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Task Overview:

I was assigned the task to implement an aquarium species detection system using the MMDetection framework. The goal was to utilize the Roboflow Aquarium dataset for training an object detection model capable of identifying various marine species within an aquarium environment.

Steps Taken:

1. Dataset Preparation: I downloaded the Aquarium Dataset from Roboflow, which contained labeled images of various marine species. This dataset was split into training, validation, and test sets to ensure the model could generalize well.

   <u>Datasets</u>

   ```
   from roboflow import Roboflow
   rf = Roboflow(api_key="nMBrOGYRRVnkXQj6Il9x")
   project = rf.workspace("brad-dwyer").project("aquarium-combined")
   version = project.version(6)
   dataset = version.download("coco")
   ```

2. Environment Setup: I used Anaconda as my development environment and installed MMDetection with all its dependencies. This included setting up PyTorch, MMCV, and COCO API for annotation handling.

   ```
   # Clone MMDetection repository
   !git clone https://github.com/open-mmlab/mmdetection.git
   %cd mmdetection
   !pip install -r requirements/build.txt
   !pip install -v -e .
   ```

I cloned the MMDetection repository from GitHub and configured the Faster R-CNN model by specifying my training and validation datasets, setting the number of classes, and defining the number of epochs. Initially, I encountered a ValueError: need at least one array to concatenate. However, I found a solution by modifying the file located at E:\projects\Aqua\mmdetection\mmdet\datasets\coco.py, where I made necessary changes related to the classes and bounding boxes (bbox).

3. Train Model:-

   After resolving the issue, I proceeded with training the model. Upon completing the training, I obtained the epoch_5.pth file, which contains the trained model's weights. The training process was executed using the following command:

   ```
   python mmdetection/tools/train.py mmdetection/configs/_base_/default_runtime.py
   ```
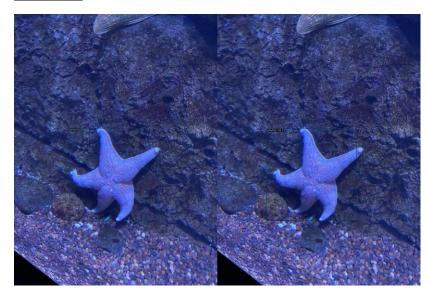
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4. Test Model:-

I then tested the model using the epoch_5.pth file by running the following command:

```
python mmdetection/tools/test.py mmdetection/configs/_base_/default_runtime.py
work_dir/default_runtime/epoch_5.pth --show-dir work_dirs/test
```

After testing the model with the command, I received the test.bbox.json file, which contains the detection results. I then provided an internet photo to the model for testing. Upon processing the image, the model generated the output, which includes the detected objects and their corresponding bounding boxes.

```
from mmdet.apis import init_detector, inference_detector
from mmdet.registry import VISUALIZERS
import mmcv
import cv2

config_file = 'E:/projects/Aqua/mmdetection/configs/_base_/default_runtime.py'
checkpoint_file = 'E:/projects/Aqua/work_dirs/default_runtime/epoch_5.pth'




model = init_detector(config_file, checkpoint_file, device='cpu')

image = mmcv.imread('test6.jpg')
result = inference_detector(model, image)

visualizer = VISUALIZERS.build(model.cfg.visualizer)

visualizer.dataset_meta = model.dataset_meta

visualizer.add_datasample(
    'result',
    image,
    data_sample=result,
    draw_gt=False,
    wait_time=0,
    out_file='outputs/result.png'
)
visualizer.show()
```

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Output: -

Why Faster-RCNN

Faster R-CNN is known for its high accuracy in tasks such as detecting multiple object categories (like fish, jellyfish, etc.) in the Aquarium dataset. It is particularly useful for datasets where precision is key.

Faster R-CNN works well on a variety of object detection tasks, from general object detection (like animals, vehicles, etc.) to specialized domains like marine species detection in your project.]

Conclusion

The Aquarium Species Detection project uses MMDetection to identify marine species like fish, jellyfish, and starfish from the Roboflow dataset. The model is trained and fine-tuned for species detection, leveraging object detection techniques. The project successfully detects species in images, with potential for real-time and mobile integration. Future improvements could include expanding species coverage and deploying a real-time system. This project demonstrates the power of AI in marine species recognition and conservation efforts.