YOLO Perception Pipeline

Workspace Location:
Folder in PC: capstone_2022/darknet for regular YOLO,
capstone_2022/perception_ws/darknet_ros for ROS Integrated YOLO.
Note: Use regular YOLO to train, copy weights and configs to capstone_2022/perception_ws/src/darknet_ros/darknet_ros/yolo_network_config once weights are finalized

Steps:
1) Train regular darknet
2) Copy .cfg file and .weights file to darknet_ros folder
3) Configure topics and class names in capstone_2022/perception_ws/darknet_ros/darknet_ros/launch/yolov3.launch and capstone_2022/perception_ws/darknet_ros/darknet_ros/config/yolo.yaml
4) Run roslaunch darknet_ros yolov3.launch

Regular Darknet/YOLO
-- Data Collected
    -- coco_data (Just deleted to save space)
    -- pier_data

-- 3 Models
    -- Model 1: Pier Only, CFG: yolo-pier.cfg Weights: yolo_pier.weights // Fully Trained from scratch (would sequentially with default yolo in order to detect person)
    -- Model 2: Pier + Person, CFG: yolo-person_pier.cfg // With COCO - Decently Trained from scratch (I suggest you retrain and manually check the dataset before training if you get time)
    -- Model 3: 81 Classes (COCO + Pier), CFG: yolo-v3_pier.cfg // COCO - Didn't get enough time to train from scratch (Need to manually train from scratch, alternative used to simplify testing process is to cascade the Pier Only model (Model 1) with default YOLO Model (2 NN Models in series))

-- Custom Model Generation:
    -- Filters: (classes + 5)*3
    -- Classes: classes (as per .data file)
    -- Max Batches: 2000 * classes
    -- Steps: (80% and 90%) Max Batches

-- Custom Data File:
    -- train.txt: File with list of train images
    -- test.txt: File with list of test images

-- valid.txt: File with list of validation images
-- names: File with list of class names

Training

-- Transfer Learning: ./darknet detector train <data_file> cfg/<cfg_file> darknet53.conv.74
-- Resume Learning: ./darknet detector train <data_file> cfg/<cfg_file> backup/<backup_file>
-- Fresh Learning: ./darknet detector train <data_file> cfg/<cfg_file>

Once you finish training on regular darknet, copy .cfg, .weight files to darknet_ros/yolo_netowrk_config

Detection/Testing

-- Video: ./darknet detector demo <data_file> cfg/<cfg_file> <weight_file> <video file> -thresh 0.3
-- Image: ./darknet detect <data_file> cfg/<cfg_file> <weight_file> <image_file> -thresh 0.3
-- ROS: roslaunch darknet_ros yolo-pier.launch (Make sure correct topics are subscribed and correct weights/cfgs are used in darknet_ros/config/yolo.yaml file)

Common Problems, Fixes & Suggestions

-- When you clone a new repository for YOLO, make sure to edit makefile with GPU=1, OpenCV=1 and remove older NVIDIA compute architectures like -sm 30 and so on. The removal of older compute architectures depends on the computer and its graphics card.

References

-- darknet: https://pjreddie.com/darknet/yolo/ (You might want to switch to AlexeyAB fork of darknet)
-- darknet (AlexeyAB): https://github.com/AlexeyAB/darknet (Most updated fork of original darknet repository)
-- darknet_ros: https://github.com/leggedrobotics/darknet_ros