

Digital Twins and Disaster Management: An Automated Solution to Flood Risk Assessment With Climate Change.

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Current Challenge

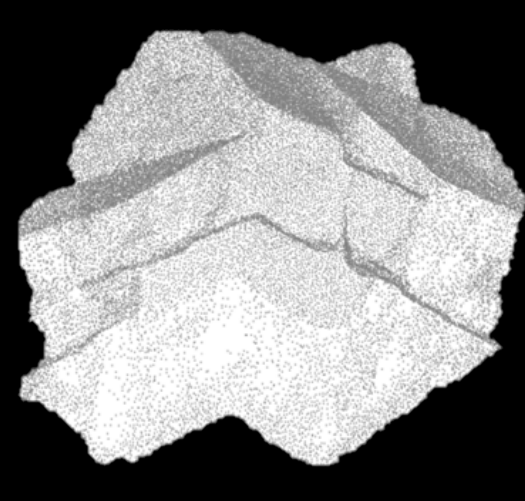
Floods are increasing in frequency and intensity due to climate change (1, 2), making flood vulnerability in cities a crucial topic. Digital Twins – i.e., the 3D representation of cities in digital form – offer an effective way to assess flood risk (3, 4), but most models lack the

semantic detail necessary to map vulnerability of cities. To address this gap, this research proposes an automated approach to create 3D city models enriched with building façade details using multi-modal, high-res data and Artificial Intelligence (AI).



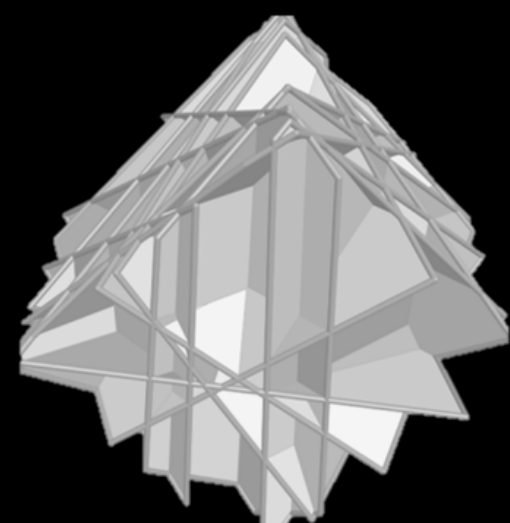
Input

Multiple images from different view points taken from drone survey.



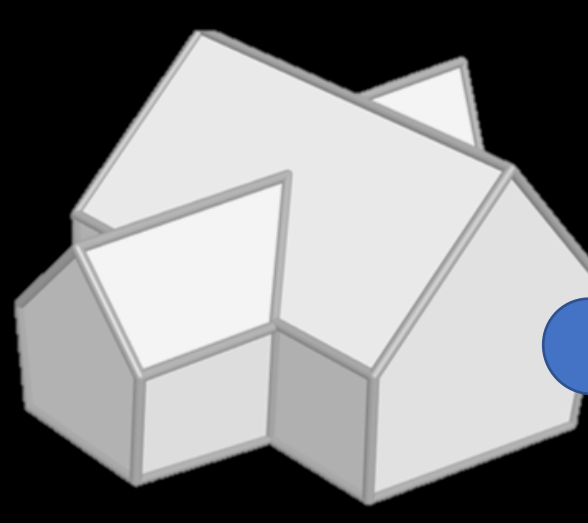
Point Cloud

Use photogrammetric methods to derive a point cloud from the imagery.



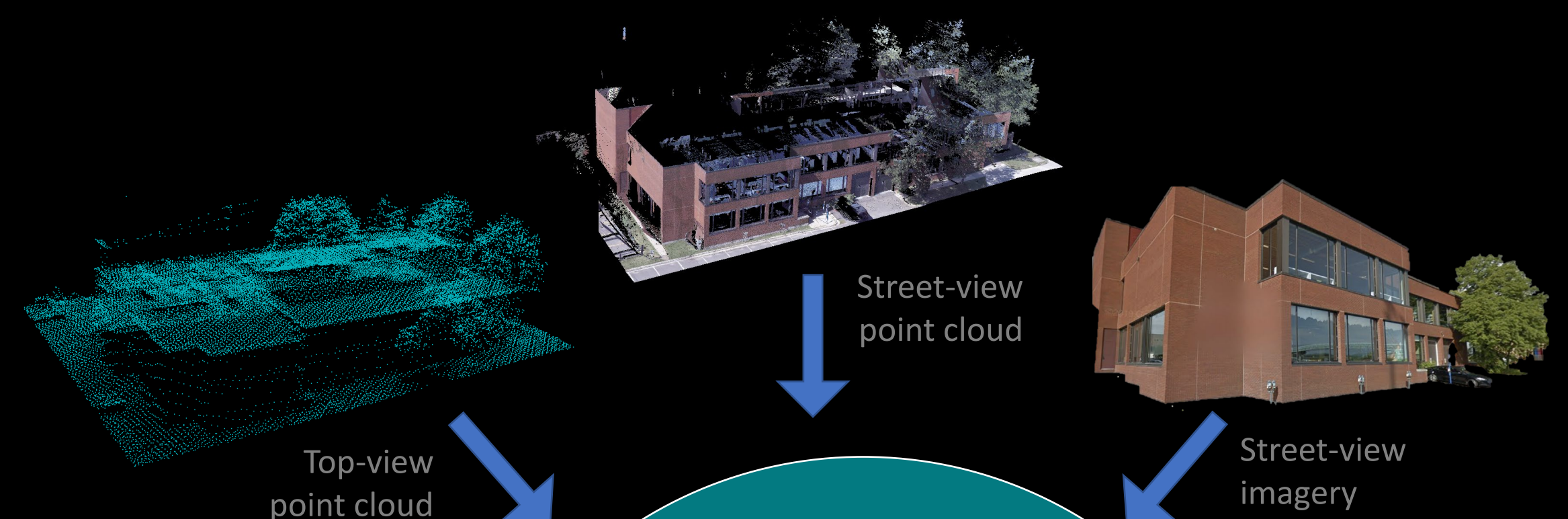
Planar Surfaces

Fit planes to the point cloud and create a series of planar intersections.



3D Model

Select the planes forming a water-tight polygonal surface with Polyfit (5)



Extract Building Details

Create an AI algorithm to learn building features from street-view images and point cloud data.

Generate

3D Building Model

Use multi-view point cloud data to create a water-tight polygonal representation of a building and merge with building details.

Determine

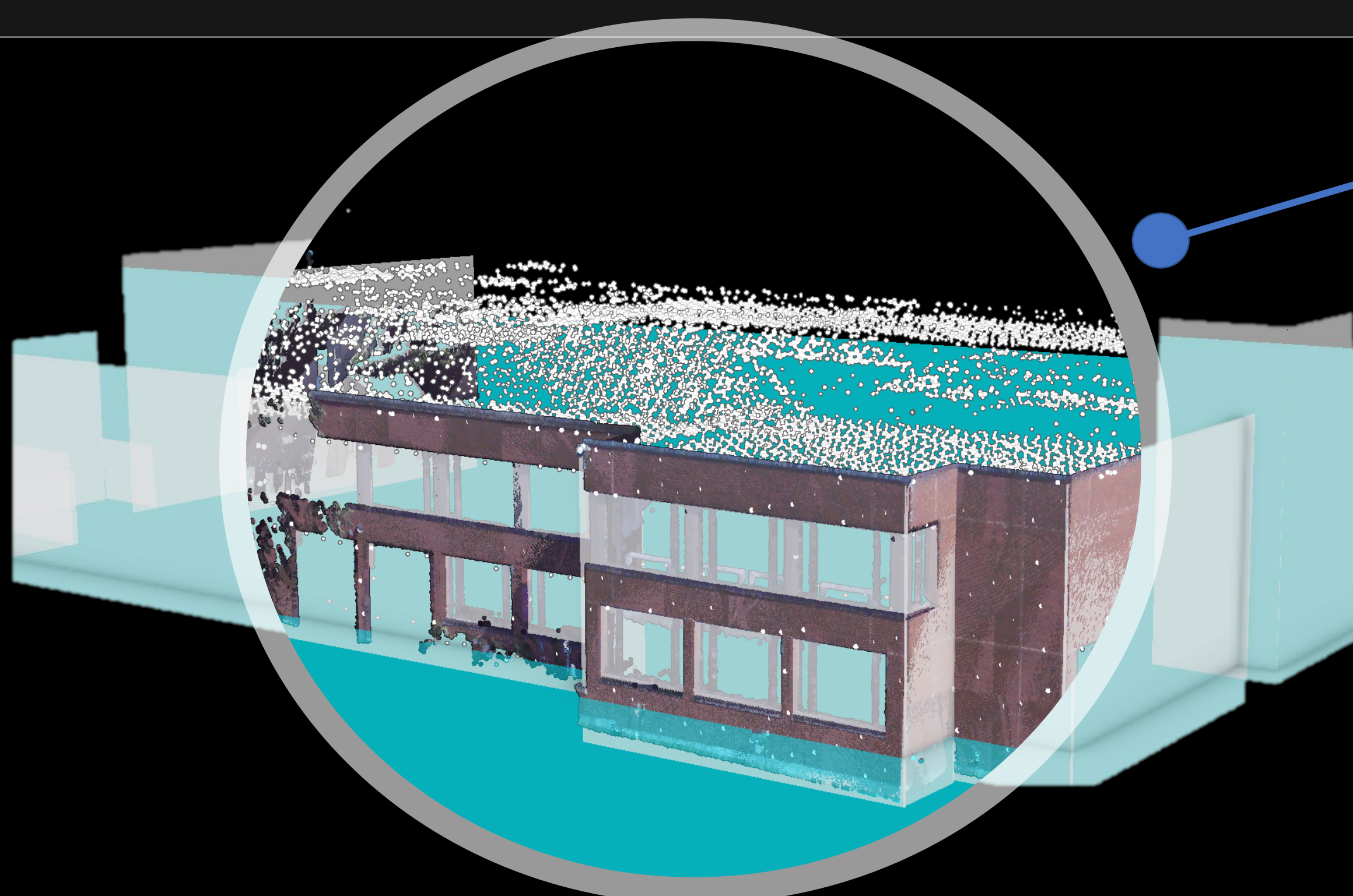
Flood Vulnerability

Intersect the 3D building model with a water depth layer based on flood levels predicted under future climate change scenarios in Fredericton, NB.

Preparing for Climate Change

We can use the location of windows and doors characterized in the building model to assess whether water will

penetrate the building based on the predicted 1-in-100 flood occurrence under various climate change scenarios.



Contributions

1. An automated approach to Digital Twins using multi-modal data and multi-task algorithms rooted in AI.
2. A case study for Fredericton, NB to demonstrate the applicability of the method to flood-prone areas.