Deep Green Diagnostics

Readme

Description

System designed to analyze the health of the vegetation of urban areas through a UAV.

Software requirements

Operating System

- MacOSX 10.12.0 - 10.14.0
- Linux Ubuntu 16.04 LTS
- Windows 10

Software needed

- python 3.6
- Anaconda2-5.2.0
- Tensorflow 1.8.0

It is recommended to create a virtual environment in Anaconda before installing the packages listed below.

To create an enviroment

In the terminal client enter the following:

```
conda create -n yourenvname python=3.6 anaconda
```

To activate your virtual enviroment on Linux/MacOS

```
source activate yourenvname
```

To activate your virtual enviroment on Windows

`activate yourenvname`

Use the package manager pip to install the modules below.

`pip install name_module`

name_module:

- jupyter
- numpy*
- Pillow
- beautifulSoap4
- glob3
- selenium
- secrets*
- pyqt5
- QtWebKitWidgets for Linux/MacOSX
- QtWebEngineWidgets for Windows
- matplotlib

*In some cases those modules are already installed.

If you want to search for one of them or look for the packages already installed.

`conda search name_module` or `conda list`

Use the package manager conda to install scikit-learn

`conda install -n yourenvname scikit-learn`

Hardware requirements

- UAV of the DJI family with a 12 megapixel camera. (The most recommended is the drone phantom 4 or higher).

If the software runs on a computer with *MacOS* operating system:

RAM	CPU	Storage
8 GB or more	Intel Core i5 or higher	15GB or more

If the software runs on a computer with *Linux or Windows* operating system:

RAM	CPU	Storage
12 GB or more	Intel Core i7 or higher	15GB or more

Note: If your computer doesn't have enough RAM you should try to go to the network code and change the size of the batch that the network receives in the propagation. The current size of the batch is **300** as you can see in the line 2 of the code below.

```python
for k,v in self.dicc_pos.items():
     clase_arquitectura = TT_modelo_RNC30(300,
                self.directorio
                +'pickle/pickle_'+str(k),
                self.path_pesos)
          l = clase_arquitectura.propagacion(self.currentDir)
                self.dic_aux[k] = list(l[0])
                self.etiquetas.append(list(l[0]))
                del clase_arquitectura
```

If you want the changes to work you need to change the *for* cycle that the function has above.

You can find the complete code in this path:

`./DGD_ENG/View/VistaInicio.py`

Usage

For a quick start follow the steps below and watch the video.

Step 1: Take the photos with the drone and the Pix4D capture© application.

Step 2: Download the zip file and open the main directory with the name **DGD_ENG**.

Step 3: You'll see next directories tree.

- /DGD_ENG
  - TT_cultivos_main.py
  - readme.txt
  - chromedriver
  - /Images**
    - ParqueBicentenarioMAPA2_20180610134929
    - Mapa1ESCOM_20180428121951

        - Mapa1_20180520122028
        - EstacionamientoESCOM_20180524105606
    - /View
    - /Model
        - /Nets
        - /OriginalNet
        - /Pickles

***In this directory put the images from the drone.*

** **IMPORTANT!** *Create a new directory for each new project.*

***The content of this directory are examples of the system.*

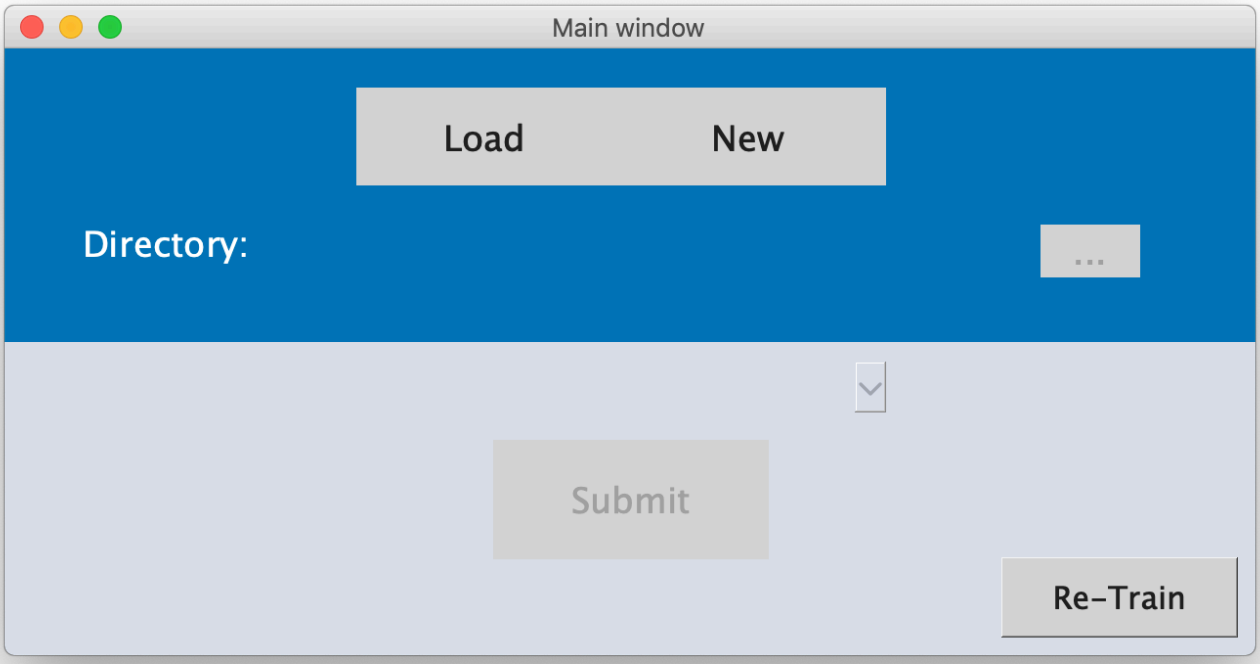
Step 4: Open a terminal in your operating system and look for the DGD directory with cd command.

```
cd /Users/userDGD/Desktop/DGD/
```

Step 5: Execute the script TT_cultivos_main.py

```
python TT_cultivos_main.py
```

You'll see the main window

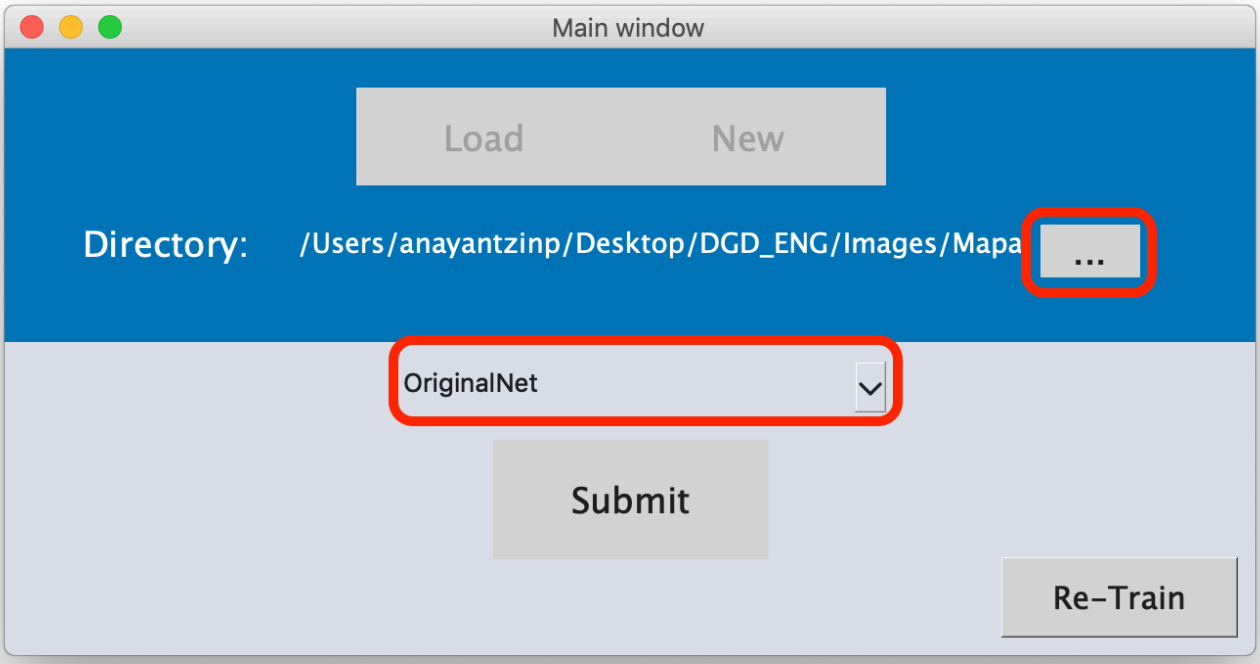


New

Choose the option **New** when you've never done an analysis with your images, this option will propagate the images in the neural network and it will take around 20 minutes for each 30 images.

Remember that if you want to analize a new map you must copy your photos in a new directory within the *Images* directory.

Then you can choose the photos and the neural network with which you want to analyze the map.



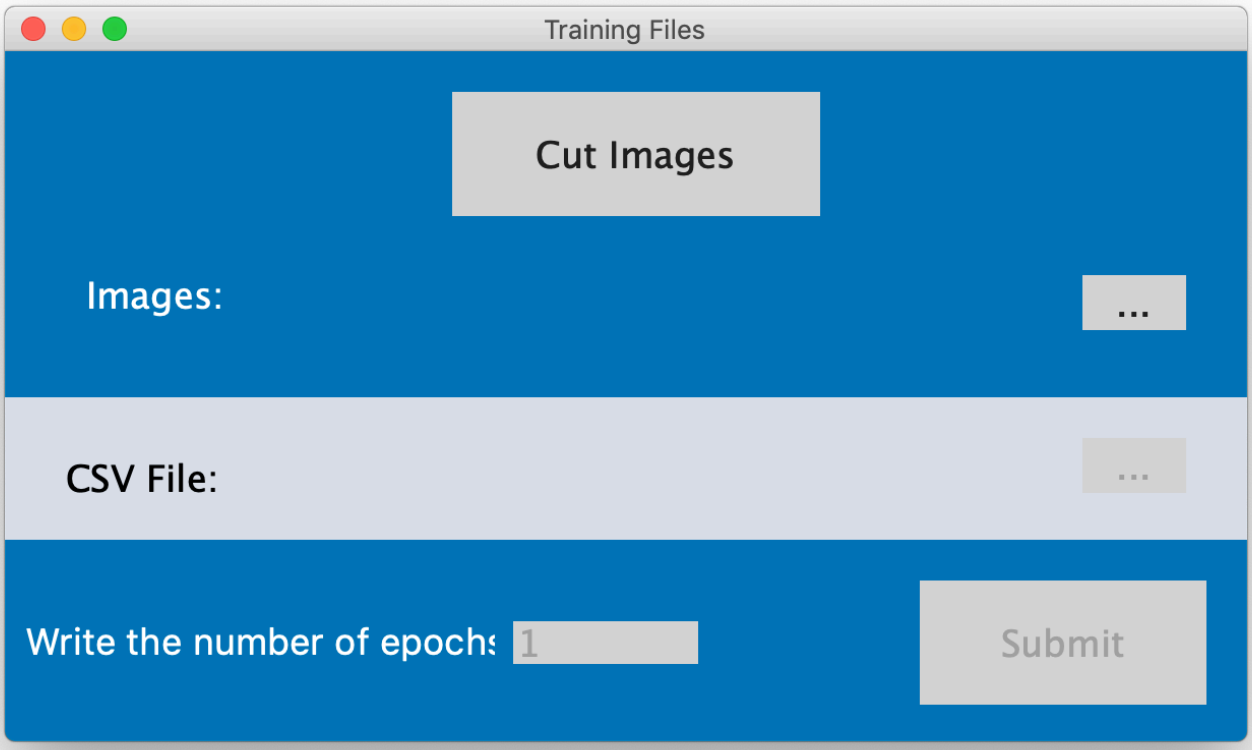
Load

Choose the option **Load** when you have a previous analysis and the file with extension .p.

In the ZIP file is a directory with some examples maps that you can try with the **load** option.

Retrain

Choose the option **Re-train** when you want to improve the accuracy of the neural network with your own drone images.



Prepare the dataset

The input images for training must be of size 200 x 200 pixels and they must be in .JPG format as well. If you don't have the pieces of the image, press the *Cut Images* button to prepare your images. The system will cut the image of 12,000 pixels in 300 pieces and it will rename them.

When your images are ready the system will close and you will have to tagg the amount you want to be used to retrain the neural network.

Then you'll have to prepare the CSV file as follow:

- In the first column the name of the image is written.
- In the second column the tag of the class (see the section **About the neural network** for more information).
- In the third column a label *1* is placed if in the photograph there's contamination or *0* if there's no contamination. We consider the contamination as all the garbage that could be found in an urban environment, such as waste of food, empty containers of sweets or chips, plastic bottles, and other things.

The example of how the CSV file is to be seen is shown below.

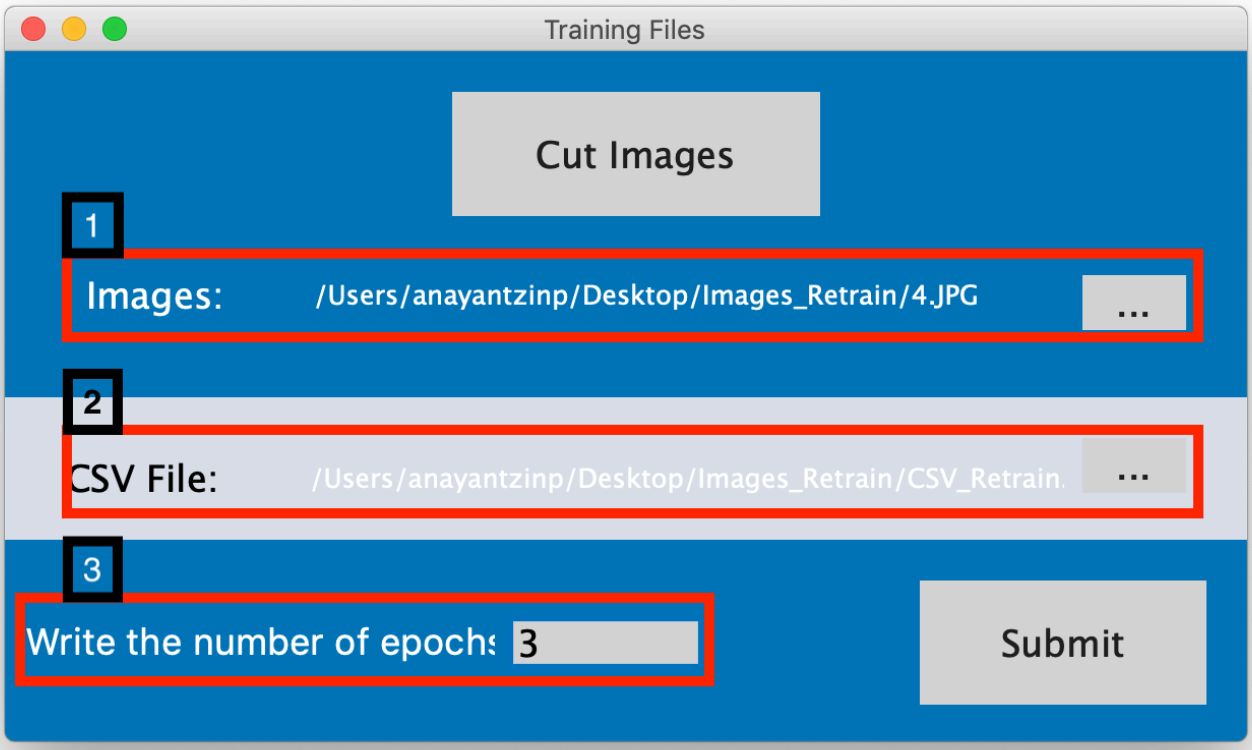
1616_11.JPG	NS	0
1617_0.JPG	SA	1
1617_1.JPG	NS	1
1617_2.JPG	SE	1
1617_3.JPG	NS	1
2009_9.JPG	NP	0

Dataset ready

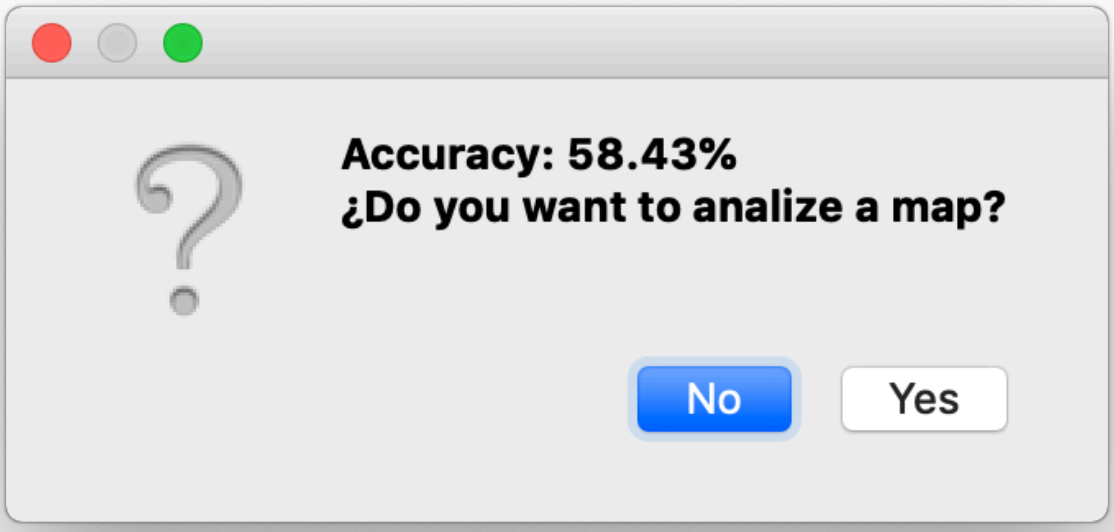
If you have the images in a directory with the correct size and **all of them with their tags** continue with the next steps and see the image below:

1. Choose the directory with your images wherever it is
2. Choose the CSV file.
3. Write the number of iteration for the network.

When you press the submit button, the system will separate the images in two sets, one for retraining and another for testing.



Wait for the system and finally you'll see a window like this:



The current accuracy is **72.03%**

About the neural network

In this project, we use a neural network with **5** convolutional layers to extract characteristics and **4** classification layers. To access the files that contain the neural network, follow this path:

```
cd DGD_ENG/Model/TT_modelo_RNC30.py
```

Classes

The buttons shown in the map view represent each of the classes separated by colors, the next are exmples of each class.

Healthy
(H)

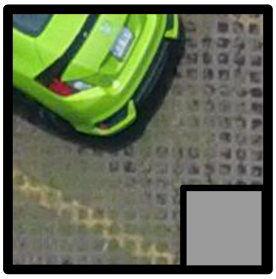
Healthy
Contaminated
(HC)

Dry
(D)

Dry
Contaminated
(DC)

Unhealthy
(UNH)

Unhealthy
Contaminated
(UNHC)



No Vegetation
(NV)

No Vegetation
contaminated
(NVC)

If you want to tag your own dataset follow the examples above and place the labels in the CSV file as shown in the following table.

Name of the label	Description
SA	Healthy (H)
SE	Dry (D)
NS	Unhealthy (UNH)
NP	No Vegetation (NV)

To indicate **contamination** write a number **1** for contamination and **0** for no contamination.

Troubleshoot

Images without metadata: If the images don't have metadata, the system won't be able to analyze them, the system use specific data to work. Those are the *GPS information*, the *RelativeAltitud* and the *FlightYawDegree* to construct the map.

Non-square maps: If your drone didn't finish the flight and the map is incomplete, we recommend to repeat the operation because a non square map causes loss of information and makes the algorithm to create the map put the output labels in wrong places.

Press any button on the map view and the images don't appear: This may happen because the images aren't in the "Images" directory, find the project and copy it in the right directory.

Load a map and the images don't appear: This may happen because the images aren't in the "Images" directory, find the project and copy it in the right directory. Another reason could be because the name of the directory is wrong, the system rename the directory of your project with an ID according to the date. In that case it is recommended that you analize the map again.

The accuracy of the network doesn't increase: You should take care of the data that you use for feed the neural network, try to follow the examples in the section **About of the neural network**. You can try increasing the value of the number of the epoch. It is very important that you follow the labels as shown in the past examples.

Contact

For any questions about the system and problem solving

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