Råtedeteksjon på enkelttrær

Benjamin Allen PhD avhandling: “Using Remote Sensing for Detecting Root, Butt and Stem Rot in Norway Spruce”

med litt ekstra…

Benjamin Allen: PhD Candidate
Supervisors: Terje Gobakken, Michele Dalponte, Erik Næsset, Hans Ole Ørka

Bakgrunn

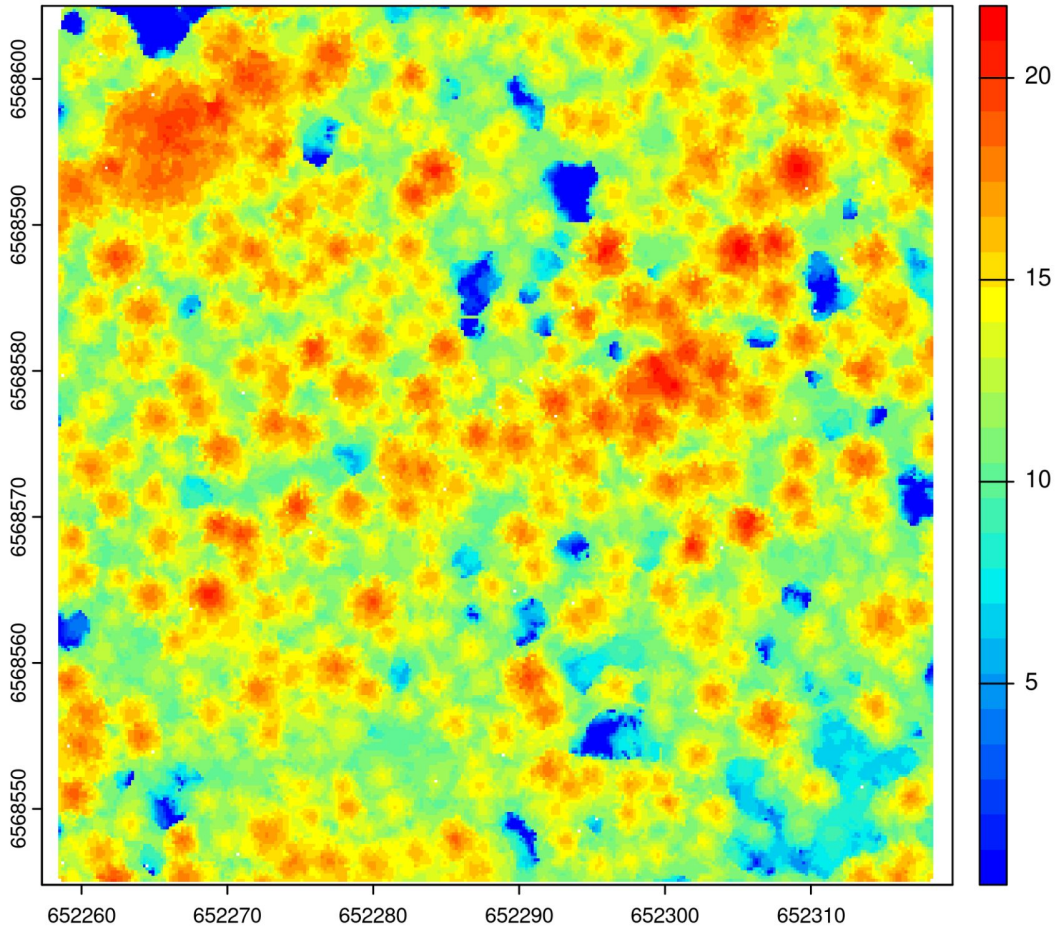
- Primære sopper: Heterobasidion, Armillaria
- Forårsaker skade på trær og reduserer veksten
- Estimert skade: 100 millioner kroner per år

- Det er ekstremt vanskelig å identifisere infiserte grantrær

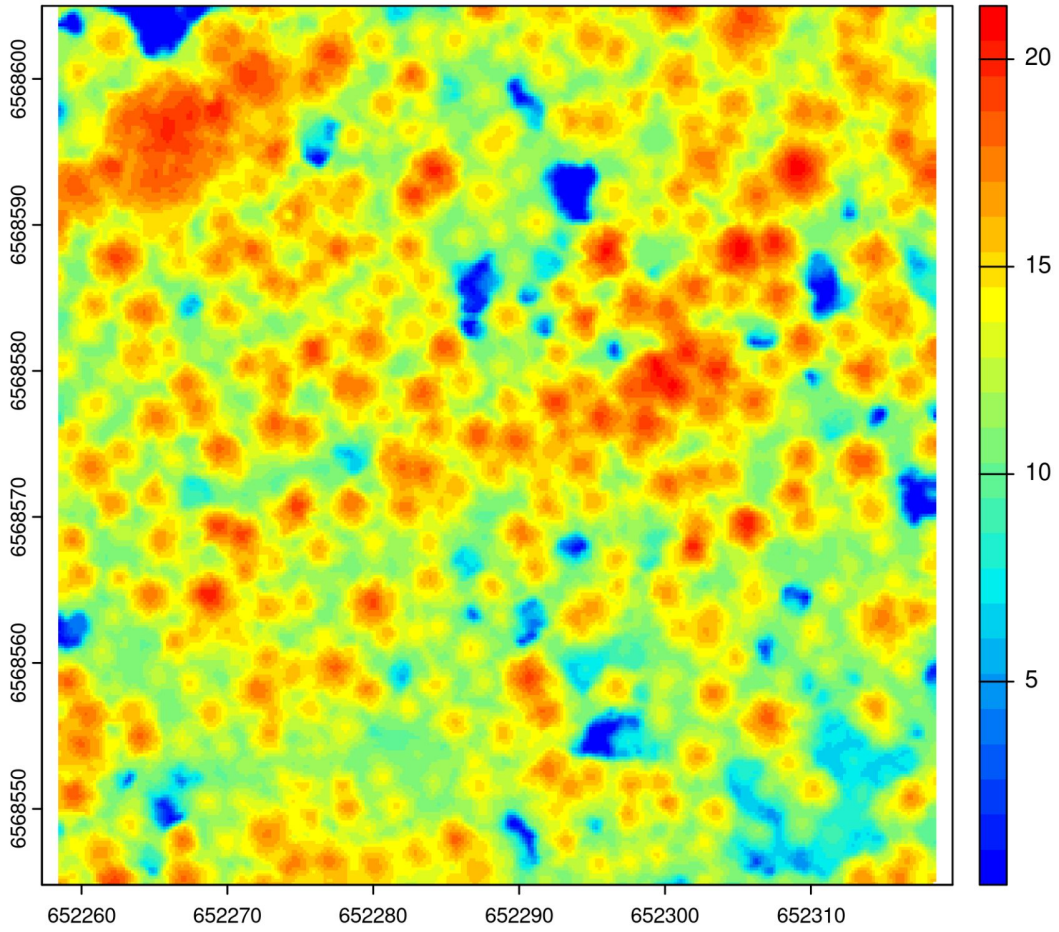
Studieområder

- Etnedal (Hogstmaskin)
- Nordskogen, Ås (Stubberegistering)

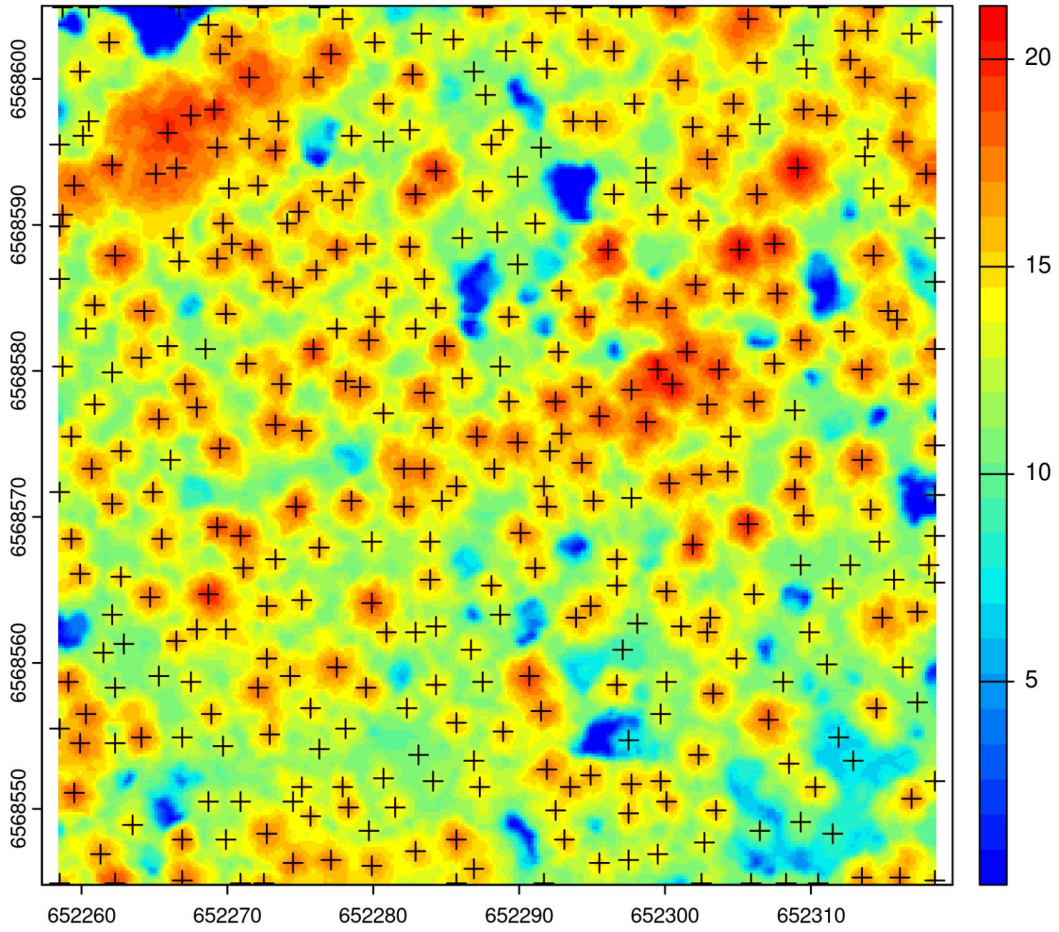
Enkelttremetoden



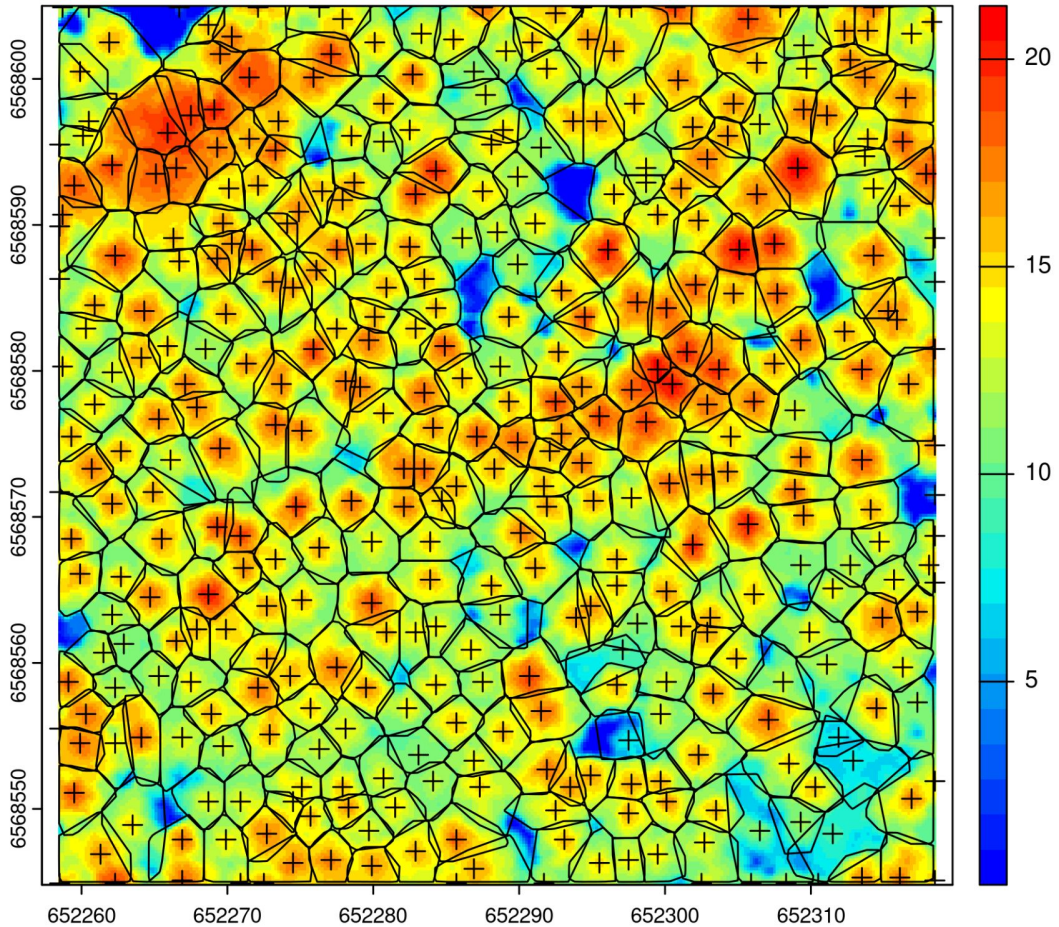
Enkelttremetoden - glatta kronehøydemodell



Enkelttremetoden - lokale maksimum



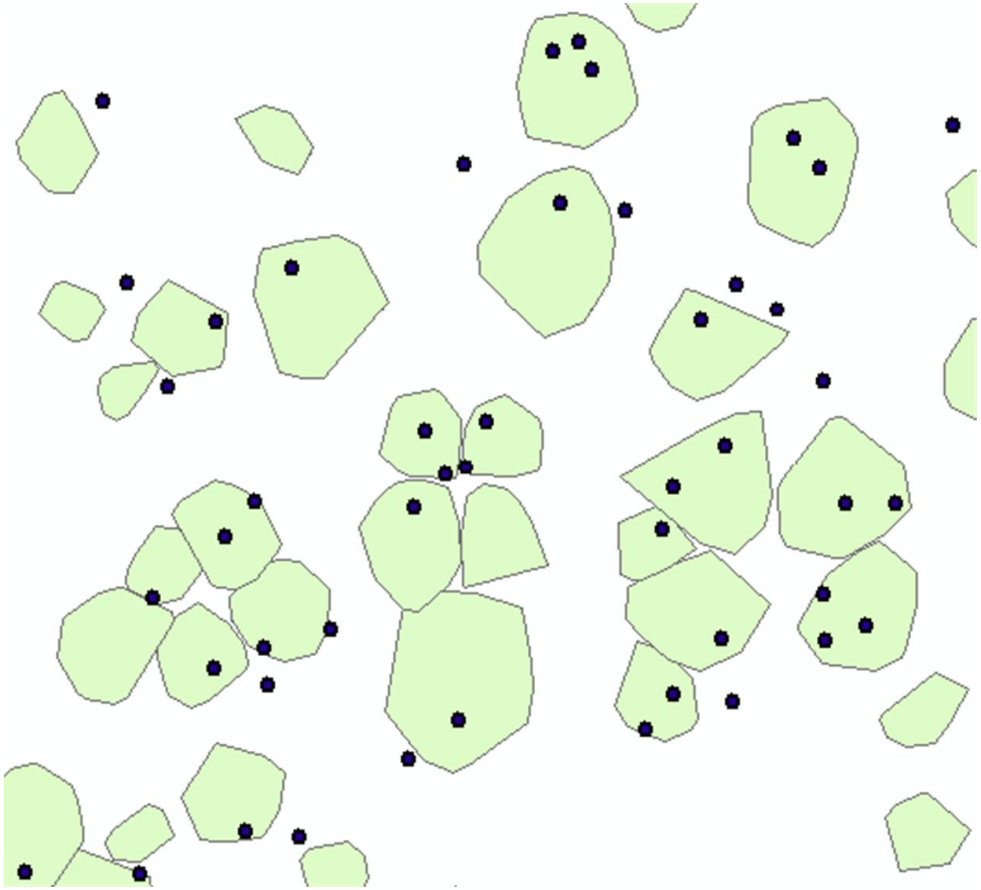
Enkelttremetoden - kroneavgrensning



Enkelttremetoden

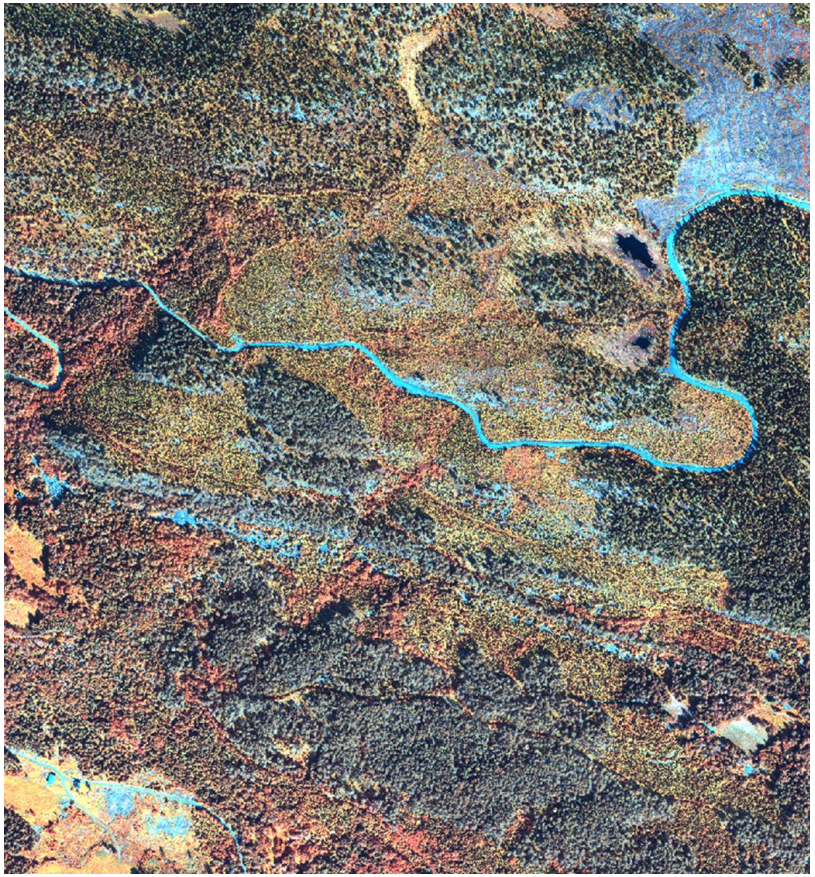
Identifisere trekroner fra laserdata (ITC)

Trær posisjoner fra hogstmaskin er linket til ITC basert på posisjon og høyde.

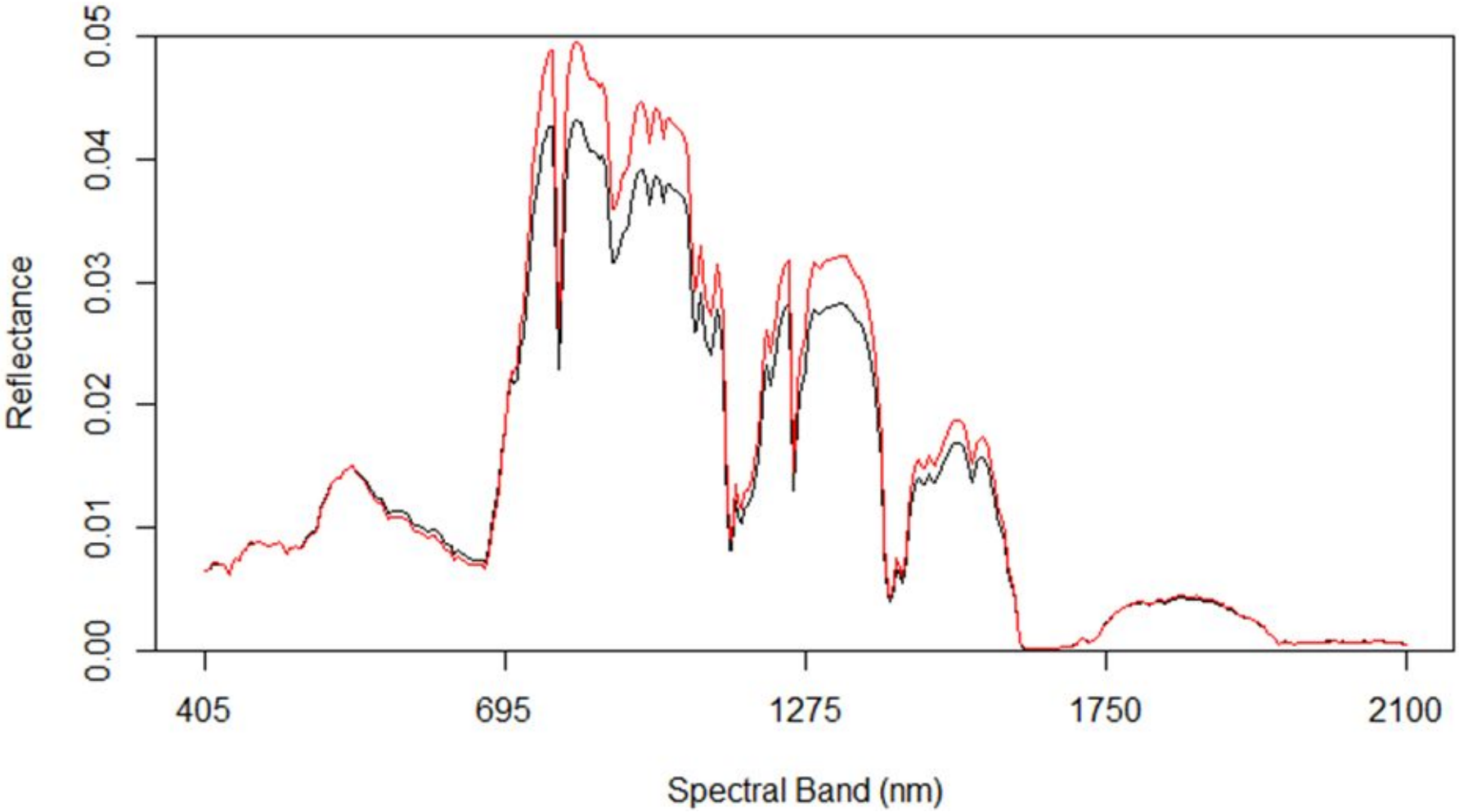


Fjernmålingsdata

- Hyperspektrale bilder (30 cm GSD)
- Laser: 17 punkt/m^2, 2019
- Multispektrale bilder
- Laser: 2-5 punkt/m^2, 2007



Paper 1 Results



Modelleringsmetoder

Maskinlæring: Support Vector Machines (SVM) og Random Forest

Variabel: Råte ikke råte

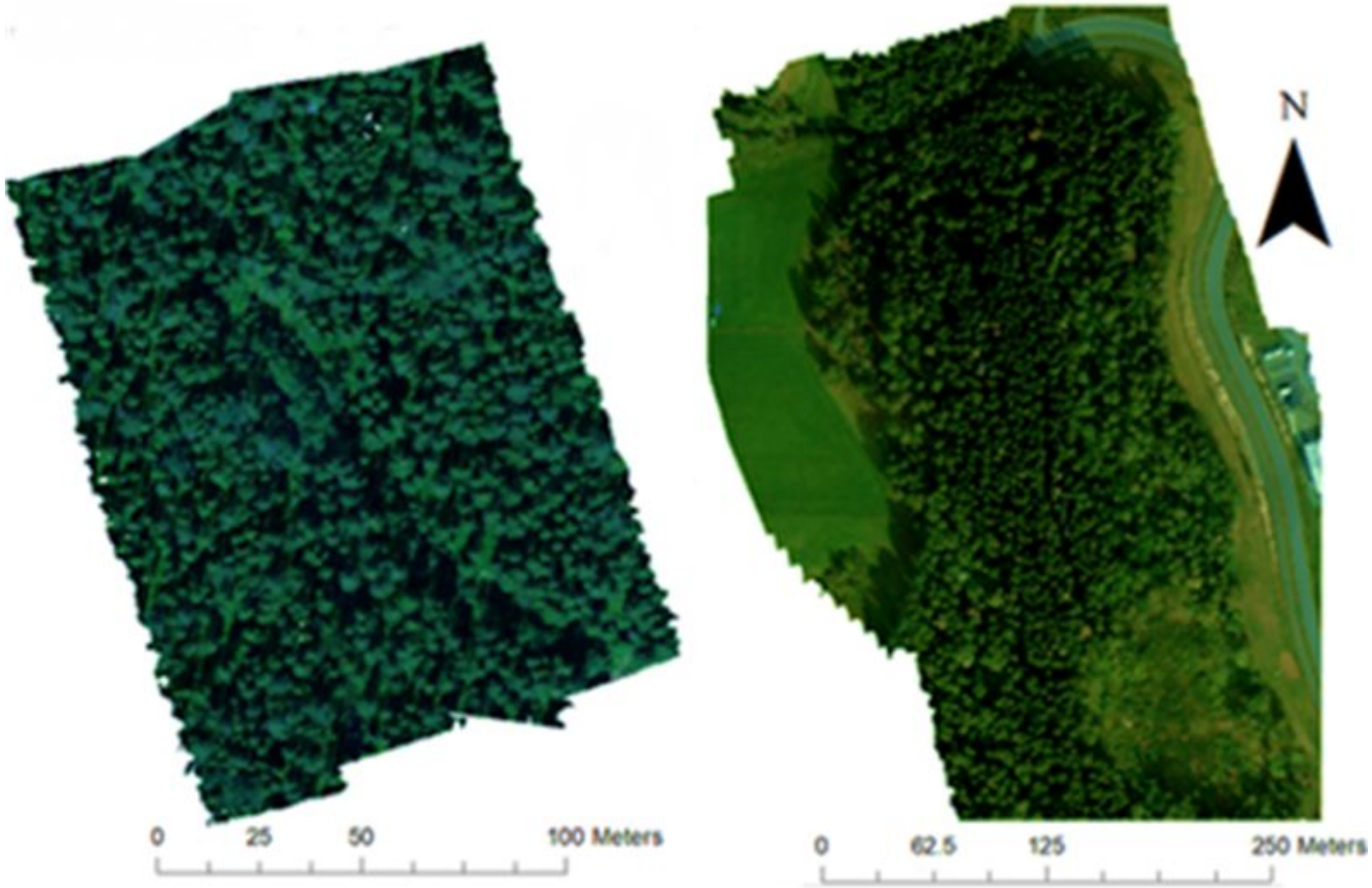
Resultat: Random Forest

	Reference			
Prediction	**No Rot**	**Rot**	**Total**	**User's Accuracy (%)**
No Rot	307	141	448	68.52
Rot	208	336	544	61.76
Total	515	477	992	
Producer's Accuracy (%)	59.61	70.04		
Overall Accuracy	64.81	κ: 0.27		

Paper 3 Results

Data Source	PA-No Rot[2]	PA-Rot	UA-No Rot[3]	UA-Rot	OA[4]	Kappa
Hyperspectral & ALS	69.0	64.0	58.5	73.8	66.1	0.32
Hyperspectral Alone	69.3	64.4	49.5	64.0	64.3	0.28
ALS & Multispectral	60.6	59.0	55.8	63.8	59.8	0.20
ALS Alone	60.1	58.5	0.55	0.635	59.3	0.19
Multispectral Alone	54.7	53.9	49.5	59.0	76.4	0.16

Paper 2: Drone bilder



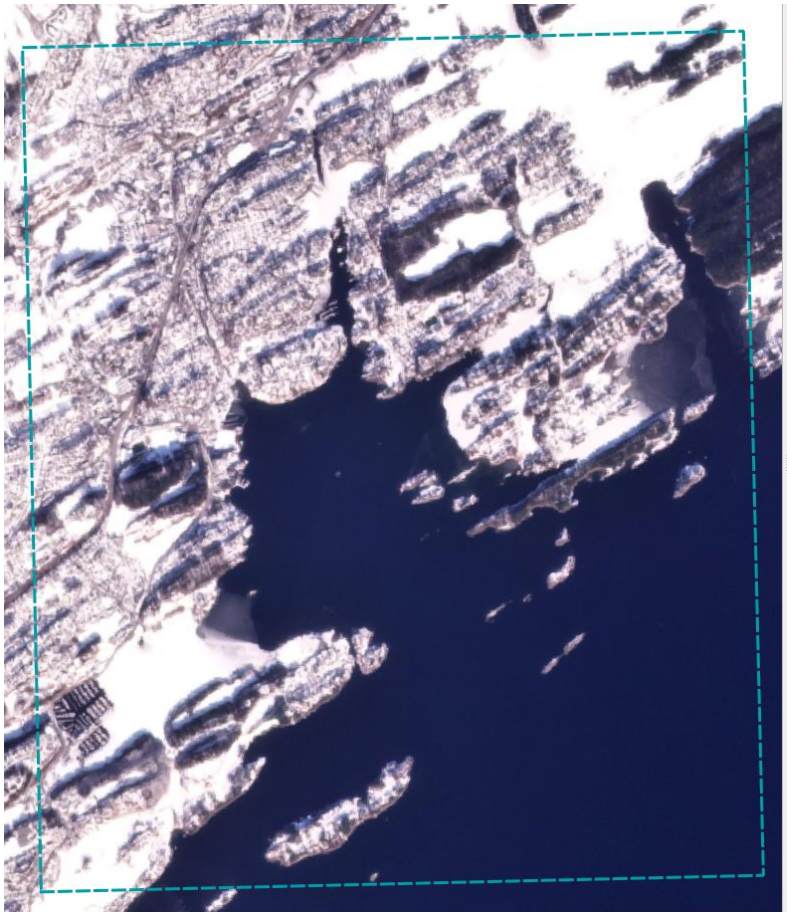
Study Area	Etnedal	Nordskogen
Name of Sensor	HySpex Mjolnir VS-620	Rikola HSI
Number of Bands	490	29
Spectral Range (nm)	400–2500	450–895
GSD (cm)	16	8

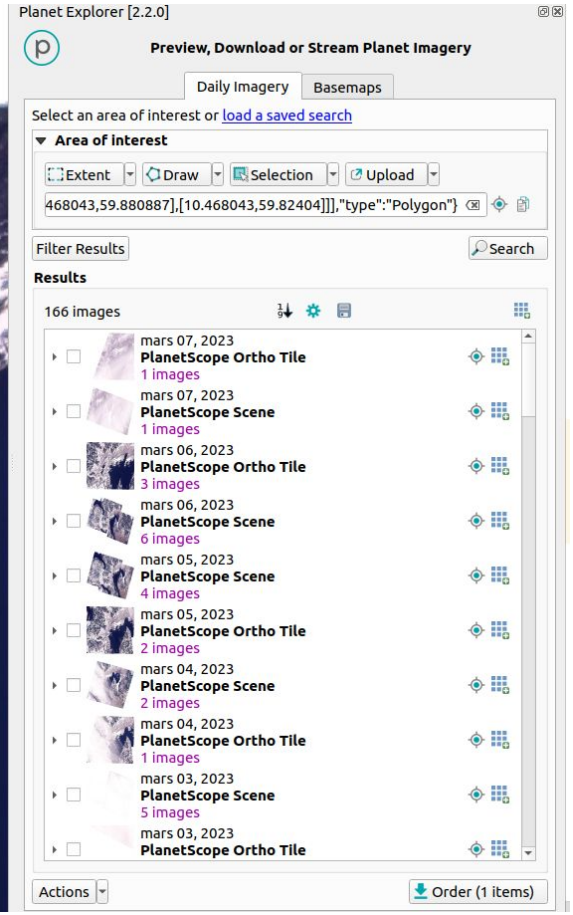
Paper 2 Resultat: Klassifikasjon

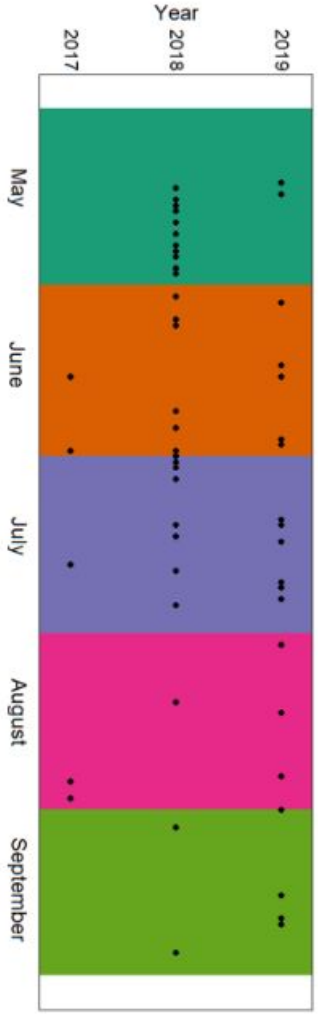
Imagery Source	PA-No Rot[1]	PA-Rot	UA-No Rot[2]	UA-Rot	OA[3]	Kappa
Etnedal	82.3	44.4	87.3	35.1	75.6	0.24
Nordskogen	55.6	79.3	95.9	17.2	60.1	0.13
Etnedal-Resampled	78.0	44.7	85.1	33.3	71.4	0.20

[1] PA: Producer's Accuracy (%). [2] UA: User's Accuracy (%). [3] OA: Overall Accuracy (%).

Paper Ekstra - Planet Doves



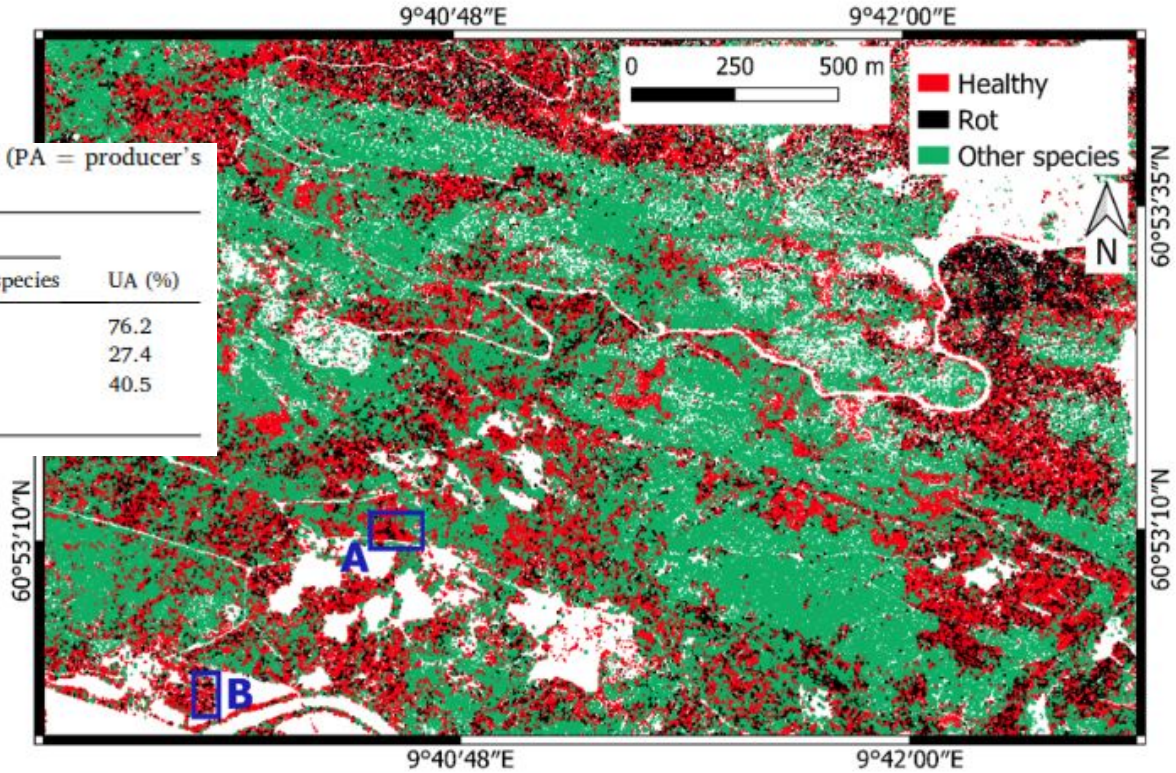


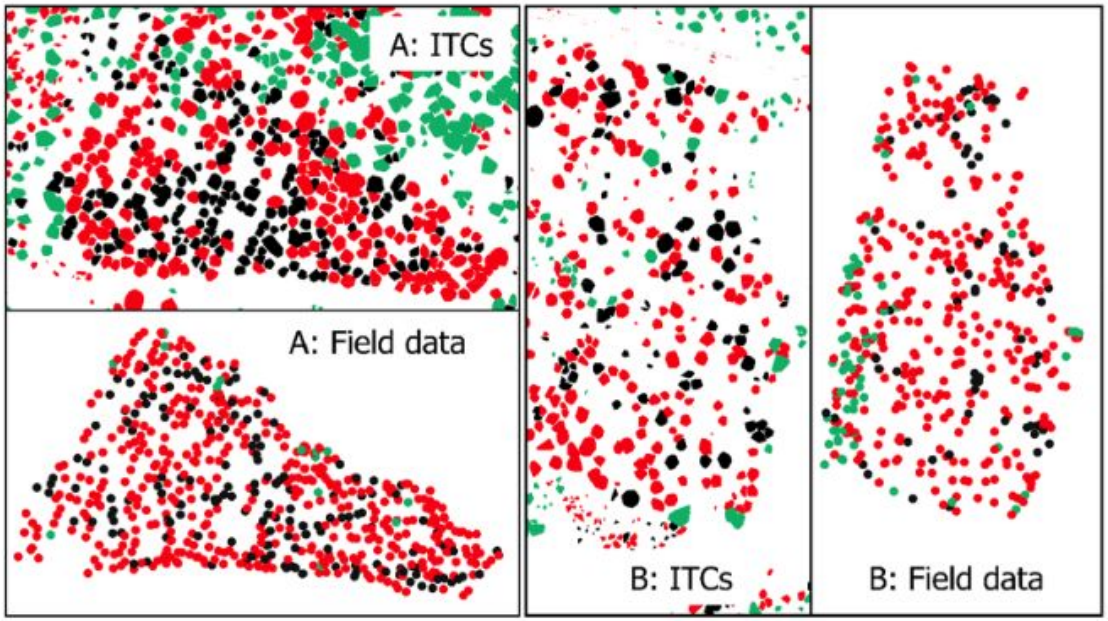


Dalponte, M., Solano-Correa, Y. T., Ørka, H. O., Gobakken, T., & Næsset, E. (2022). Detection of heartwood rot in Norway spruce trees with lidar and multi-temporal satellite data. *International Journal of Applied Earth Observation and Geoinformation*, *109*, 102790. https://doi.org/10.1016/j.jag.2022.102790

Confusion matrix for the species and rot map at ITC level (PA = producer's accuracy; UA = user's accuracy).

		Ground reference			
		Healthy	Rot	Other species	UA (%)
Classification	Healthy	2892	667	235	76.2
	Rot	1873	735	77	27.4
	Other species	952	263	828	40.5
	PA (%)	50.6	44.1	72.6	





Hovedkonklusjoner

Deteksjon av rotråte er mulig, men nøyaktigheten er ikke imponerende (alternativt: veldig dårlig)

Hyperspektrale bilder gir høyest nøyaktighet

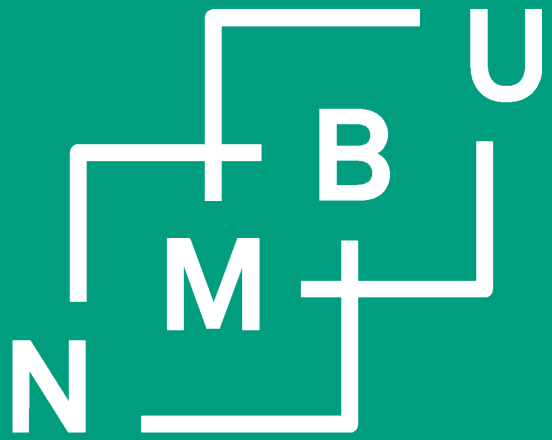
“Data fusion” øker nøyaktigheten noe

Laser gir relativt høy nøyaktighet og er tilgjengelig

Tidsserier fra høyoppløselige satellitter er en mulig kilde

Manuskript

- Paper 1: Classify presence of RBSR with airborne hyperspectral imagery; attempt to predict rot severity
- Paper 2: Classify presence of RBSR with UAV-based hyperspectral imagery; compare effectiveness of two sensors (488 vs 29 bands)
- Paper 3: Compare classification accuracies from airborne hyperspectral, airborne laser scanning, and historical aerial imagery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