

Photogrammetry and Neural Networks to Detect Form Changing Slope Conditions

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Landslide detection

2018: Record year of landslides in our region

- Record **rainfall**: wettest year
- Soil: **red clay**
- Many **hills**
- Not enough **\$\$\$**



Route 30



Greenleaf St. /
West End



What is Deep Learning?

Example: Find the function that marks each pixel with the probability that it is “road”



~1 million elements

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~10 million parameters



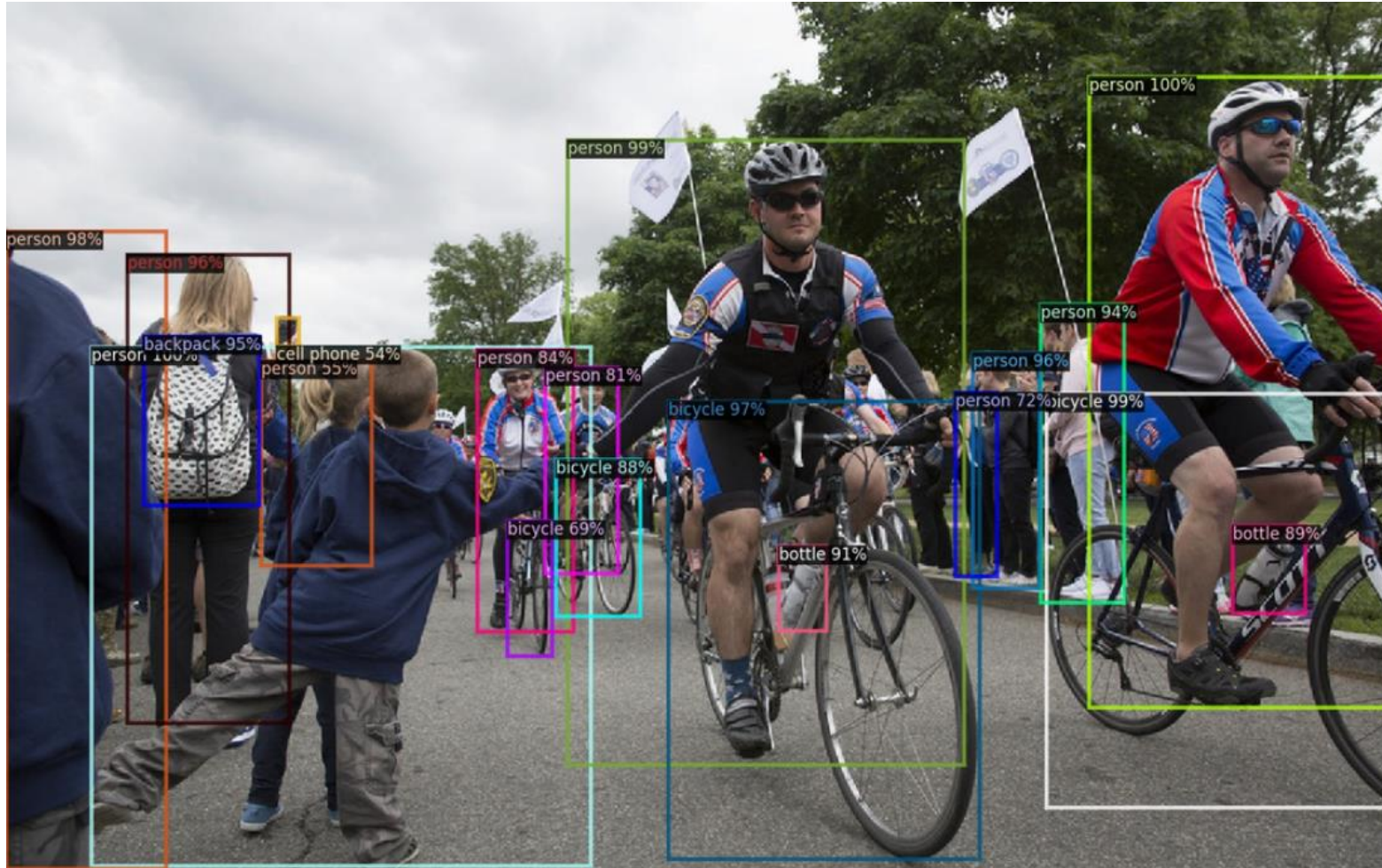
)

~1 million elements

Advantage: Only need to show it enough examples!

Disadvantage: Need to show it >10,000, sometimes millions of examples

State of the Art computer vision / machine learning



Object classification and localization

Code: <https://github.com/facebookresearch/detectron2>

State of the Art computer vision / machine learning



Panoptic segmentation

State of the Art computer vision / machine learning



Keypoint detection

Indicator events in images



Debris on road

Cracks: longitudinal,
then curving



Persistently wet => reduced friction

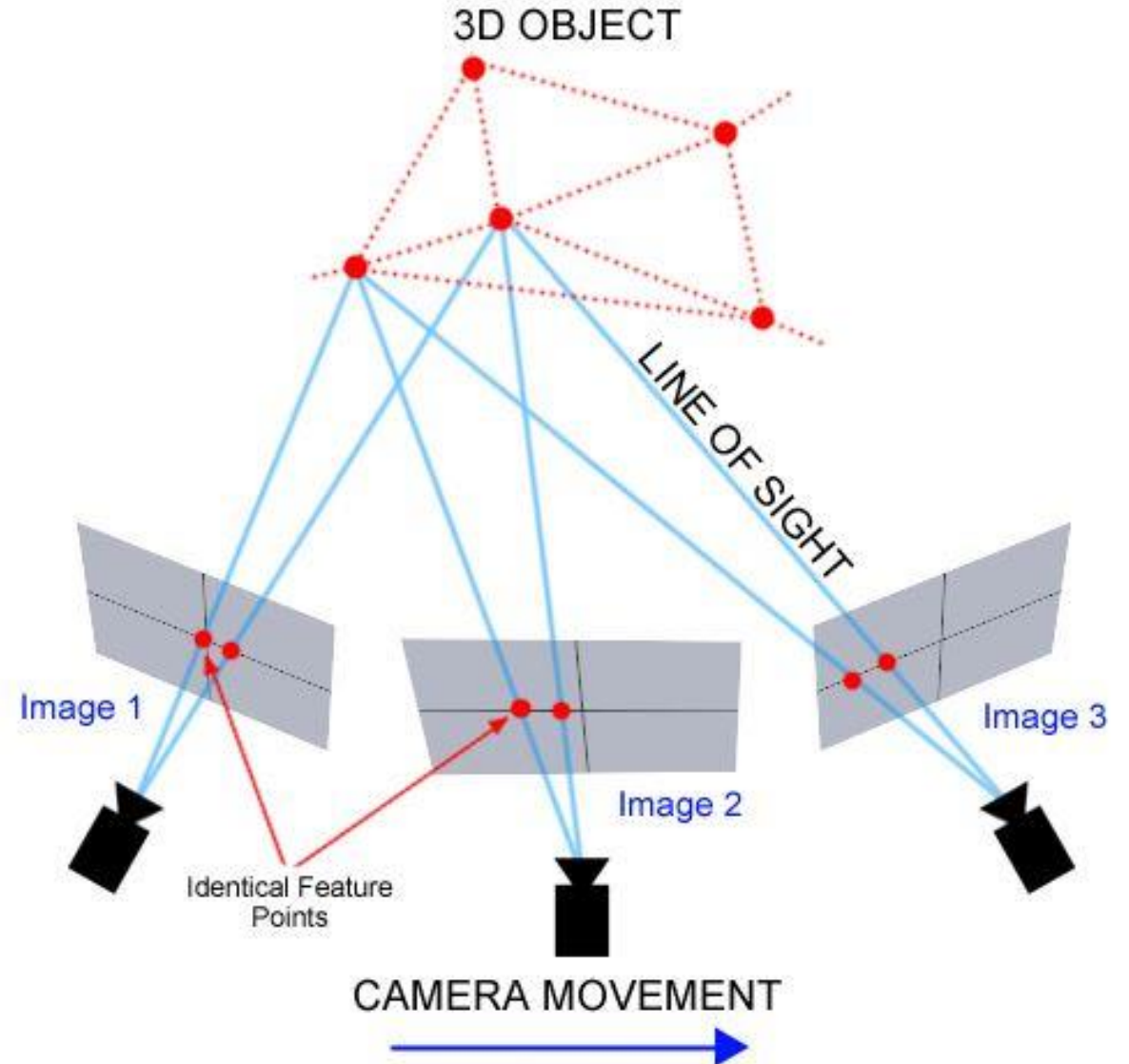
Leaking pipe => Earth movement might cause
leak.

Photogrammetry

Variations:

- Structure from motion (SfM)
- stereo
- visual odometry (VO)
- visual Simultaneous Localization and Mapping (SLAM)

=> Using geometric methods



3D reconstruction from images (Photogrammetry)

From 80 images:





Indicator events in 3D

Retaining wall:
bulges, tilting,
bowing,
undermining



Tree



Rail guard



Current focus: development of cracks

Example: Spring Run Road



November 11, 2018



March 12, 2019



May 20, 2019

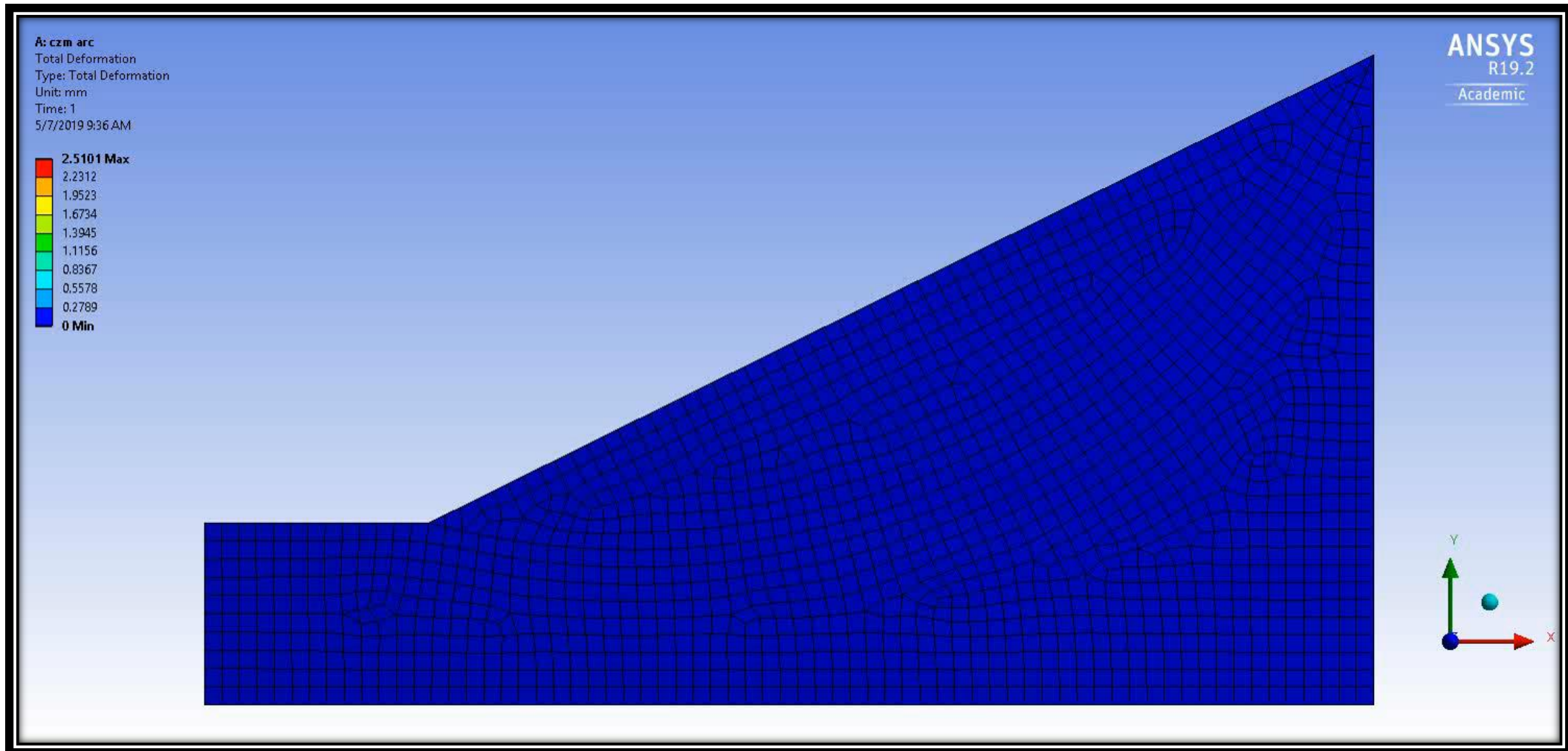
3D model of Spring Run Road landslide



Cross section



Work with Civil Engineering: Modeling of failing slope



Get lots of data with Transit bus

Applications:

Monitor and assess infrastructure and traffic



Damage detection – e.g. landslides



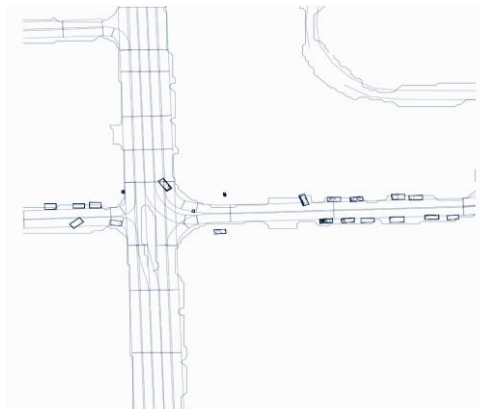
Traffic counts – parked and moving cars

Detect relevant changes and events

Send only relevant information, given bandwidth, time, and privacy constraints



Bus with cameras, GPS, storage, communication and computing



Update HD maps

Traffic management center

