

# Bygningsdeteksjon

Prosjektresultater FKB maskinlæring

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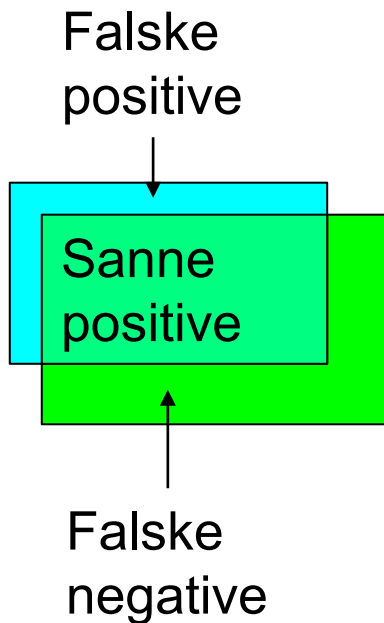
30. mars 2023



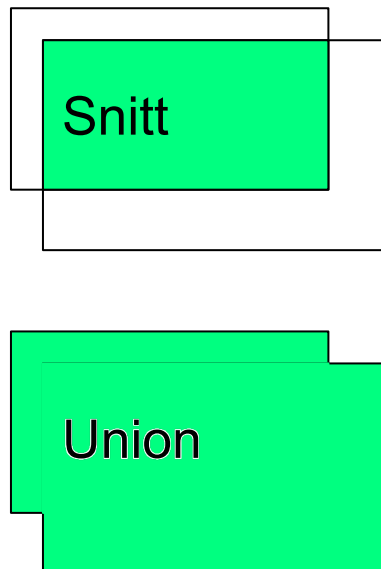
# Datakilder

- ▶ Lidardata fra Bærum 2018: xyz-punkter med RGB fra flybilder 2016-2018
- ▶ Samtidig opptak av hyperspektrale data 30 cm og lidar fra Bærum 2019
- ▶ Samtidig opptak av RGB ortofoto 8 cm og lidar fra Bærum 2020
- ▶ Evt. samme bildedata som over men uten lidar

# Måling av prediksjonsnøyaktighet, per piksel



Snitt over union:



Klassifikasjonsrate:



$$\frac{\textit{Snitt}}{\textit{Union}}$$

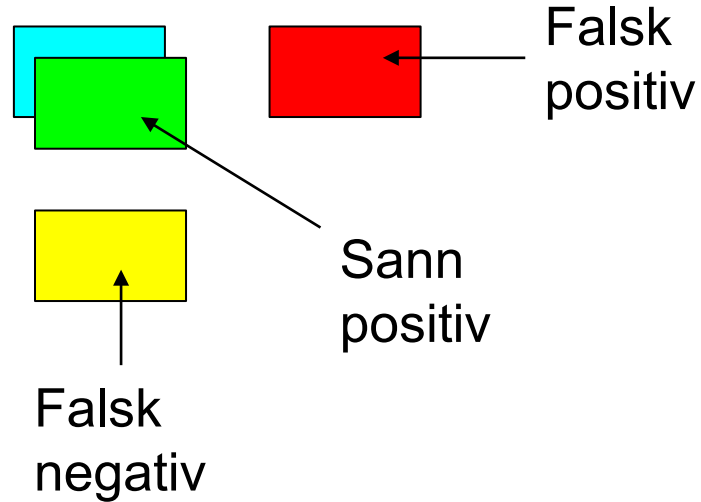
$$\frac{\textit{Sanne positive}}{\textit{Faktisk bygning}}$$

# Måling av prediksjonsnøyaktighet, per objekt

Predikerte bygninger:

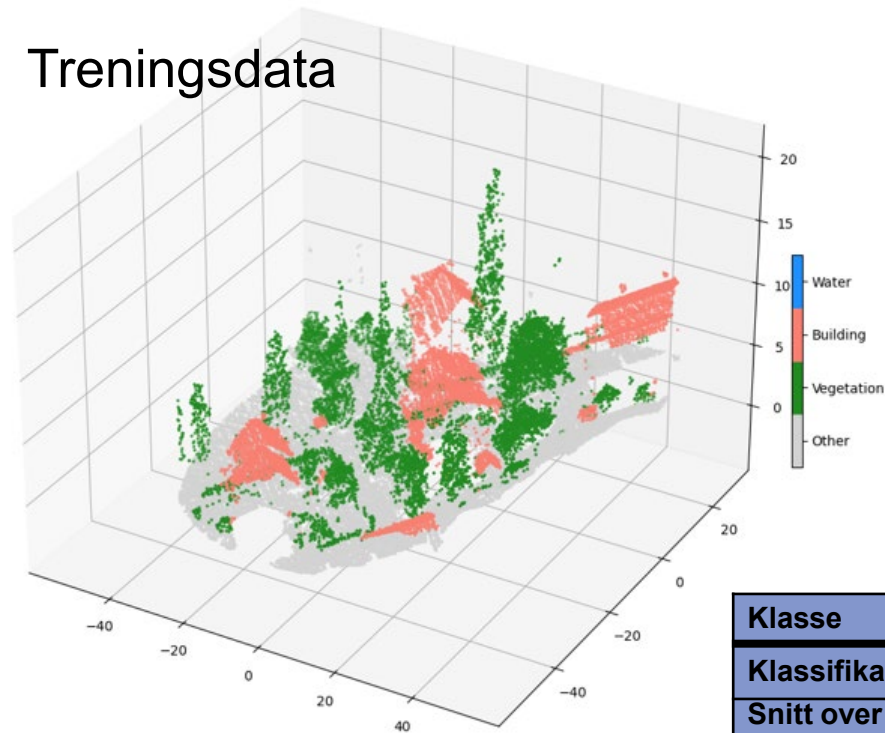


Faktiske bygninger:

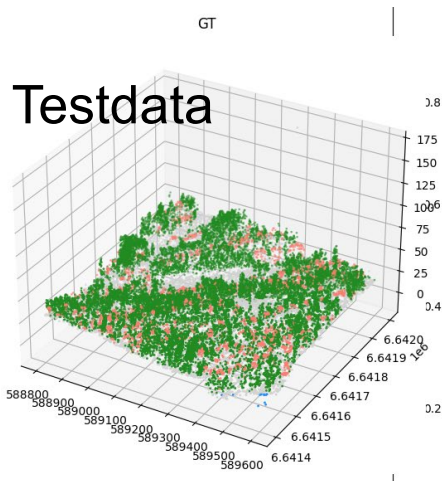


# Resultater: klassifisering av punktsky

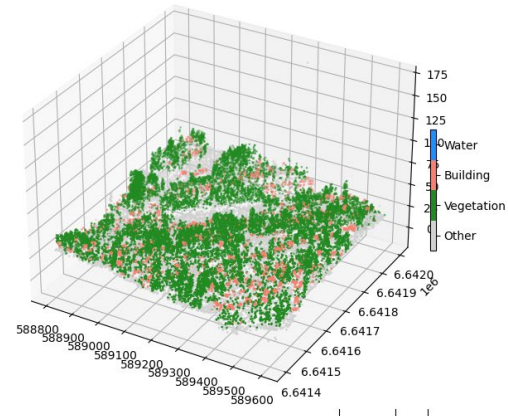
Treningsdata



Testdata



Pred



Klasse	Annet	Vegetasjon	Bygning	Vann	gjennomsnitt
<b>Klassifikasjonsrate</b>	94%	93%	75%	0%	90%
<b>Snitt over union (intersection over union, IoU)</b>	85%	87%	61%	0%	72%

# Resultater: deteksjon i bilder

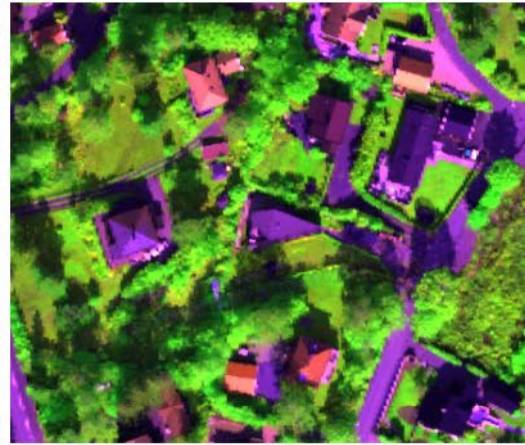
Objektbasert sammenligning av metodene	Sanne positive		Falske positive	
	antall	areal	antall	areal
Frame Field Learning RGB, uten lidar	85 %	97 %	15 %	1 %
U-Net 8 cm RGB + lidar	73 %	95 %	5 %	1 %
U-Net 8 cm RGB, uten lidar	70 %	92 %	28 %	10 %
ArcGIS Mark-RCNN 8 cm RGB, uten lidar	75 %	91%	5 %	3 %
Mask-RCNN 30 cm 6 bånd + lidar	80 %	96 %	2 %	1 %
U-Net 30 cm 6 bånd + lidar	65 %	91 %	0,4 %	0,4 %

Pikselbasert sammenligning av metodene	Snitt/union IoU	Sanne positive	Falske positive
Frame Field Learning RGB, uten lidar	76,2 %	80,4 %	5,5 %
U-Net 8 cm RGB + lidar	76,9 %	82,9 %	7,8 %
U-Net 8 cm RGB, uten lidar	49,4 %	60,9 %	23,3 %
ArcGIS Mark-RCNN 8 cm RGB, uten lidar	73,6 %	82,2 %	11,7 %
Mask-RCNN 30 cm 6 bånd + lidar	82,1 %	89,6 %	9,1 %
U-Net 30 cm 6 bånd + lidar	72,8 %	78,2 %	7,3 %

Hyperspektralt  
30 cm

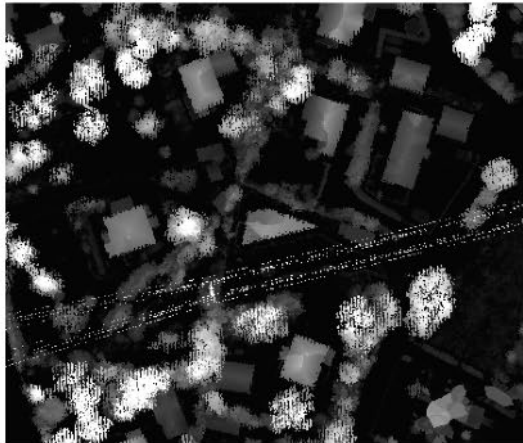


(a)



(b)

Lidar



(c)



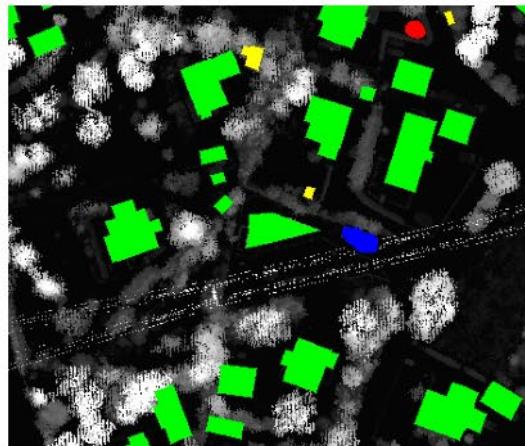
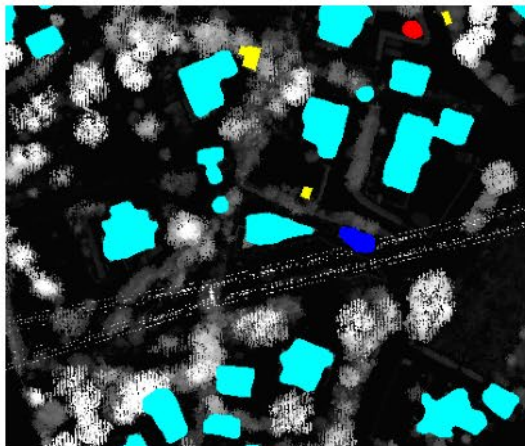
(d)



(c)

(d)

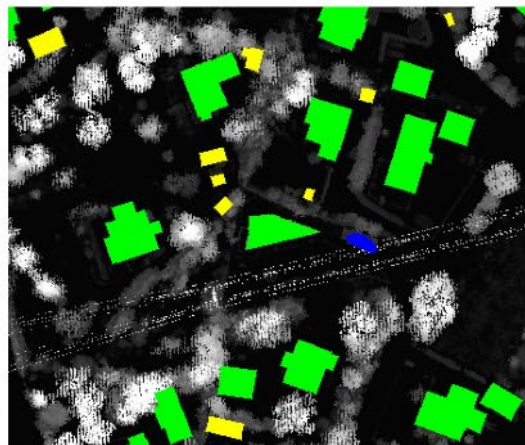
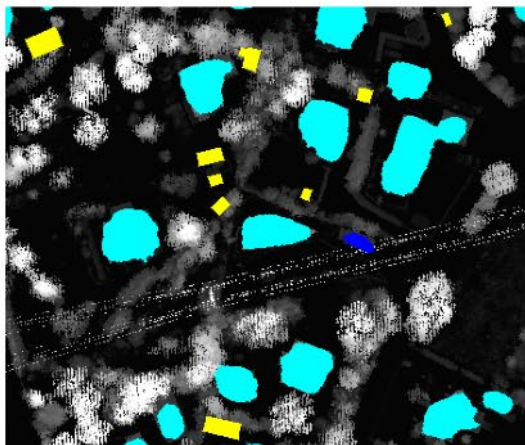
Mask RCNN



(e)

(f)

U-Net



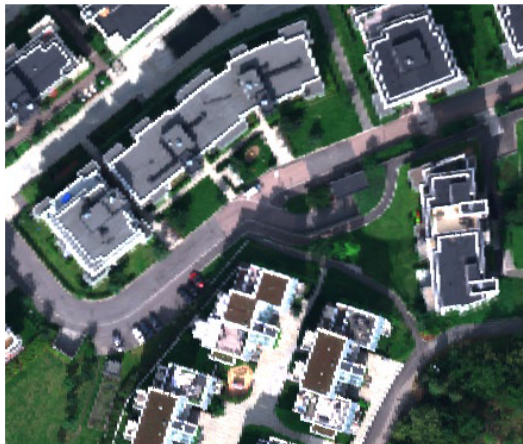
(g)

(h)





Hyperspektralt  
30 cm

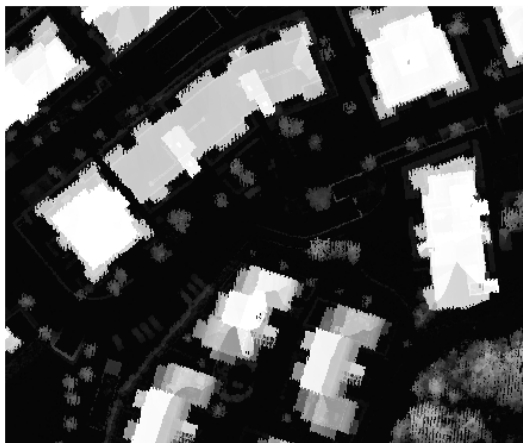


(a)



(b)

Lidar



(c)



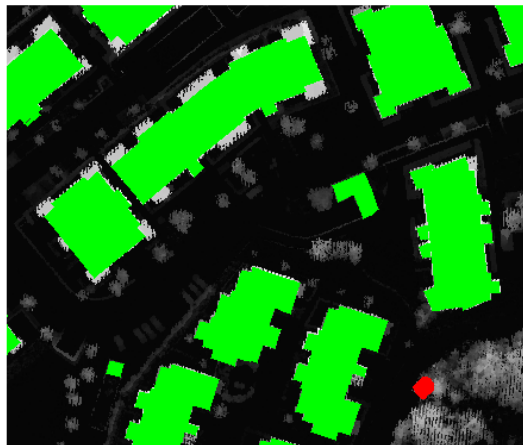
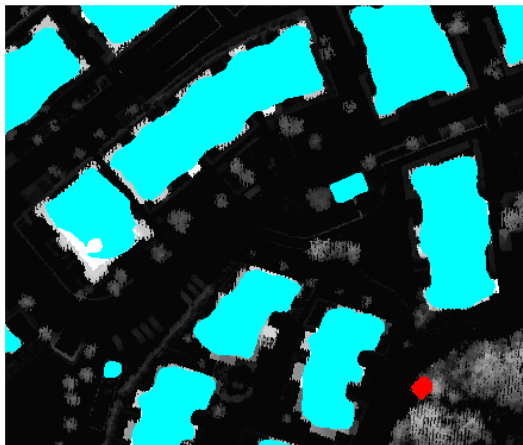
(d)



(c)

(d)

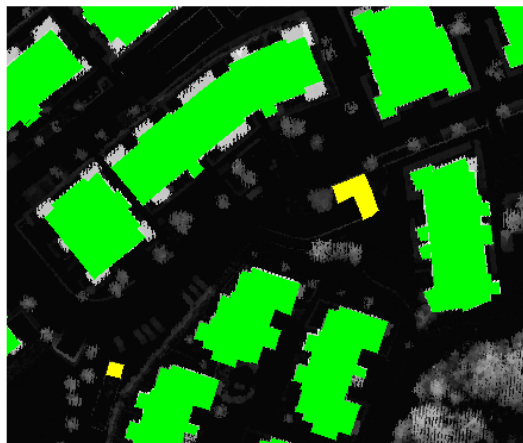
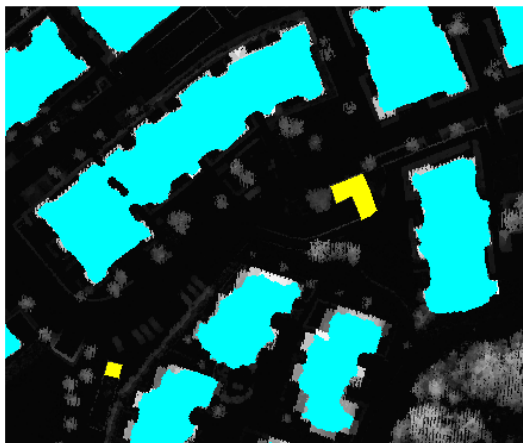
Mask RCNN



(e)

(f)

U-Net



(g)

(h)





**Frame field learning RGB**



ESRI ArcGIS Mask-RCNN RGB



U-Net RGB+lidar