

Marine Detect Developer Documentation

Overview

Marine Detect uses machine learning models and YOLOv8 image recognition to identify underwater marine life species. Built on Orange's open source repository (<https://github.com/Orange-OpenSource/marine-detect>), the models are trained to annotate marine life in images and videos that are more interpretable by educators and enthusiasts than just researchers.

Installation

There are three options for downloading from the README of the repository, the second option being the simplest one:

Option 2 - Developing on Your Host OS with Anaconda:

- Download the source code from the repository: <https://github.com/kaylie-a/marine-detect>
- Make sure Conda is installed and working on your machine:
<https://www.anaconda.com/download>
- Then, run the following commands in the project directory:

```
conda create --name your_env_name python=3.10
conda activate your_env_name
pip install -r requirements.txt
```
- Download the models from
<https://drive.google.com/drive/folders/1Ir22v22zIP0F1wEHxxBuA4c4IKy6-GvE?usp=sharing> and place them within a folder "models" in the directory.
- In the `marine_test.py` program, check the file paths for:

```
images_input_folder_path
images_output_folder_path
model_paths
```
- Begin predicting on images and individual videos.

Architecture & Key Components

To train new models, use the `training.py` program and update the directory to a new dataset. Old models can also be retrained and improved using the program. Datasets used must include each of the following image sets: test, train, and valid. Classifications for species types of marine animals are found through the `data.yaml` file within each dataset located in the `datasets` folder of the repository. The resulting model is found as `best.pt` in the `weights` folder of the output, found in `runs/detect`.

Each model's precision, recall, f1, score, and accuracy are calculated in the `individual_test.py` and `multiple_test.py` programs. File paths for each program also must be updated to evaluate each models' respective metrics. `individual_test.py` tests the evaluation metrics of a single model, while `multiple_test.py` tests the evaluation metrics of all the models in sequence, then a combined average. The two programs are used to determine which models are weaker and have less accuracy than others.

Marine Detect can predict on both images and video. For video prediction, it is the same process as image prediction as it goes through each frame of a video. Predictions are made through the `marine_test.py` program, which goes through each of the individual models and uses each to analyze the images. The confidence threshold varies for each model, depending on how accurate each model is and the contents of the image. This is the `confs_threshold`, and each value is determined through testing on images and checking if the threshold should be lowered for certain models.

In `src/marine_detect`, the `predict.py` program holds the algorithms for processing images and the paths the results will be outputted to, and going through the models to predict on those images.

Future Development

The individual models have better accuracy for certain marine species types on their own, but the accuracy could be further enhanced through Ensemble Learning. Training individual models to be later combined into one model could increase the precision of the annotations on images, and result in more accuracy on identifying marine life.

Licensing

The GNU AFFERO GENERAL PUBLIC LICENSE requires that the source code is made available, and any modifications must be made under the same license.