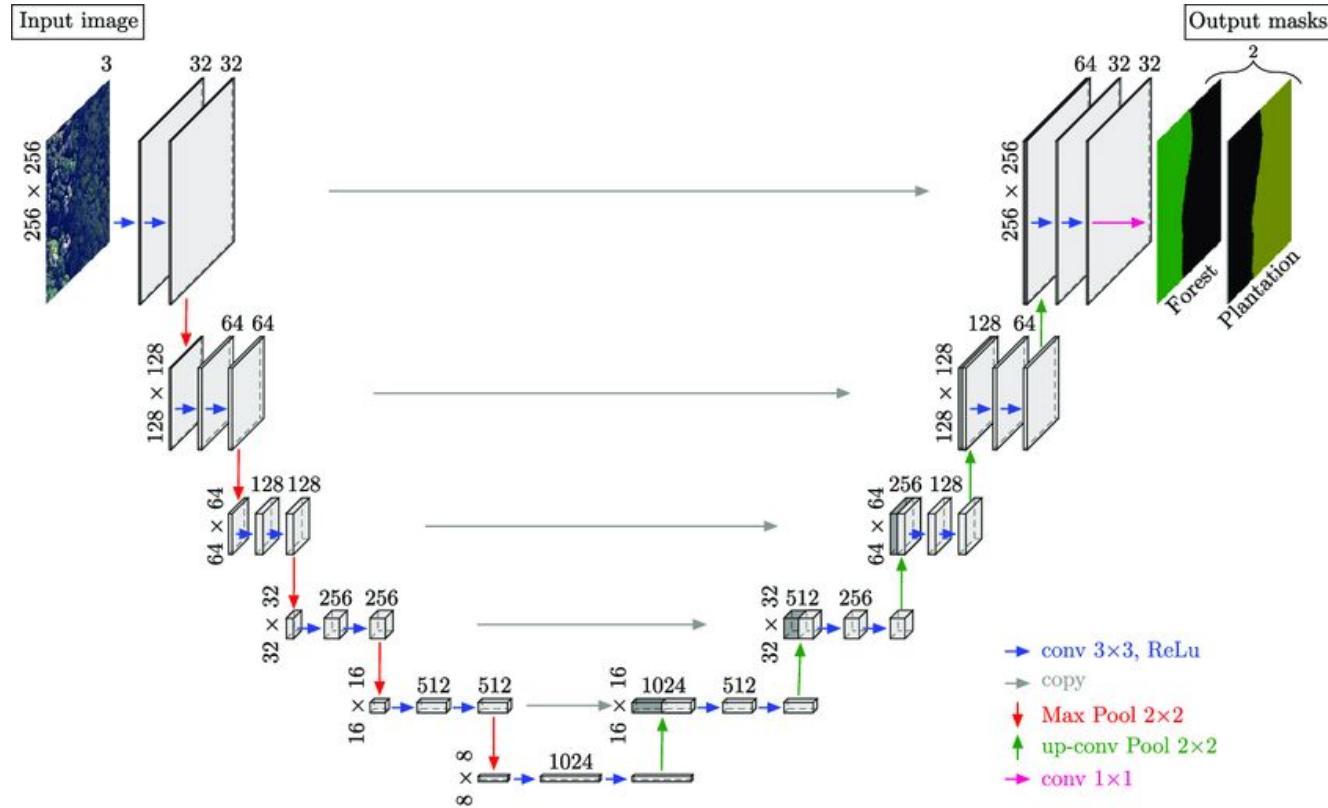
1: Person

2: Purse

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Example U-Net Model

Tools

Tools

Google Colab

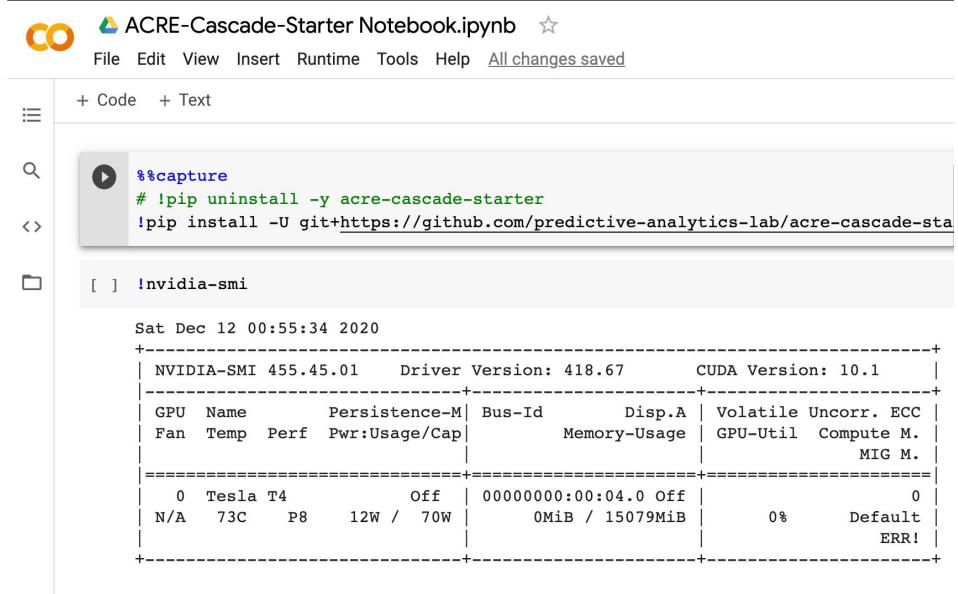
PyTorch Lightning

GitHub

Weights & Biases

Google Colab

Cloud-based notebook environment
with GPU.



The screenshot shows a Google Colab notebook titled "ACRE-Cascade-Starter Notebook.ipynb". The code cell contains the following command:

```
%%capture
# !pip uninstall -y acre-cascade-starter
!pip install -U git+https://github.com/predictive-analytics-lab/acre-cascade-starter
```

The output cell shows the results of the `!nvidia-smi` command, displaying GPU statistics for a Tesla T4:

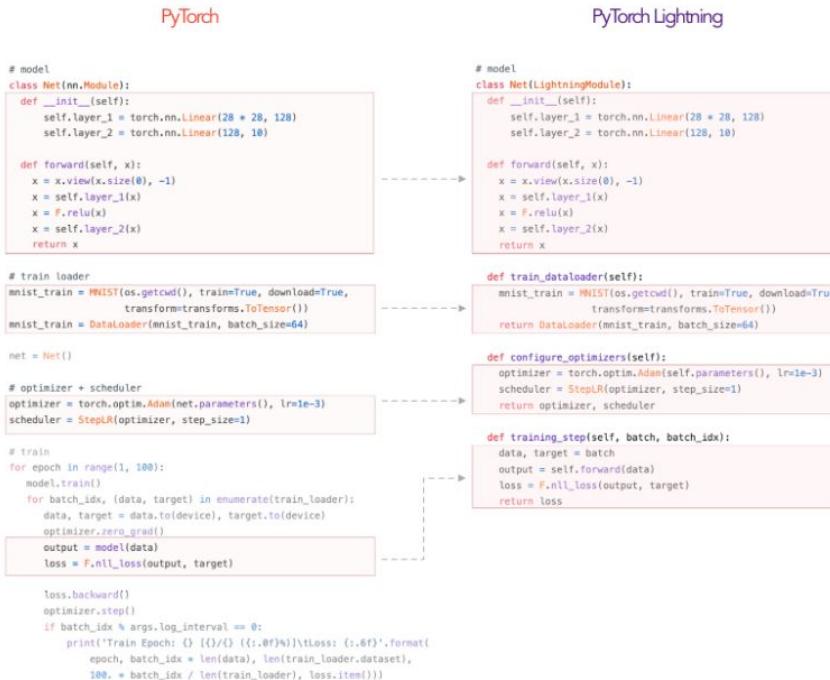
```
Sat Dec 12 00:55:34 2020
+-----+
| NVIDIA-SMI 455.45.01    Driver Version: 418.67      CUDA Version: 10.1 |
+-----+
| GPU  Name      Persistence-M| Bus-Id      Disp.A  | Volatile Uncorr. ECC | |
| Fan  Temp  Perf  Pwr:Usage/Cap| Memory-Usage | GPU-Util  Compute M. |
|                               |             |            | MIG M. |
+-----+
|   0  Tesla T4      Off  00000000:00:04.0 Off |          0 |
| N/A   73C   P8    12W /  70W |        0MiB / 15079MiB |     0%  Default |
|                               |             |            | ERR!
+-----+
```

PyTorch Lightning

<https://pytorch-lightning.readthedoc.s.io/en/latest/>

PyTorch: Machine Learning Framework

Adds structure and removes a lot of the boring boilerplate from PyTorch-based code (training/evaluation loops, for example)





Tool for collaborating and tracking code changes.

Allows for installation from a remote repository

The screenshot shows a GitHub repository interface. At the top, there are buttons for 'main' (with 10 branches), 'Code' (highlighted in green), and file navigation. Below this is a commit history for a pull request by 'olliethomas'. The commits are listed with their files, descriptions, and timestamps:

File	Description	Time Ago
src	Allow crop to be set via the AcreCascade datamodule.	2 days ago
tests	merge	2 days ago
.editorconfig	check hook	3 days ago
.gitignore	add download script	11 days ago
.pre-commit-config.yaml	select teams in right place	2 days ago
README.md	Update README.md	3 hours ago
environment.yaml	add env yaml, in case it's useful	11 days ago
main.py	Allow crop to be set via the AcreCascade datamodule.	2 days ago
mypy.ini	make initial submission script	4 days ago
pyproject.toml	Update pyproject.toml	2 days ago
setup.py	Fix CLI.	4 days ago

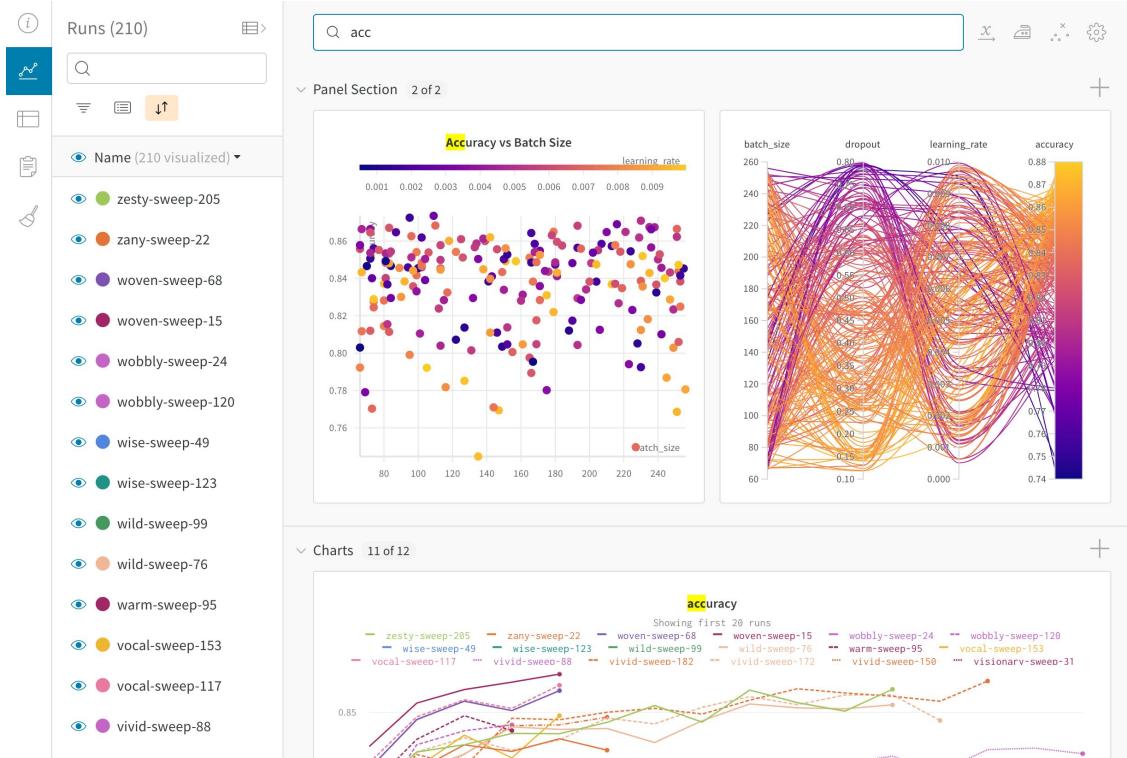
```
pip install git+https://repo.com/project.git
```

Weights & Biases

Experiment-logging tool.

The data is logged to a server and so can be accessed remotely just by logging into your account - can be easily shared amongst members of a team.

Can also be used to facilitate hyperparameter selection.



Starter Kit

What it contains

Link: <https://github.com/predictive-analytics-lab/acre-cascade-starter>

- A PyTorch Dataset and accompanying PyTorch Lightning data module specific to the ACRE Cascade dataset
 - Handles the downloading of the data, patch-generation, and loading of the data (including index-encoding of the RGB masks)
- A rudimentary Pytorch-Lightning-based model that includes routine for:
 - training/validating a basic U-Net model with a mixture of Cross-Entropy/Dice losses
 - Generating predictions with the trained model and preparing them for submission
- A basic command line interface (CLI)

In Teams

- Introductions
- Arrange a time (and method) for a daily catch-up that you'd like us to attend
- (Also probably a good idea to work out what computing resource you have access to!)