[AI'24] Introduction to Vision and Robotics

Marine Life Classification and Detection

Marine life, sea life, or ocean life is the plants, animals, and other organisms that live in the salt water of seas or ocean. Using AI for the recognition and detection of marine animals could aid efforts for fishing, endangered animal protection, tracking and analysis. In this project, you will be tasked with applying classification, detection and few-shot recognition concepts to a variety of marine life images.

Project Main Objectives:

1. Apply Image Classification to identify the marine animal in a given image.
2. Apply Object detection to localize different instances of the same species in a single image.
3. Apply few-shot learning (Siamese) concepts to recognize specific instances of a certain sea animal (could be used for tracking specific instances of whales)

   Minimum Requirements:

   The provided dataset consists of five main classes: **fish**, **jelly**, **shark, tuna and whale**. You are required to apply the following:

   a. A deep learning classification model to classify a given image into one of the five classes.
   b. An object detection model should be trained for these four classes: **fish**, **jelly**, **shark, tuna.**
   c. A few-shot learning mechanism (i.e., Siamese) should be applied and trained for the **whale** class to recognize specific instances of the same whale.

Additional Bonus (Not Required):

- Apply segmentation on the whale class using image processing algorithms to separate the whale tail from the background and measure the length of the tail.

Dataset Description

The project dataset can be found [here]

The dataset consists of 5 main classes: **fish**, **jelly**, **shark, tuna and whale**.

The first four classes are provided along with the object detection annotations while the whale class does not have object detection annotations but rather Whale ID for each instance of a specific whale.

The dataset contains three folders for each of the three tasks:

1- Classification folder:

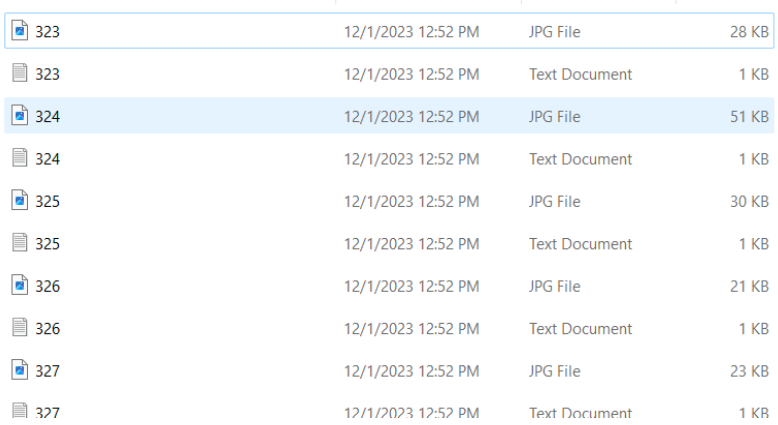
- Separated into train and val subsets
- The classification folder is separated into five subfolders for each of the five classes.
- Each subfolder contains the list of images pretraining to that class.

  Note: In the first four folders, you will find .txt files corresponding to each image's detection annotations, these txt files are to be ignored in this task.

- The classes are unbalanced and contain lighting variations.

2- Detection folder:

- Separated into train and val subsets.
- Contains only four classes: **fish**, **jelly**, **shark and tuna.**
- Each image has a corresponding annotations file with the same name as the image.



323	12/1/2023 12:52 PM	JPG File	28 KB
323	12/1/2023 12:52 PM	Text Document	1 KB
324	12/1/2023 12:52 PM	JPG File	51 KB
324	12/1/2023 12:52 PM	Text Document	1 KB
325	12/1/2023 12:52 PM	JPG File	30 KB
325	12/1/2023 12:52 PM	Text Document	1 KB
326	12/1/2023 12:52 PM	JPG File	21 KB
326	12/1/2023 12:52 PM	Text Document	1 KB
327	12/1/2023 12:52 PM	JPG File	23 KB
327	12/1/2023 12:52 PM	Text Document	1 KB

E.g., The object detection annotations for image "323.jpg" can be found in "323.txt" in the same folder. The label of each object in the txt file is the name of the folder it was found in.
Each txt file contains 1 or more lines. Each line corresponds to an object in the image.

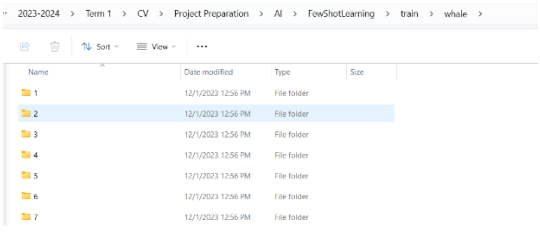
```
640,640,156,0,436,640
```

Each line in a text file has 6 values corresponding to: width, height, xmin, ymin, xmax, ymax.

Note: The width and height refer to the width and height of the image, not the object.

3- Few-Shot Learning folder:

- This folder also consists of train and val subsets.
- Each set is separated into several subfolders where the name of the folder is the ID of a given whale.



- Each whale ID has from ~(7-12) instances.
- There is a total of 50 whale Ids (folders) in the train set and 17 whale Ids (folders) in the val set

- The whales found in the val set are completely different from those in the train set.

Practical Exam Project Deliverables:

1. Apply and train an image classification model using deep learning to classify the images into 5 classes (Deliver Code)
2. Apply and train an object detection model on the first four classes You can use Faster RCNN or YOLO or any preferred deep learning model for object detection. (Deliver Code)
3. Apply and train a few-shot learning model (Siamese) on the whale class. (Deliver Code)
4. Run the validation set on each model to acquire the validation accuracy.
5. If you trained the deep learning/Siamese models using a notebook, you must deliver the notebook with the output cell saved displaying the training logs. If you trained the model using IDE (i.e Pycharm). **You must deliver screenshots of the training process**.
6. You will be given test samples on the practical exam day. You should prepare test scripts such that:
   - You are expected to classify each test image,
   - If the predicted class is one of the first four classes, then apply object detection on the image and visualize the predicted bounding boxes,
   - If the predicted class is whale, then you should identify the ID of the whale in the given image from the IDs that you had during the training process (You can use either one reference from each training folder or several references from each training folder).
7. A Report that includes description of:
   - Your data preparation process.
   - Brief description of the models and techniques used in each task.

- Training and Testing times for each model.
- Image Classification training and validation accuracy.
- Object detection performance metrics for training and validation
- Few-Shot Learning performance metrics for training and validation.
- Provide screenshots of the validation sets classification with visualization.
- Provide screenshots of the validation sets detection with visualization.
- Provide screenshots of the validation sets few shot learning with visualization.