

# Progress in detection and monitoring of transportation infrastructure in the Arctic based on satellite data

Bartsch, Annett <sup>(1)</sup>, Pointner, Georg <sup>(1)</sup>, Ingeman-Nielsen, Thomas <sup>(2)</sup>, Lu, Wenjun <sup>(3)</sup>

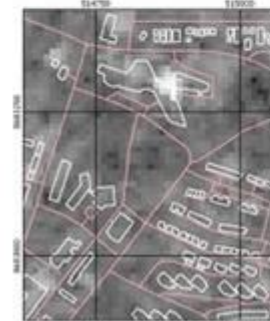
1: b.geos, Austria; Austrian Polar Research Institute, 2: Technical University of Denmark, Department of Civil Engineering 3: Norwegian University of Science and Technology

- Records of settlements and infrastructure for the entire Arctic are incomplete & inconsistent
  - Satellite data with sufficient resolution needed
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- Sentinel-1/2 with 10 m promising
  - Machine learning methods promising

Sentinel-2

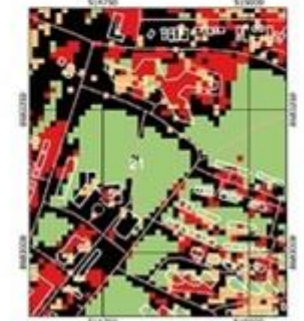


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Sentinel-1  
(2016-2018)

Deep Learning

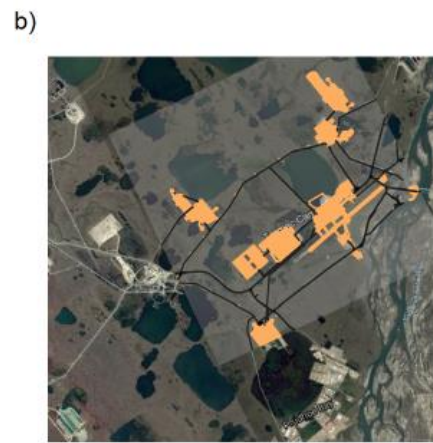
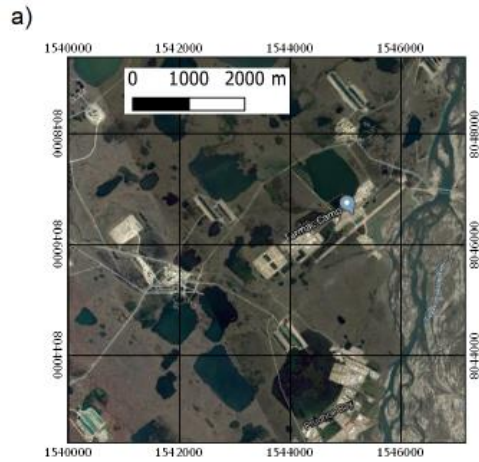


Gradient boosting machines

Bartsch, Pointer, Ingeman-Nielsen & Lu (2020), RS

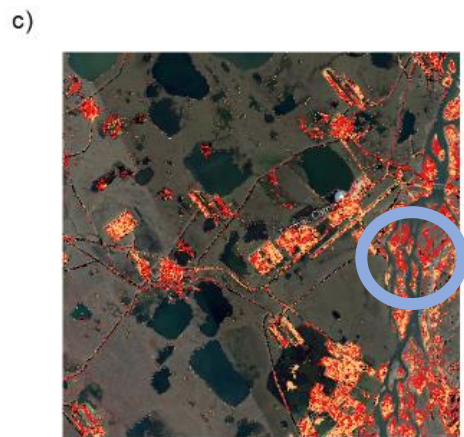
# Performance - Example Prudhoe Bay, Alaska

Google Hybrid  
background map



high-resolution validation dataset  
(area C of the work in Reynolds et al. 2014)

Gradient Boost  
Machine  
classification result

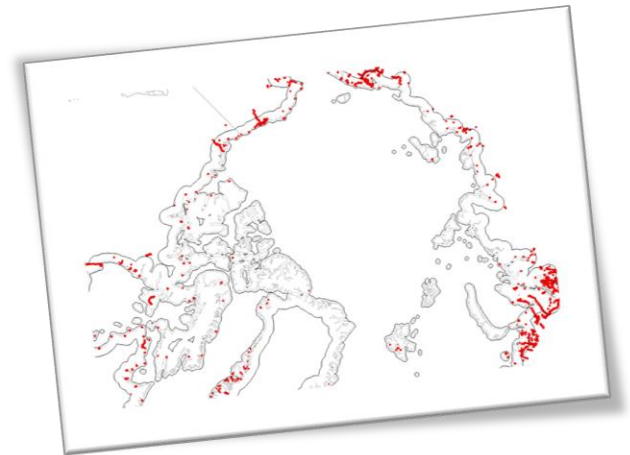


Gradient Boost Machine  
■ Roads  
■ Buildings and artificial objects  
■ Other human impacted area



Deep Learning  
■ Roads  
■ Buildings  
■ Other human impacted area

Deep Learning result



within ~100 km from coast

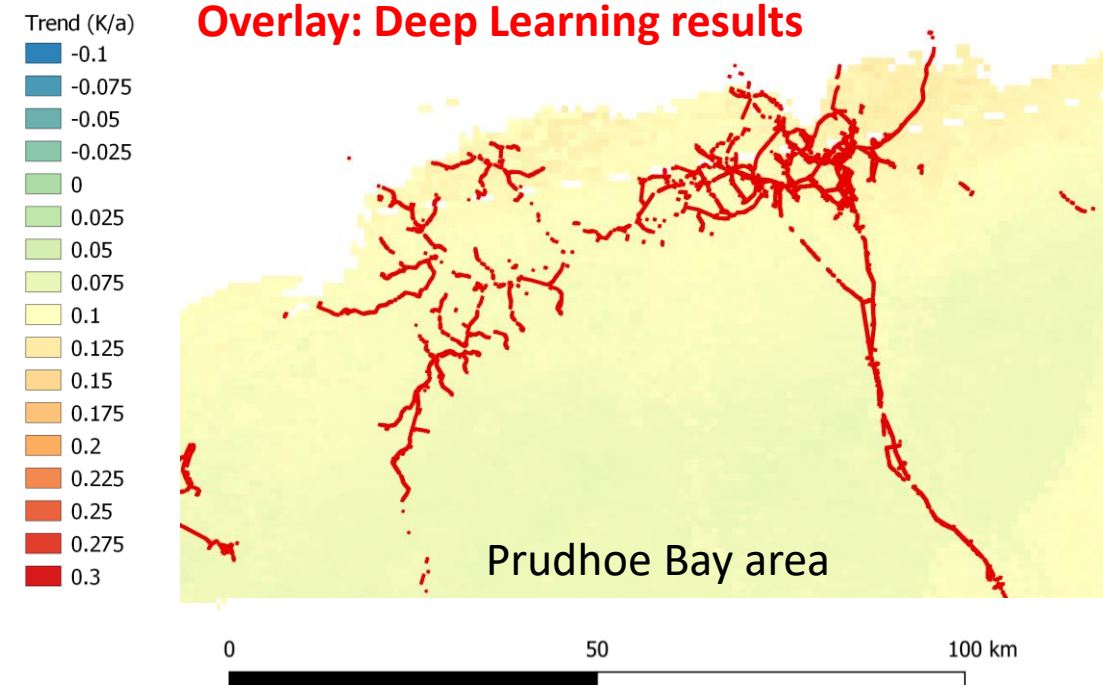
Bartsch, Pointer, Ingeman-Nielsen & Lu (2020), RS

# Summary

- Gradient boosting machines and Deep Learning have both advantages and disadvantages
  - Combined approach needed
- Consistent mapping across the Arctic possible what allows for circumpolar permafrost thaw related assessment

Permafrost\_cci CRDPv1 (just released): 1997-2018  
(Obu et al. 2020, CEDA archive)

Trend at 2 m depth



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