Pavement Marking Fadeness Detection Project

with New York City Department of Transportation

COLUMBIA | ENGINEERING
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Introduction

- Primary Goal
  Quantify the fadeness of the pavement markings (crosswalk, bus lane, bicycle lane) based on aerial images
- Dataset (Sample)

- YOLO - You Only Look Once

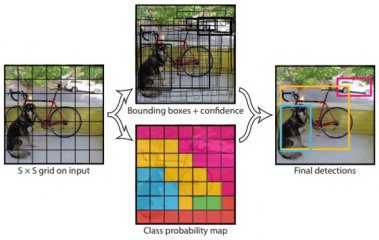
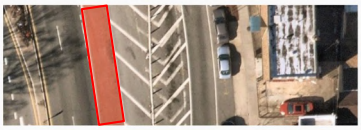


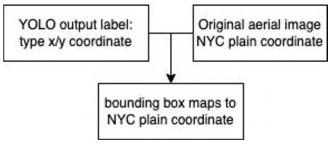
Image Source: https://doi.org/10.48550/arXiv.1506.02640

Object Detection

- Preprocessing
  - Crop into tiles with a size of 640 * 640
- Labeling - Label Studio



- Model training
  - YOLO v5 pretrained weight loaded
  - 175 cropped labelled images
  - Colab GPU
  - 8:2 - training/validation set split
  - 100 epochs with batch size = 10
- Coordinate mapping



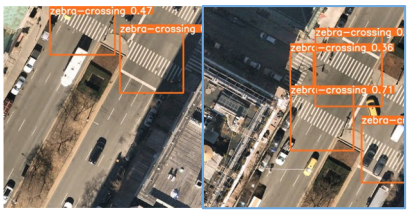
Fadeness

- Convex hull around crosswalks
  - Denoise using morph_open in opencv
  - Contour and minimum_area_rectangle
  - Filter using aspect ratio of rectangles
  - Draw convex hull
- Fadedness Score Calculation
  - Based on Convex hull, locate the pixel that belong to the crosswalks
  - Perform pixel values calibration
  - Calculate the fadedness score based on the mean of pixel values
  - Calculate the percentage fadedness score based on the threshold value

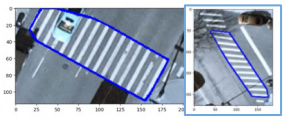
Result

- Bus Lane & Bicycle Lane

- Crosswalk



- Convex Hull



- Fadedness Scores

98.7% 87.5%

Further Improvement

- Cover of Shadow and passing vehicles
- Quantification of the fadeness of colored pavement
- Flaking of crosswalk, bus lane symbol

Flowchart