# Research Summary

## Artificial Intelligence Framework for Crosswalk Detection Across Massachusetts

### Research Need

Crosswalks are critical parts of our roadway infrastructure. Knowing the locations of crosswalks is important for prioritizing our systemic countermeasure program to enhance pedestrian safety. MassDOT has already developed the risk models for pedestrian safety but does not have a complete list of midblock crosswalk locations.



### Goals/Objectives

Artificial Intelligence (AI) can automatically detect crosswalks from satellite images and quickly generate the midblock crosswalk inventory data needed by MassDOT. This project has the following objectives:

- Develop an AI model to detect crosswalks across Massachusetts.
- Use Python scripts to clean up the AI model detection outputs and prepare a qualiy checked copy of the detected crosswalks in a polygon feature class within a geodatabase.

Compared to manual identification of crosswalks from satellite images or Google Street Views, an AI tool will be more efficient and more adaptable. An AI tool will allow MassDOT to update the crosswalk inventory frequently when new satellite images are available. Given new satellite images, this tool can be used to conduct change detection over time and identify crosswalks that need maintenance.

### Methodology

Task 1: Data collection and annotation of 2019 and 2021 satellite image tiles from MassGIS. Annotation involves findig and labeling polygons of crosswalks by category to create ground truth dataset.

Task 2: Train AI model (e.g. UNet) for detection of crosswalks, specifically those in midblock, shade and other semi obstructed settings

Task 3: Categorize detected crosswalks by shape and type, and mid block or intersection

Task 4: Quality checks, verification and final product

## Key Findings

Based on our analysis, there were 88,440 crosswalks detected in Massachusetts in 2021 and 83,380 crosswalks detected in 2019. Of these, 89% were intersection crosswalks, whereas about 8% were midblocks. The remaining 3% were driveways. These proportions were similar in both years. In terms of type, continental ("zebra") crosswalks accounted for 62–64%, standard/parallel line crosswalks comprised 36–38%, and solid/painted crosswalks accounted for the remainder (<1%).

## Use of Findings

A python script was developed to perform the post-processing. The model and the post-processing script will be available to MassDOT to perform further analyses, and results will be expected to inform maintenance and safety initiatives.

The framework can be further fine-tuned and can assist policymakers in pedestrian safety and traffic planning initiatives as it aids manual inspection of the Commonwealth's road infrastructure assets.

## Project Information

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