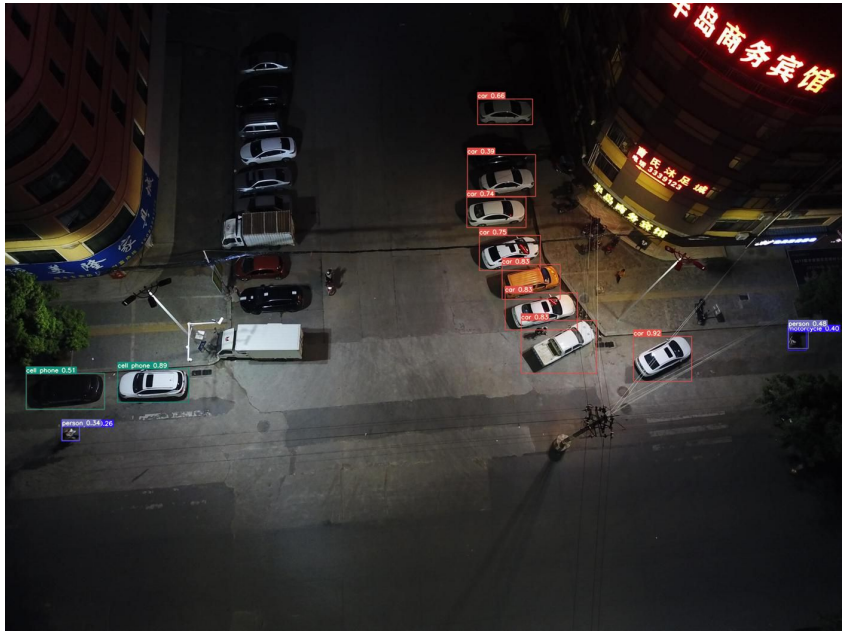
DIP Final Project

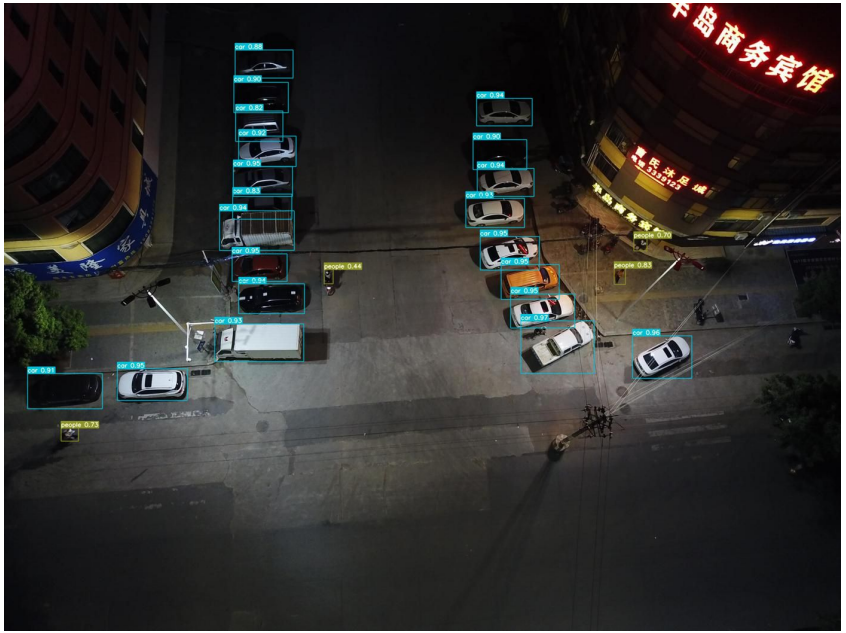
Fine-tune Yolov7 pretrained model with Visdrone-Dataset.

資工三 B09902053 何碩宸
資工三 B09902060 馮楷
資工三 B09902073 朱俊能

Fine-Tune with VisDrone Dataset



Original YOLOv7



YOLOv7 with VisDrone Dataset

Thanks for listening (?

JUST KIDDING

With VisDrone Dataset, YOLOv7 seems to perform perfectly, and we hardly can think of a way to make it even better. Therefore, we have modified our team's final project goal.

DIP Final Project

Fine-tune Yolov7 pretrained model ~~with VisDrone Dataset.~~
without additional datasets.

資工三 B09902053 何碩宸
資工三 B09902060 馮楷
資工三 B09902073 朱俊能

Outline

- Model & Methods
- Method 1: Local Histogram Equalization
- Method 2: Betti Number Filtering
- Experiment

Model & Methods

- Model: the pretrained YOLOv7 model

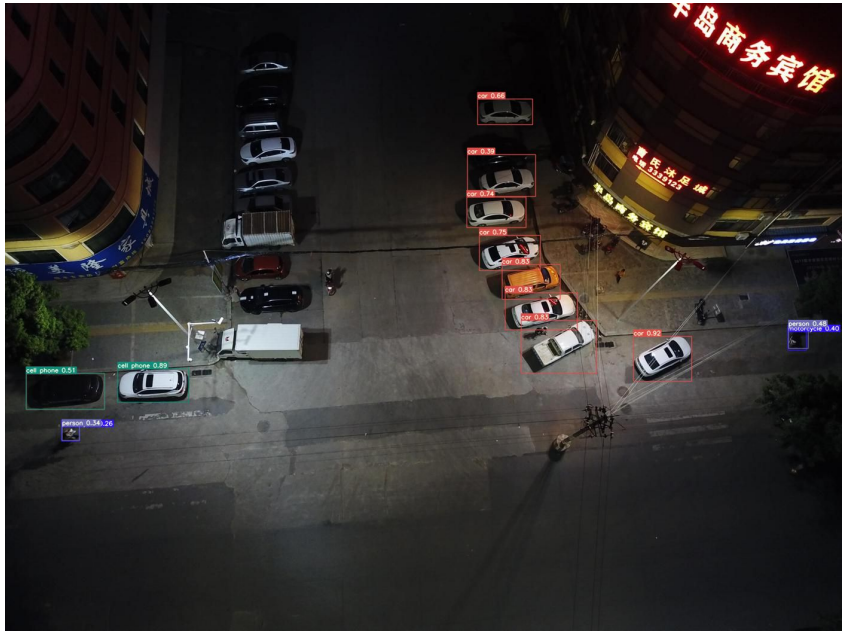
- Dataset: VisDrone-Dataset

- Methods:
  a. Local histogram equalization
  b. Betti number
  c. Parallel programming

Outline

- Model & Methods
- Method 1: Local Histogram Equalization
- Method 2: Betti Number Filtering
- Experiment

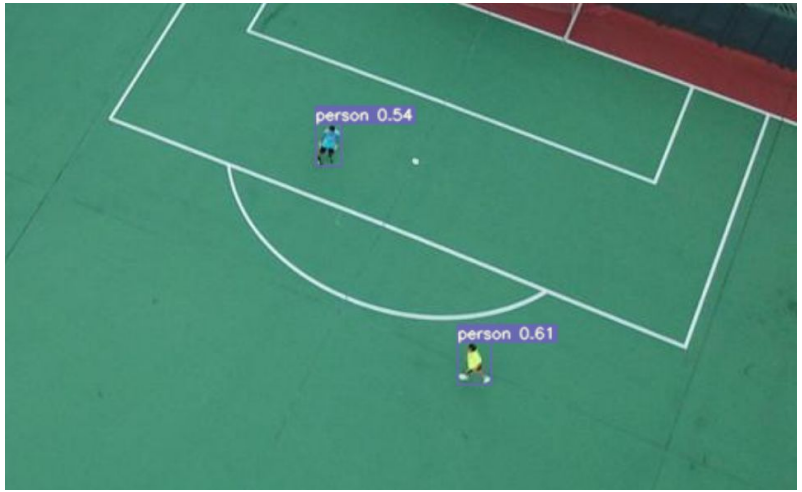
Local Equalization



Original YOLOv7

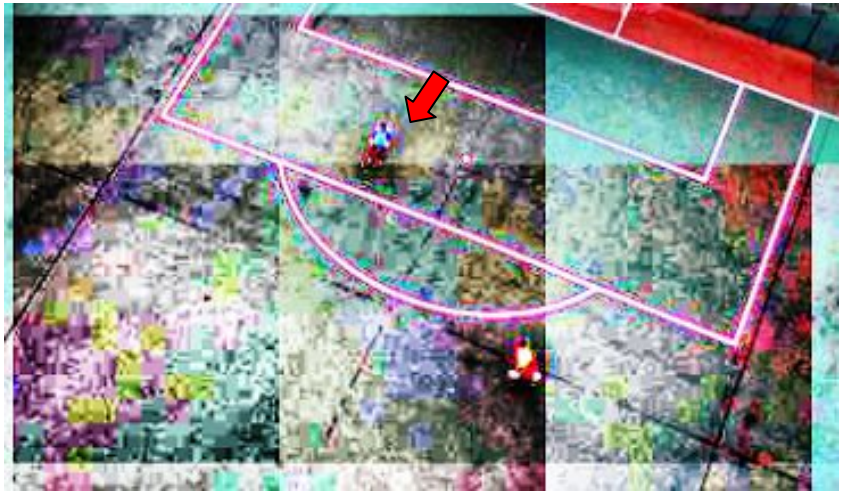
Local Histogram Equalization

Two Problems…



Both are detections without pre-processing.

Two Problems…

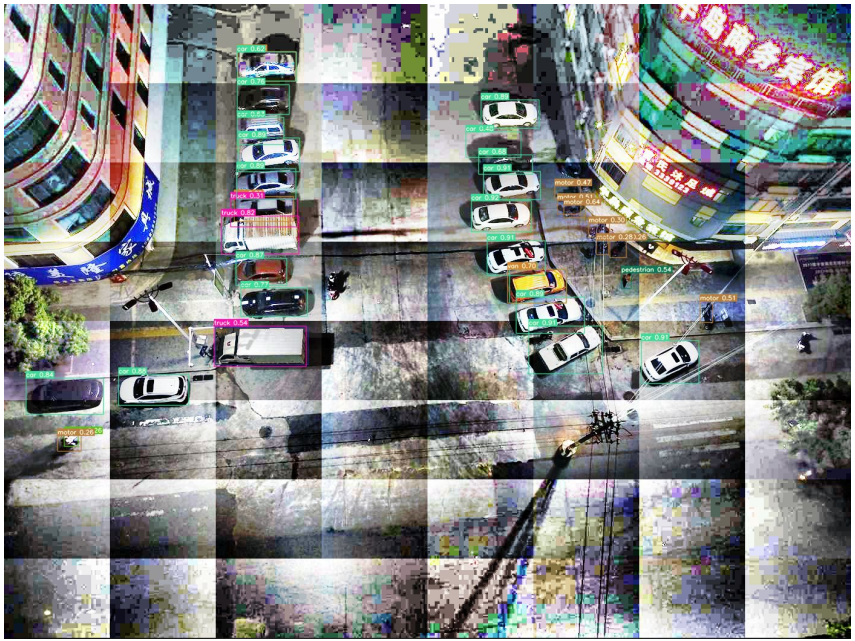


Under detecting

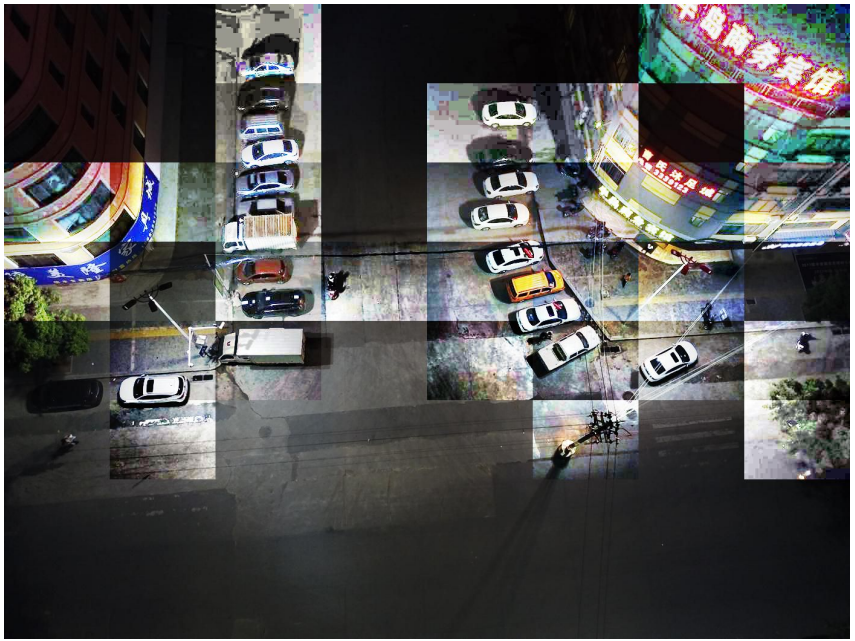
Over detecting

But with local histogram equalization, the results turn to be terrible.

Local Equalization W or W/O Betti Number Filtering



Local Equalization W/O Betti Number



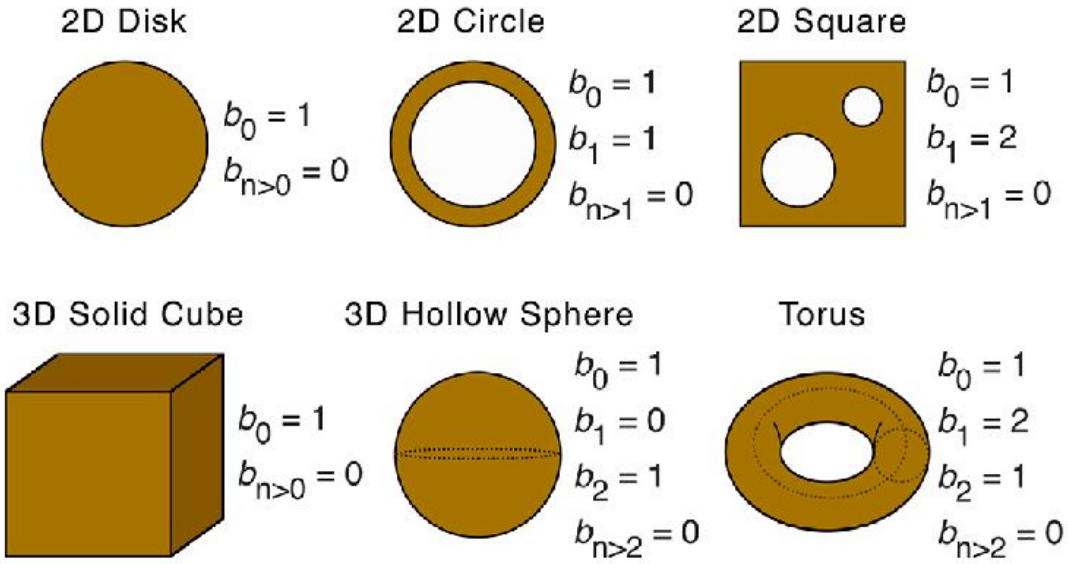
Local Equalization W Betti Number

Outline

- Model & Methods
- Method 1: Local Histogram Equalization
- Method 2: Betti Number Filtering
- Experiment

Betti Number

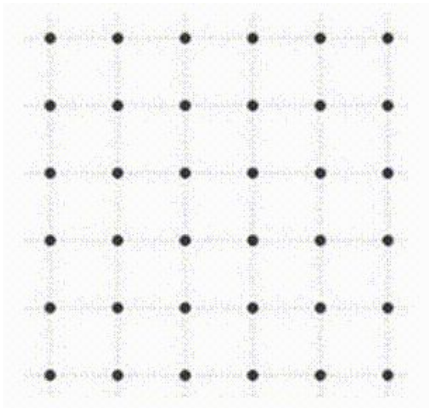
In algebraic topology, the Betti numbers are used to distinguish topological spaces based on the connectivity of n-dimensional simplicial complexes.

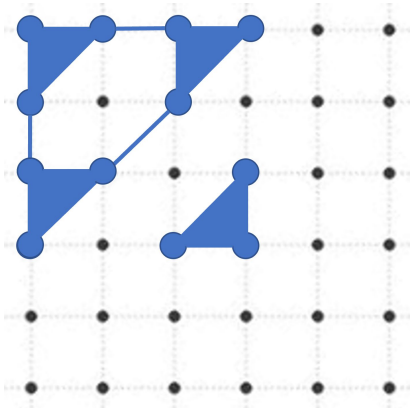


Algorithm

- Delfinado, C. J. a., & Edelsbrunner, H. (1993, July 1). *An Incremental Algorithm for Betti Numbers of Simplicial Complexes**.

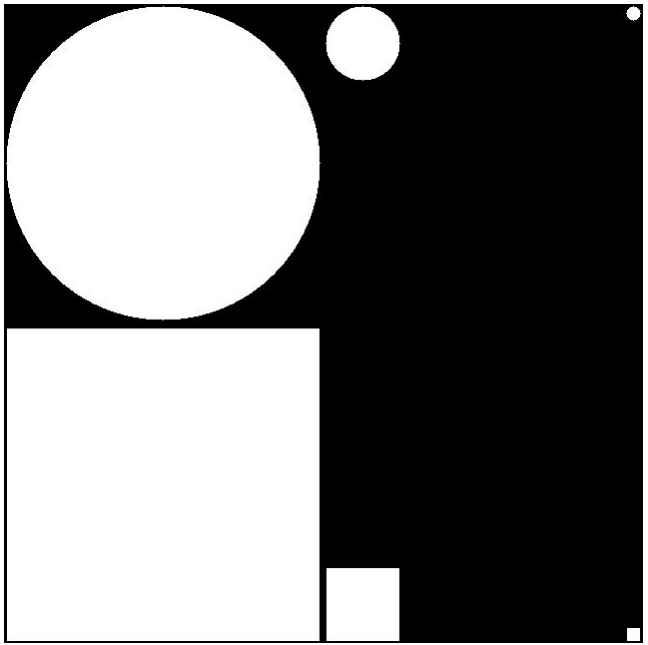
- Goal: find “holes” on a picture





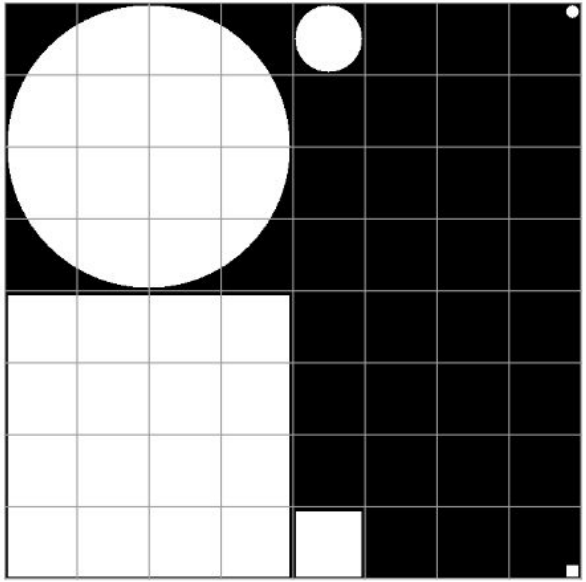
1-Dimensional Betti Number Filtering

Detect objects(holes) with sizes in specified range(eg. 20*20~80*80).



A 640*640 picture with holes

1. Detect Objects with Sizes Smaller than 80x80

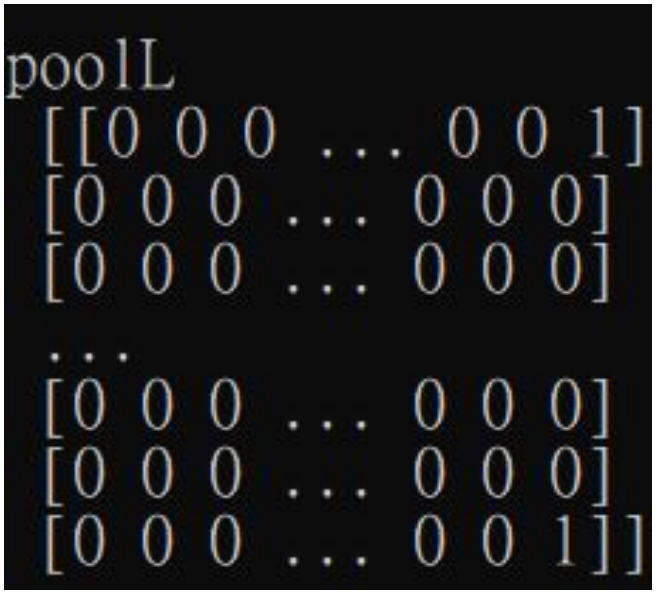


A 640*640 picture with holes

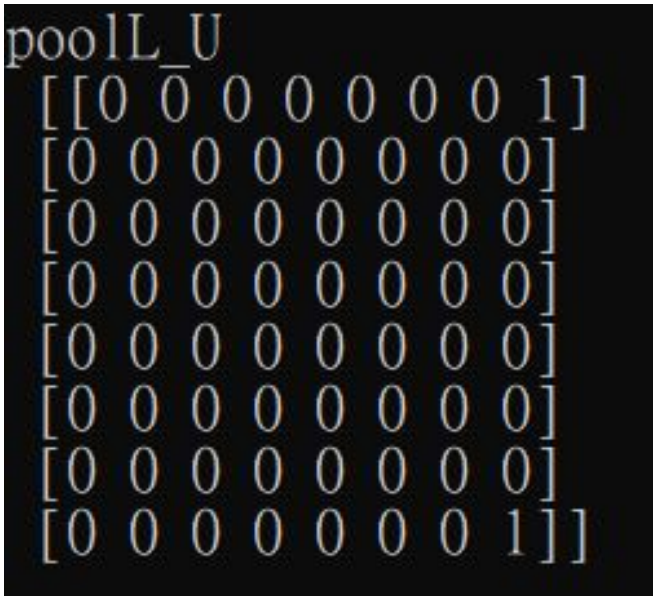
```
poolU
 [[0 0 0 0 1 0 0 1]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0]
 [0 0 0 0 1 0 0 1]]
```

Holes with size smaller than 80*80

2. Detect Objects with Sizes Smaller than 20x20

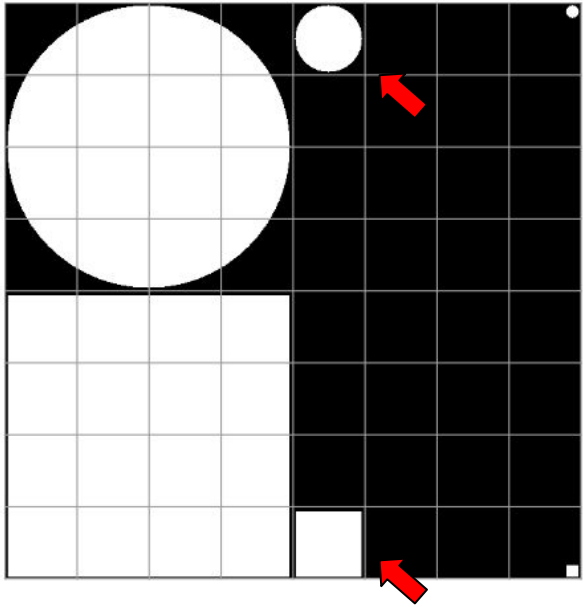


Holes smaller than 20*20

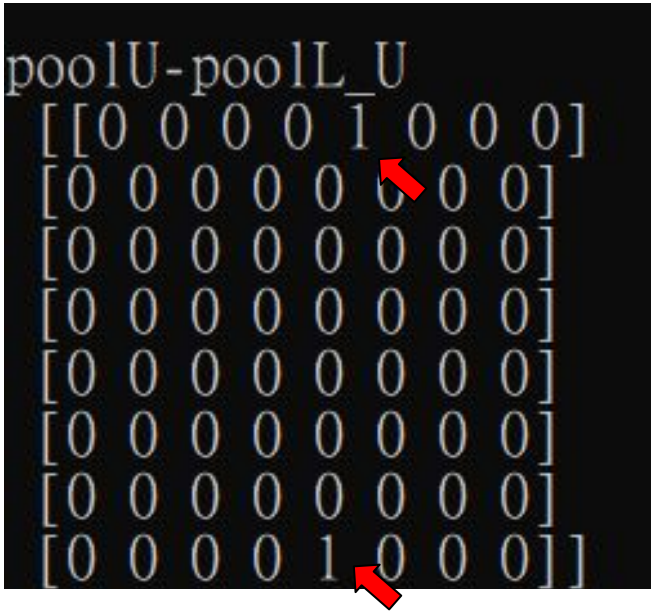


Aggregate 4x4 neighbors to one

3. Detect Objects with Sizes within 20x20 ~ 80x80

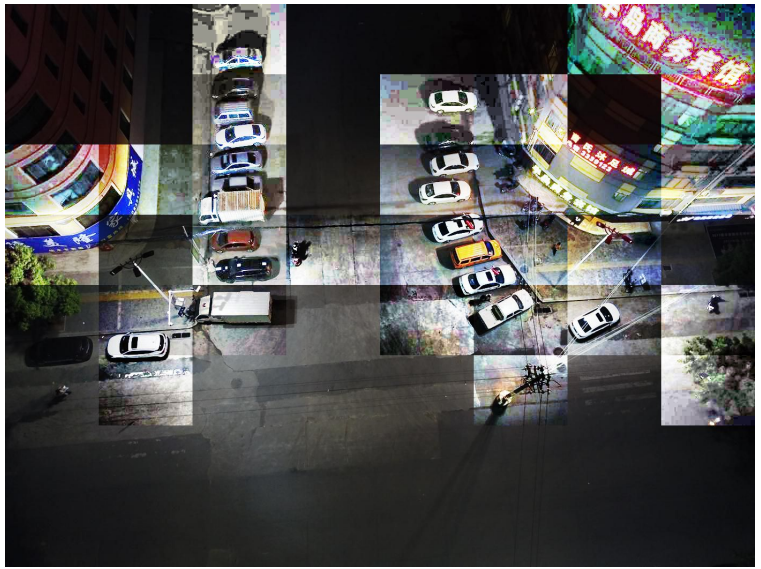


A 640*640 picture with holes

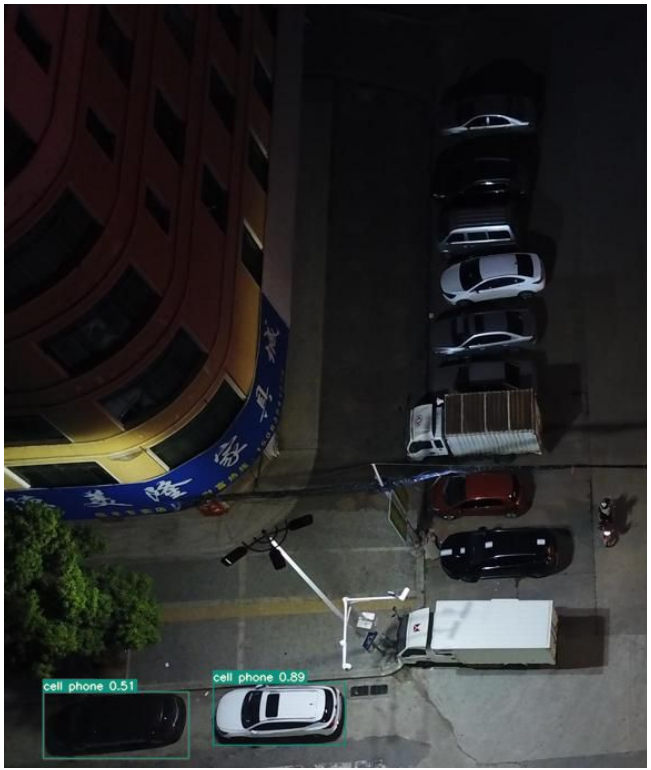


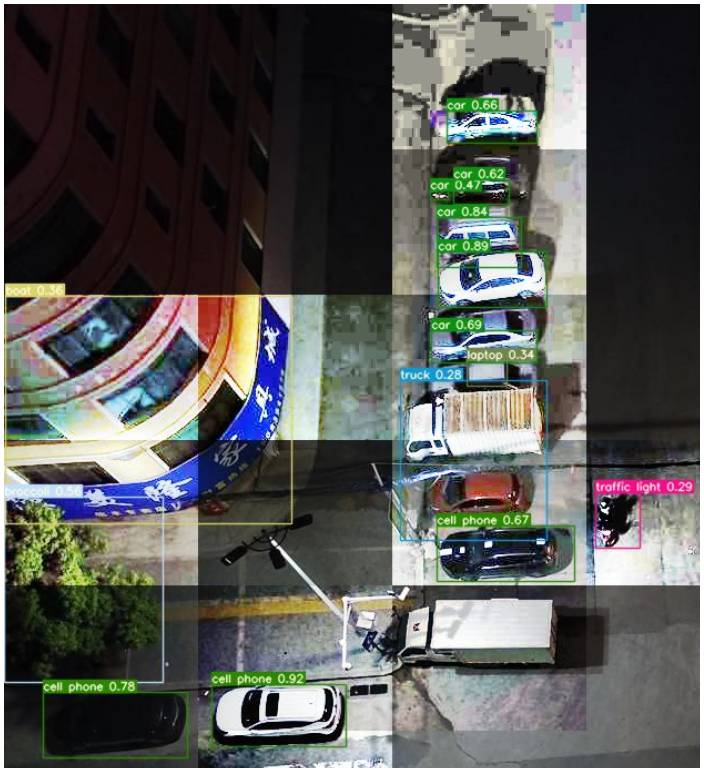
Holes(Objects) detected by our model

Local Equalization only with holes



Easier for Yolov7 to Detect





Outline

- Model & Methods
- Method 1: Local Histogram Equalization
- Method 2: Betti Number Filtering
- Performance

Performances on a representable Image in Testing Data

Outcome

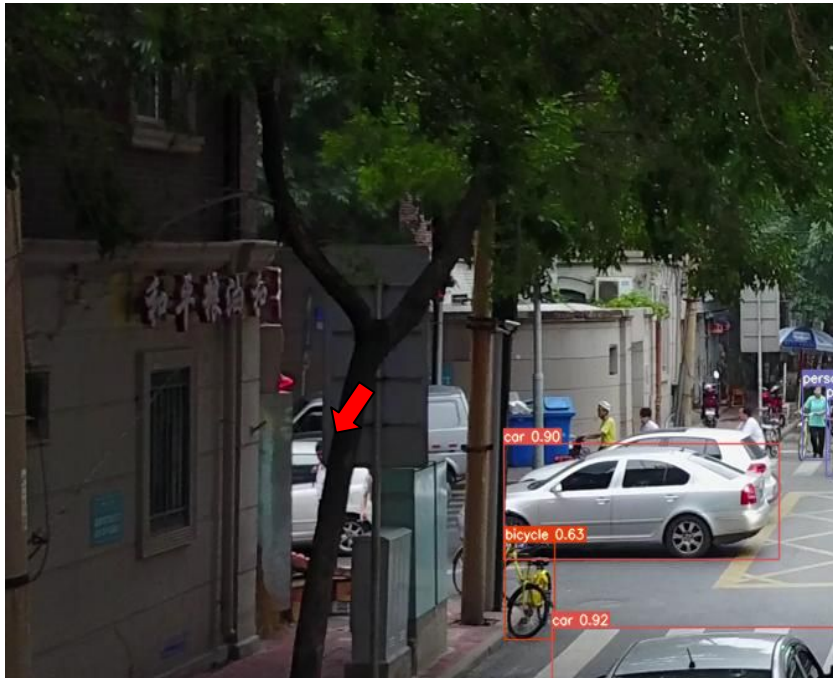
Original yolov7 model on raw image : 18 persons, 6 bicycles, 16 cars

Original yolov7 model on betti_filtered image : 22 persons, 9 bicycles, 18 cars

Fine-Tuned model on raw image : 25 persons, 15 bicycles, 19 cars

Fine-Tuned model on betti_filtered image : 24 persons, 11 bicycles, 22 cars

Details



Original YOLOv7 model

YOLOv7 model with our enhancement

Conclusion

1. Topological data analysis has a growing potential on image processing such that it stands for a great feature of geometry of the image.
2. However, there are still some issue that needs to be addressed. One of a

   significant problem is its long gradient path, which will lower the accuracy and training time of the model.
3. Another problem is that it is hard to accelerate the calculation by hardware,

   and thus need more care on the algorithm design.

Thanks for listening