THE UNIVERSITY OF CHICAGO
DATA SCIENCE INSTITUTE

Flooding, erosion, and declining water quality, exacerbated by climate change, pose significant risk to northeastern Illinois. To address these challenges, the Chicago Metropolitan Agency for Planning (CMAP) is creating the region's comprehensive stormwater infrastructure inventory. Supporting this, teams from the Data Science Institute (DSI) have been developing a deep learning model to identify stormwater infrastructure from aerial images (Figure 1), making the inventory process more efficient.

This team refined the model by adding Digital Elevation Model (DEM) data (Figure 1) as well as DEM-specific techniques to increase the diversity of training images, improving the Intersection over Union–a measure of overlap between predicted and actual areas–by 5% in classifying the stormwater infrastructure. We've swapped the initial training from a broad set of general photographs to a specialized foundation built using relevant aerial imagery. Additionally, the pretrained Segment Anything Model used to generate polygons from single-point prompts (Figure 2) was further trained with project-specific examples, streamlining training data creation. A new class for identification of rivers has been implemented with the training data, growing the diversity of detention basins the model is able to identify.

The improved model effectively identifies ponds and wetlands, but continues to face challenges with identifying dry-bottom detention basins. Future work will focus on addressing class balance issues when testing the model with the river data, expanding the available base of training data, and continuing to tune the model. Benchmarking the updated backbone of the model is left for a later phase. These efforts support CMAP's work in advancing stormwater management and preparing the region for growing climate challenges.


Figure 1: Example of model input and prediction. From left to right : (1) aerial input image, (2) DEM input image, (3) true basin types, and (4) predicted basin types, with labels for background, pond, and dry bottom mesic prairie.

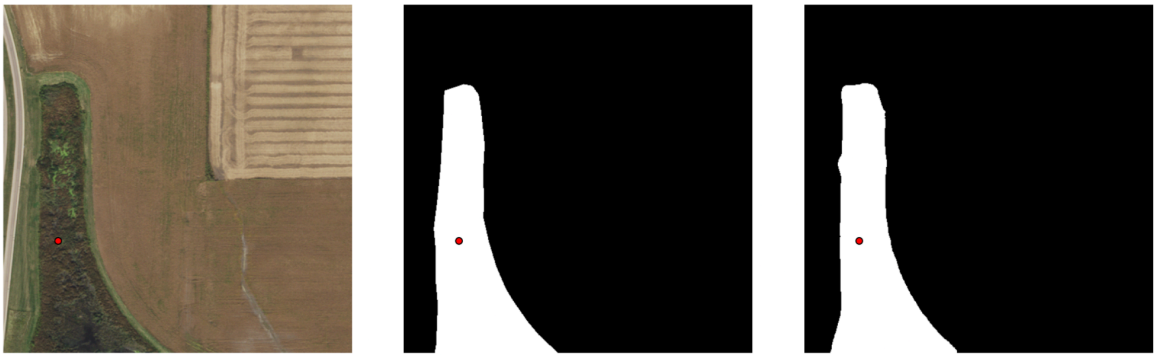

Figure 2: (1) Aerial view of the stormwater basin with a single-point prompt (red dot), (2) ground truth mask, (3) Segment Anything library prediction achieving 0.93 IoU, closely matching the basin's boundaries.