Pedestrian Tracking

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Problem and Motivation

- Our motive here is to create a working model that is beneficial for pedestrian crossing to avoid unnecessary accidents.

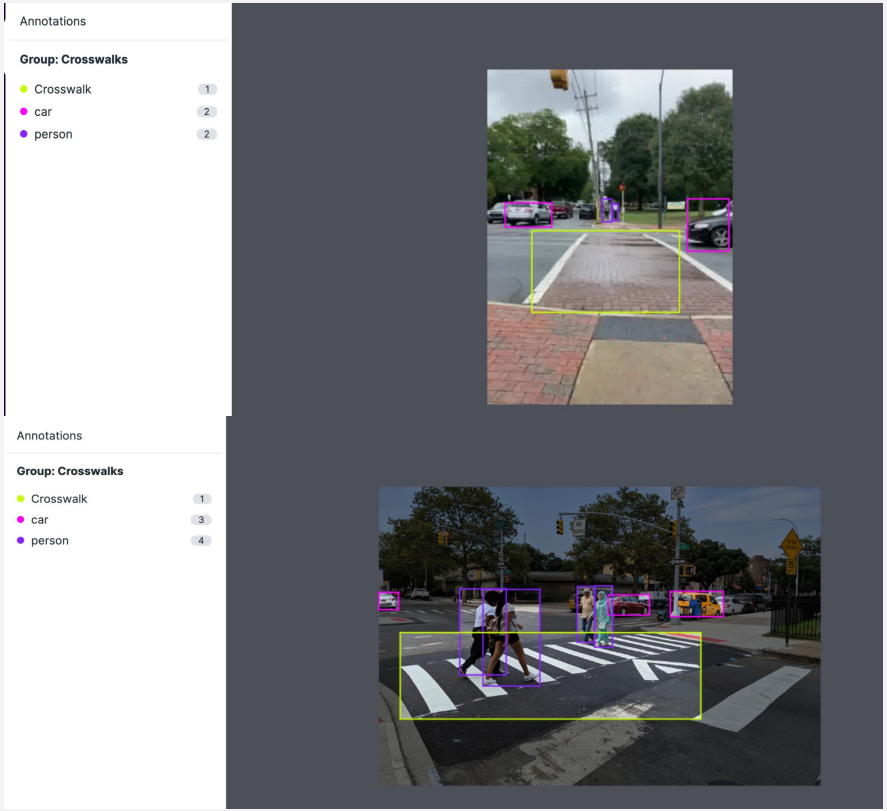
- This is for the people of Davidson County who need a software that monitors the pedestrian walks using a camera and identifies and alerts potential accidents using the statistics of previous accidents. This problem is universal and hence the solution to this problem could help the entire world.

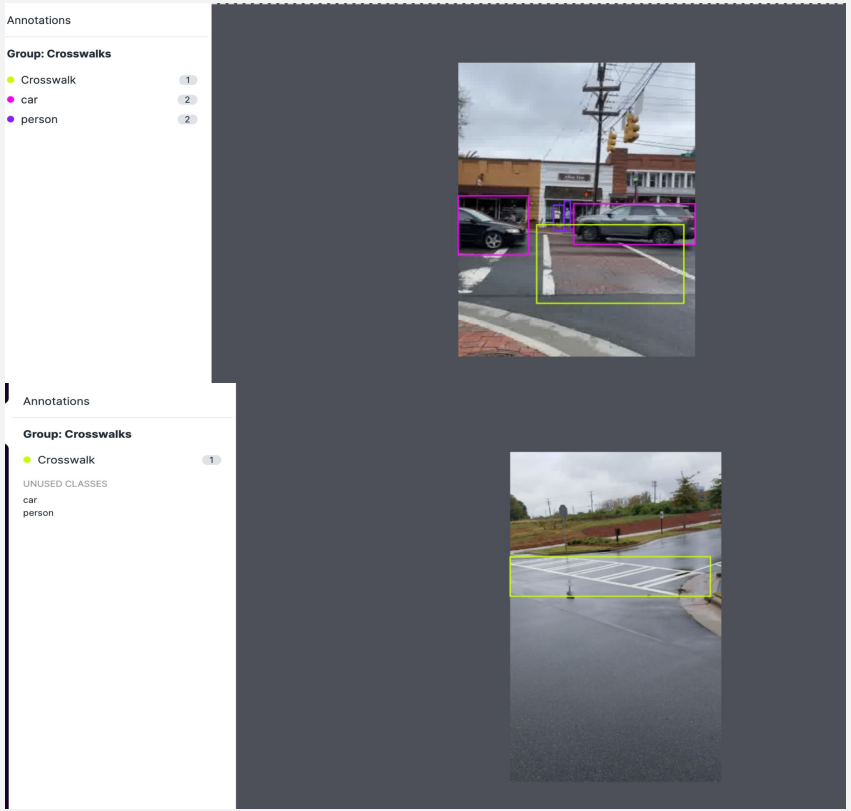
We chose to use the Yolo-v5 model based on the recommendation of Phillipe Loher who is our Advisor for this industry project. He recommended this library because it is pre-trained to detect a wide range of objects and can easily be extended to detect other things. We expanded the model to be able to detect crosswalks.

Dataset

The raw and unlabelled dataset has been collected by the team manually by taking pictures of pedestrian walks in davidson county crossings. Labelling the dataset paid a major role in our project, we labelled the dataset by using bounding boxes and classified cars, people, and crosswalk.

Pre-processed Dataset

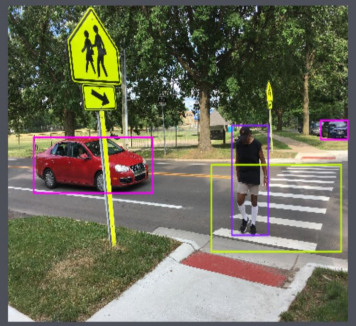




Annotations

Group: Crosswalks

- Crosswalk 1
- car 2
- person 1



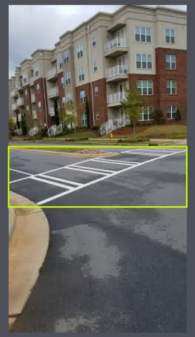
Annotations

Group: Crosswalks

- Crosswalk 1

UNUSED CLASSES

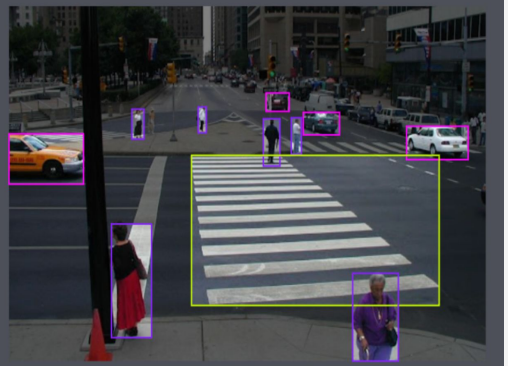
car
person



Annotations

Group: Crosswalks

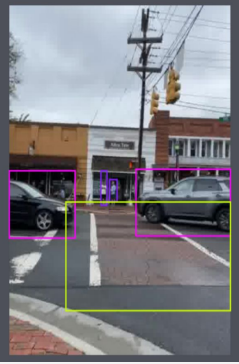
- Crosswalk 1
- car 4
- person 6



Annotations

Group: Crosswalks

- Crosswalk 1
- car 2
- person 2



Details about the Dataset

- **Classes and Labels:**
  - ➢ The classes of the labels are
    - ➔ Crosswalk : Total crosswalk labels - 543
    - ➔ Person: Total Person labels - 388
    - ➔ Car: Total car label - 834
- **How many samples are present in the dataset?**
  - ➢ The total number of Images in our data set is 552.
- **Information about train/test split ?**
  - ➢ The data is split with 70% Training, 20% Validation, 10% Testing
    - ➔ Training Dataset: 387
    - ➔ Validation Dataset: 110
    - ➔ Testing Dataset: 55
- **Data Augmentation**
  - ➢ Noise added to 5% of pixels

Methodology

Implementation:

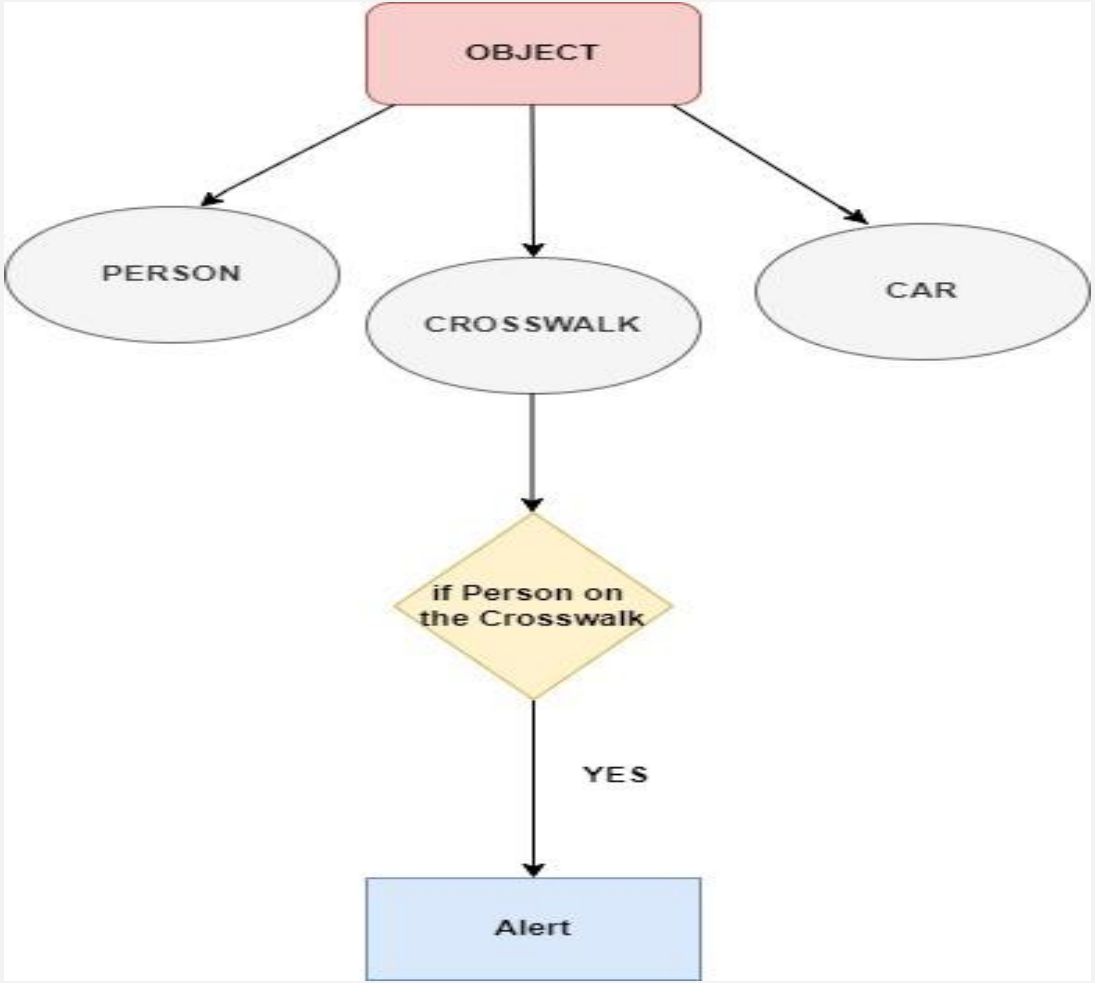
- We set up our experiment by taking photos of crosswalks in Davidson as well as around our local areas in order to train a variety of crosswalk styles into the model. We then used a website named Roboflow to annotate these pictures with bounding boxes and classifications.
- The data is split with 70% Training, 20% Validation, 10% Testing
- We experimented with using SGD as the optimization function in the model instead of Adam, and we also tried using 16 instead of 32 batch size, but we found that Adam with 32 batch brought the best results.
- The libraries used are: Yolov5, Roboflow, Wandb, and CV2

Problems:

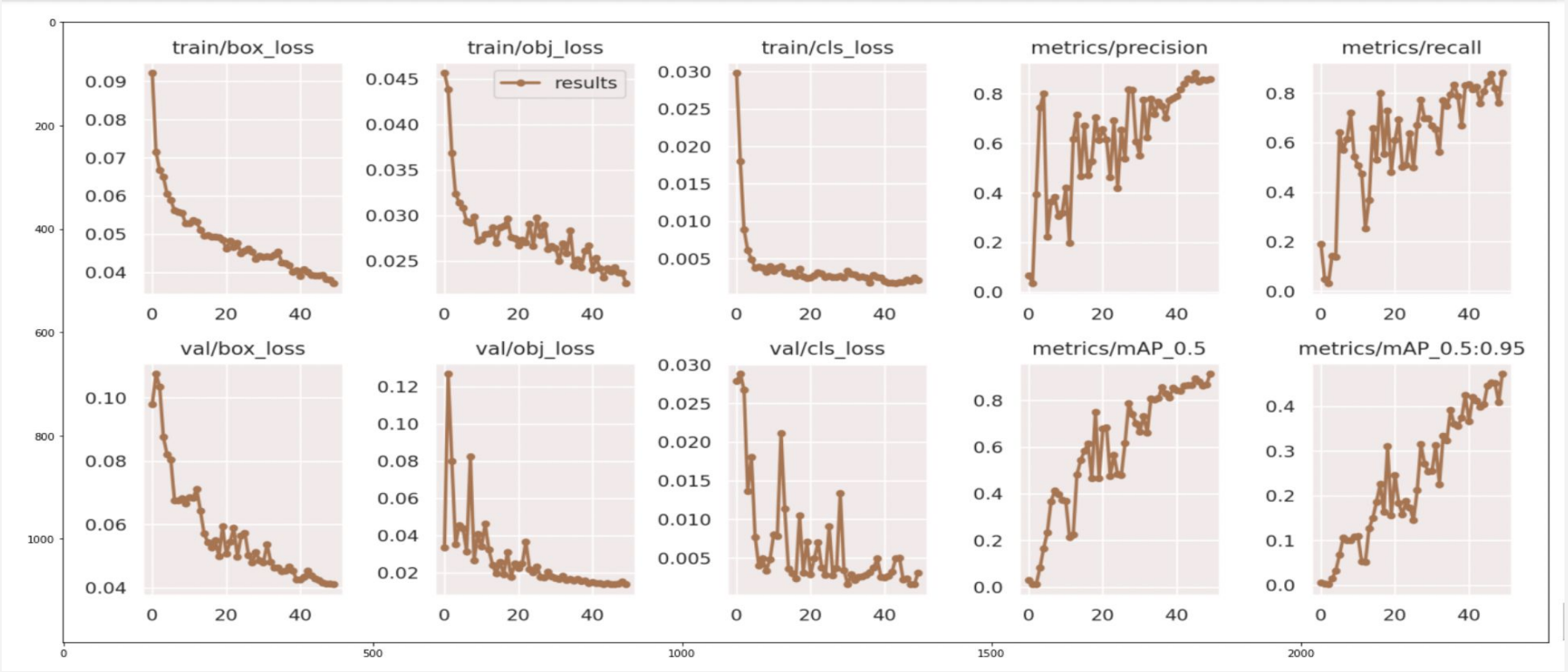
The dataset was manually taken by the team, so are not high in numbers.

Description of Model

- Yolov5 uses a Binary Cross-entropy with Logits Loss function which is calculated to measure the bounding box regression score, objectness score (which measures how well the model is finding the location and class of an object), and class probability score (which rewards high probabilities for correct classifications and punishes high probabilities for incorrect classifications)
- The model consists of 213 layers beginning with several convolution layers, followed by a dense bunch of layers using Leaky RELU as the activation function, then at the output layer it uses Sigmoid.
- The Hyper-parameters are Learning Rate: .01, Optimizer: Adam-Optimizer, Batch Size: 32.


OBJECT
PERSON
CROSSWALK
CAR
if Person on the Crosswalk
YES
Alert

Loss Function Graph



Results

Accuracy / Precision / Recall

- Precision: .85
- Recall: .82
- Mean Average Precision (when confidence > .5): .88

Limitations of our solution:

Even though there is an alert given when a pedestrian is in the crosswalk, the drivers may not always be conscious enough to be alert, so the chances of accidents when drivers are intoxicated still exists.

Conclusion

Our solution consisted of the following steps:

- Training the model with the train dataset
- Identification of object in the dataset
- Classification of objects into cars, pedestrian and crosswalk
- Identifying if a person is in the crosswalk
- Alerting with a signal that a person is in the crosswalk.

Thank You