CSci 4695 and 6965: AI for Conservation
Fall Semester, 2023
Homework 4
Due: Wednesday, November 8, 2023 at 11:59:59pm

Overview

This assignment is worth 150 points toward your homework grade. It is to be done in teams of two students from your semester project assignment group. Please pair the student with the most and least ML experience in a team, and then pair the other two students. You are welcome to provide assistance across the two pairs from within a team, but two separate solutions should be submitted. Importantly, the specific contributions of each student should be documented in the homework write-up.

Please try not to be late in submitting this assignment. You may use the **minimum** of the late days your team has remaining.

Assignment

Your challenge is to use Megadetector (MD) to implement a pipeline for analyzing camera trap images to do the following:

1. Determine which images are empty.
2. Label the species type for the image.
3. Count the animals in a burst of images.

Tasks

1. Install Megadetector. For general instructions see

   `https://github.com/agentmorris/MegaDetector/blob/main/megadetector.md#using-the-model`

   For more specific instructions on installing Megadetector on the CCI NPL cluster, see Mason Sklar's instructions below.

2. Download the dataset culled from LILA Snapshot Karoo (`https://lila.science/datasets/snapshot-karoo`) by Mav:

   `https://drive.google.com/drive/folders/1hZPZ6kWBsT3C16vwOdJjUQwrxCHgoHh1?usp=drive_link`

   This contain about 5,000 images and four classification categories — *empty* plus three animal species. Mav resized the images to each have a maximum dimension of 512.

3. Read the data set and thoroughly explore it (in a Jupyter notebook). Output both statistics and example images in order to communicate a strong understanding of the data.

4. Split the data to create train, validation, and test datasets. Ensure that all images and all ground truth detections from a burst of images– you'll understand this when you explore the data — are kept together in a split, i.e. all in train, all in validation, or all in test. Output

statistics on your splits to ensure that an approximately equal distribution of burst lengths are in each dataset.

5. Design, implement, train and test a classifier that uses the Megadetector results to decide if an image is empty. This is not as easy as seeing if the detector produces no detections, because it may produce low confidence detections in empty images. The primary result should be a 2x2 confusion matrix computed from the test dataset.

6. Design, implement, train and test a classifier that assigns one of the final object categories (see the CSV file) to the images.

7. Design, implement, train and test a classifier that counts the number of animals in each burst of two or more images.

For each of these last three steps, please describe your algorithm(s), design decisions, training and experimental results. Do all of this within a single Jupyter notebook. This will be all that you submit.

Installing Megadetector on the CCI NPL Cluster

These are written assuming you have a CCI account but have not yet logged in. If you have logged in and installed *conda* there is only a bit to do. Also, if you are using the cluster for the first time, see Shruthi Chari's notes from HW 3 on using a Jupyter notebook. Finally, here's a final tip before starting: in terminals, you can copy/paste with a right-click!

Log into the NPL Cluster

1. Ensure you're on the RPI VPN.

2. After signing up for CCI, you should've received an email with your [CCI ID] and an ability to set a password. If you don't have your [CCI ID] and CCI password, contact support. This is different from your RCS ID and password.

3. Open a terminal, and run:

   ```
   ssh [CCI ID]@blp01.ccni.rpi.edu
   ```

   Enter your CCI password and Duo 2-factor authentication when prompted. You should now be connected to one of CCI's landing pads. For more info, see: https://docs.cci.rpi.edu/landingpads/

4. From the landing pad, run:

   ```
   ssh [CCI ID]@nplfen01
   ```

   Enter your CCI password when prompted. You should now be connected to the NPL cluster!

Install Conda

1. Run the below proxy commands:

   ```
   export http_proxy=http://proxy:8888
   export https_proxy=$http_proxy
   ```

This provides access to some external websites on the cluster.
More info: https://docs.cci.rpi.edu/landingpads/Proxy/

2. Run the three below commands to install miniconda:

```
wget https://repo.anaconda.com/miniconda/Miniconda3-latest-Linux-x86_64.sh
bash Miniconda3-latest-Linux-x86_64.sh -p ~/barn/miniconda3x86
source ~/.bashrc
```

You'll need to read & accept license terms. When prompted to run conda init, answer yes if this is your first CCI conda install. For more info, see: https://docs.cci.rpi.edu/software/Conda/. If you ever need to reinstall conda, remove the miniconda folder and run these steps again.

Install MegaDetector

1. Install the MegaDetector V5a model with the single command below. If you're copy/pasting, copy each line separately to avoid the newline character.

```
wget -P $HOME/barn/megadetector/ -L
https://github.com/agentmorris/MegaDetector/releases/download/v5.0/md_v5a.0.0.pt
```

2. Complete installation and create conda environment for MegaDetector:

```
mkdir $HOME/barn/git
cd $HOME/barn/git
git clone https://github.com/ecologize/yolov5/
git clone https://github.com/agentmorris/MegaDetector
cd $HOME/barn/gitMegaDetector
conda env create --file envs/environment-detector.yml
conda activate cameratraps-detector
export PYTHONPATH="$HOME/barn/git/MegaDetector:$HOME/barn/git/yolov5"
```

If your bash line starts with (cameratraps-detector), this was successful!

3. To activate this conda environment on future logins:

```
cd $HOME/barn/git
conda activate cameratraps-detector
export PYTHONPATH="$HOME/barn/git/MegaDetector:$HOME/barn/git/yolov5"
```