A Computer Vision based approach to detect defects on urban building façades

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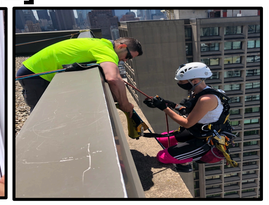
Problem Statement

Fall from façades
17
accidents/year[1]

Safety Complaints
> 700 per year[1]

Inconsistent & Incomplete



Unsafe

Labor intensive & Time consuming

Challenges

- State of the art approaches that use images fail to detect surface deformation-based defects
- Defect types to be detected on façade show variations across several different features (e.g., color/texture, surface deformations, material loss)

Expected Contributions

- A hybrid computer vision approach to detect defects that require 3D information (e.g., bulging).
- Increased efficiency & accuracy in defect detection.

Collaborators/Partners

NYU Facilities and Construction Management · NYC Buildings · SULLIVAN ENGINEERING · RAND ENGINEERING & ARCHITECTURE, DPC · HELIOS VISIONS AERIAL DATA COLLECTION

Vision

Step 1: Data Acquisition

Source: Google Images

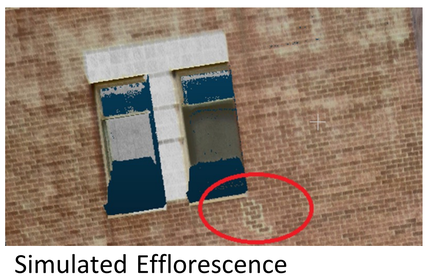
Source: Google Images

Coving
Source: Department of buildings

Spalling
Source: Department of buildings

Missing
Source: Department of buildings

(1) Through reality capture technologies (e.g., drone-based images, terrestrial scanners)
(2) Gathering from partners
(3) Existing research datasets and web scraping
(4) Simulation

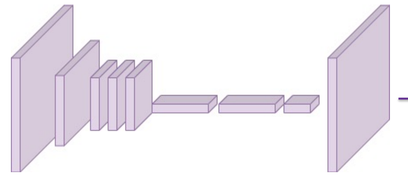


Simulated Efflorescence

Step 2: Defect Identification

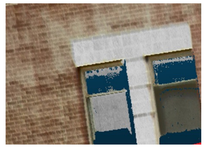
Image and point cloud-based analysis

Images

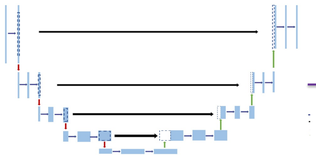


Fully Convolutional Neural Network Architecture

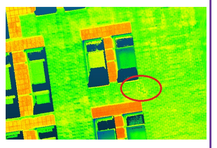
Output [2]



Point clouds



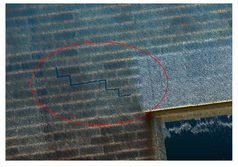
Network Architecture U-Net for point-cloud segmentation



Output

Step 3: Defect Visualization

Vertical cracks



Stepped Crack

[1] NYC OpenData. DOB Complaints Received. Online: https://data.cityofnewyork.us/HousingDevelopment/DOB-Complaints-Received/eabehavv
[2] Wang, N., Zhao, X., Zhao, P., Zhang, Y., Zou, Z., & Ou, J. (2019). Automatic damage detection of historic masonry buildings based on mobile deep learning. *Automation in Construction*, *103*, 53-66.