

AI-based parcel monitoring

October,
2019



Background

- EU Common Agricultural Policy (CAP)
- Subsidy per unit area
- Dutch Paying Agency (RVO) verifies and updates geometry ("referentiepercelen", BGT)
- $\pm 500\ 000$ parcels to check











Credit: Peter Prokosch, <http://www.grida.no/resources/1701>

Background

- Current procedure:
 - Step 1: identify changed parcels
 - Step 2: update geometries
- Our goal:

*Limit / replace step 1
with automatic change detection using satellite imagery,
automatic quality \geq current quality*

		
React 	 True Positive	 False Positive
Ignore 	 False Negative	 True Negative

Source: imitatingmachines.com/blog/embrace-the-overfit/

Method

- Approach: 2-stage CNN architecture (Deep Learning)
 - Object classification using Encoder-Decoder
 - Change detection using spatially aware RNN

Sorry for the lack of detail here..



Method

- Heavy model training:
 - Train + test AOI (600 km² each)
 - VHR satellite images of 2017:
TripleSat 3-5 cloud-free coverages (0.8m, RGBN)
 - Distinction between water, road, trees, buildings, agricultural field, cloud, cloud shadow
 - Simulated change training data
 - Rule-based postprocessing

Results: classification

- Classification for e.g.
 - water



Results: classification

- Classification for e.g.
 - water



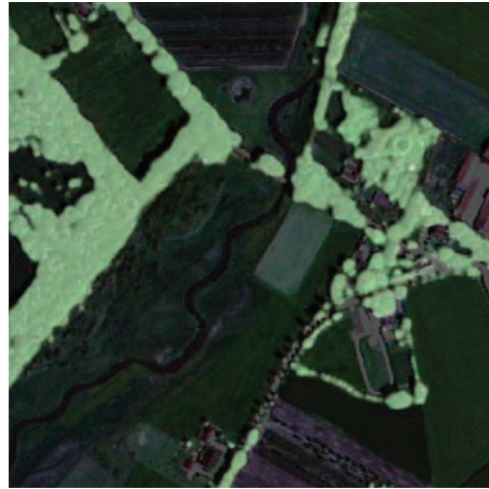
Results: classification

- Classification for e.g.
 - water
 - trees



Results: classification

- Classification for e.g.
 - water
 - trees



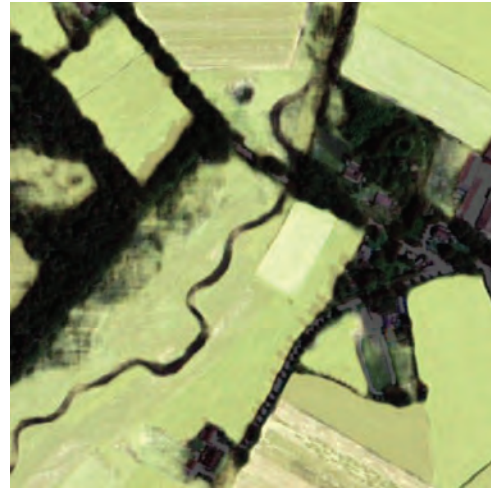
Results: classification

- Classification for e.g.
 - water
 - trees
 - agriculture



Results: classification

- Classification for e.g.
 - water
 - trees
 - agriculture



Results: classification

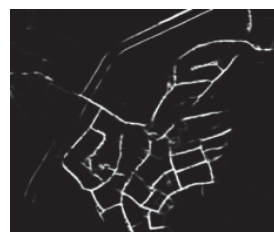
Satellite image

Classification
Probability between
0 (black)
1 (white)

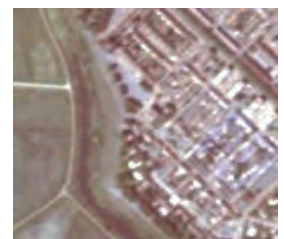
Water



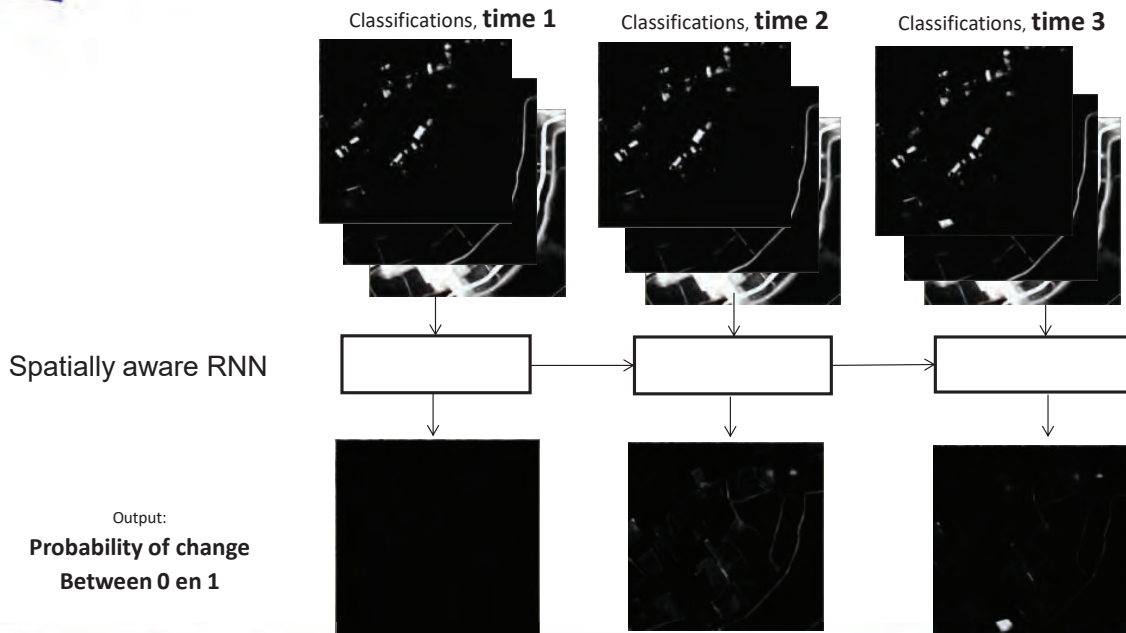
Road



Building



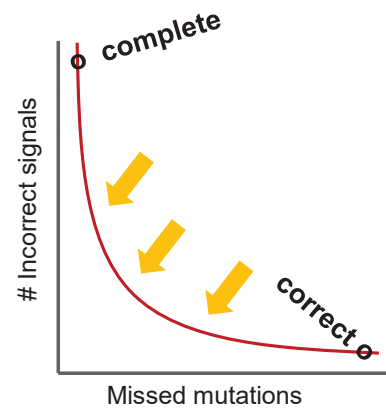
Results: change detection



Results

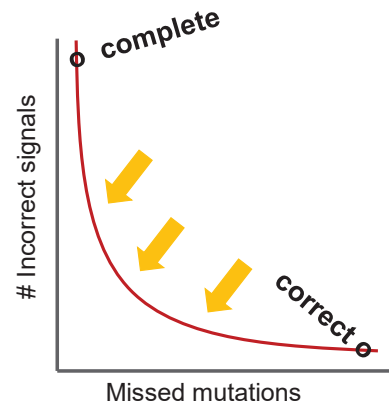
- This year operational:
 - >95% of mutations have to be caught

→ Exclude >65% of parcels from visual checks



How are we improving?

- Better models, more training
- Better data:
 - Higher resolution
TripleSat 0.8 → SuperView 0.5m
 - Higher frequency

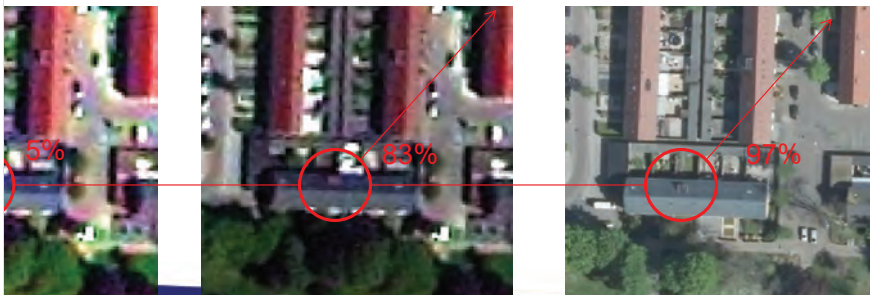


Future: opportunities

- 0.8m resolution was tipping point, but gains keep going up till at least 0.05m

Changed roof, possibly
new dormer northside (83%)

Changed roof,
new dormer northside (97%)



Future: opportunities

- 0.8m resolution was tipping point, but gains keep going up till at least 0.05m
 - Many valuable applications are almost within reach:
 - Solar panels
 - Dormers
 - Roof material
 - Narrow ditches
 - Grey/green area monitoring
 - ...
- Highly dependent on (continuation of) NSO's satellietdataportaal

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