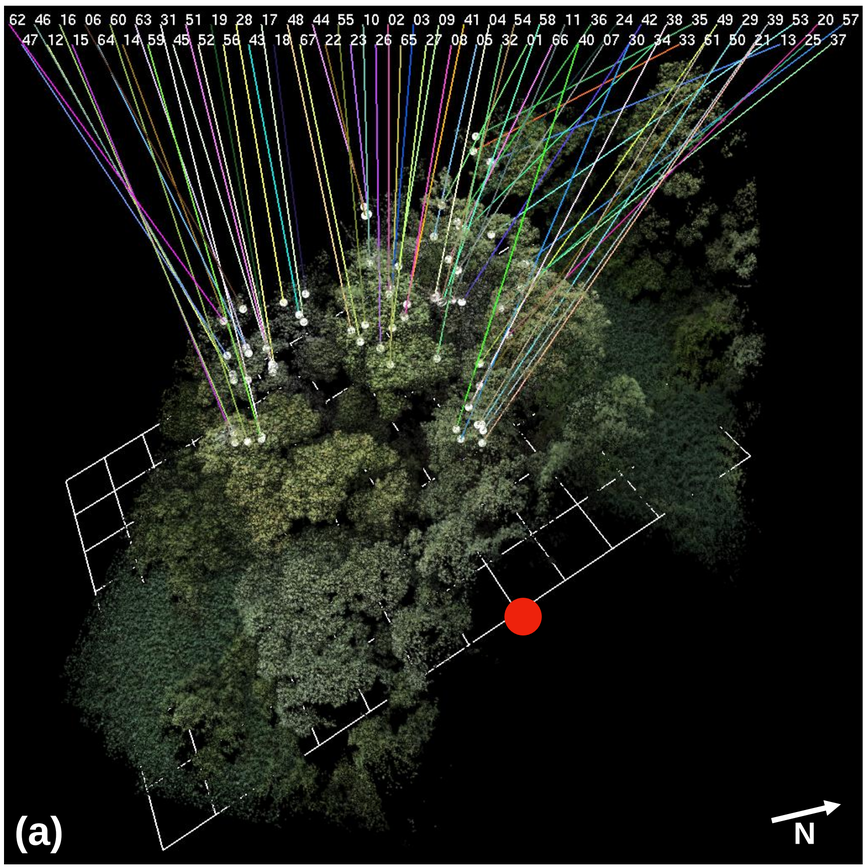
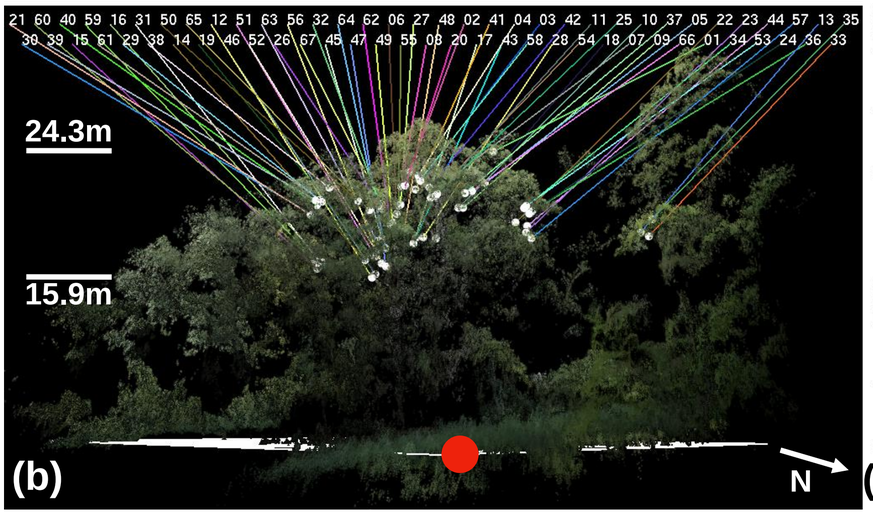
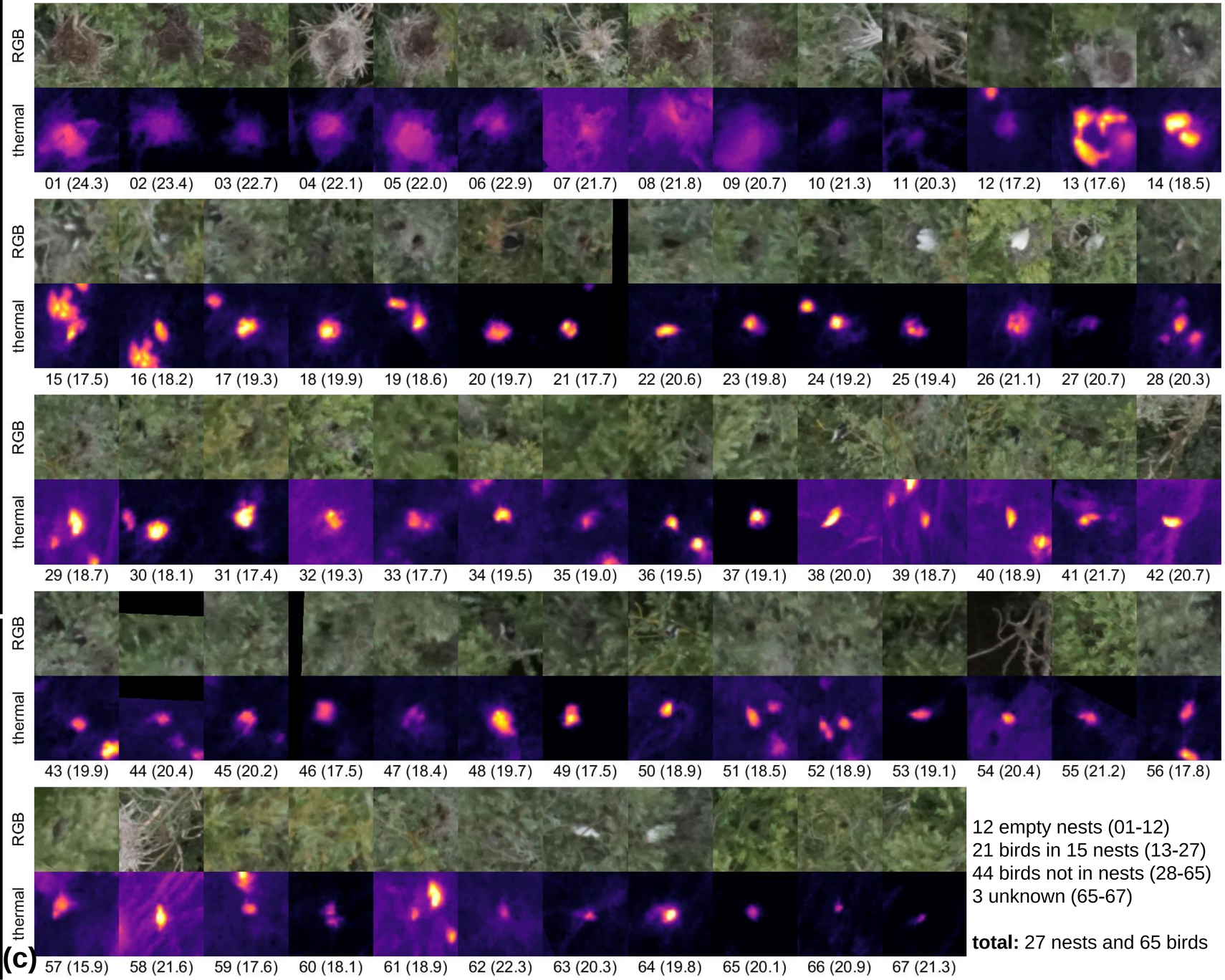




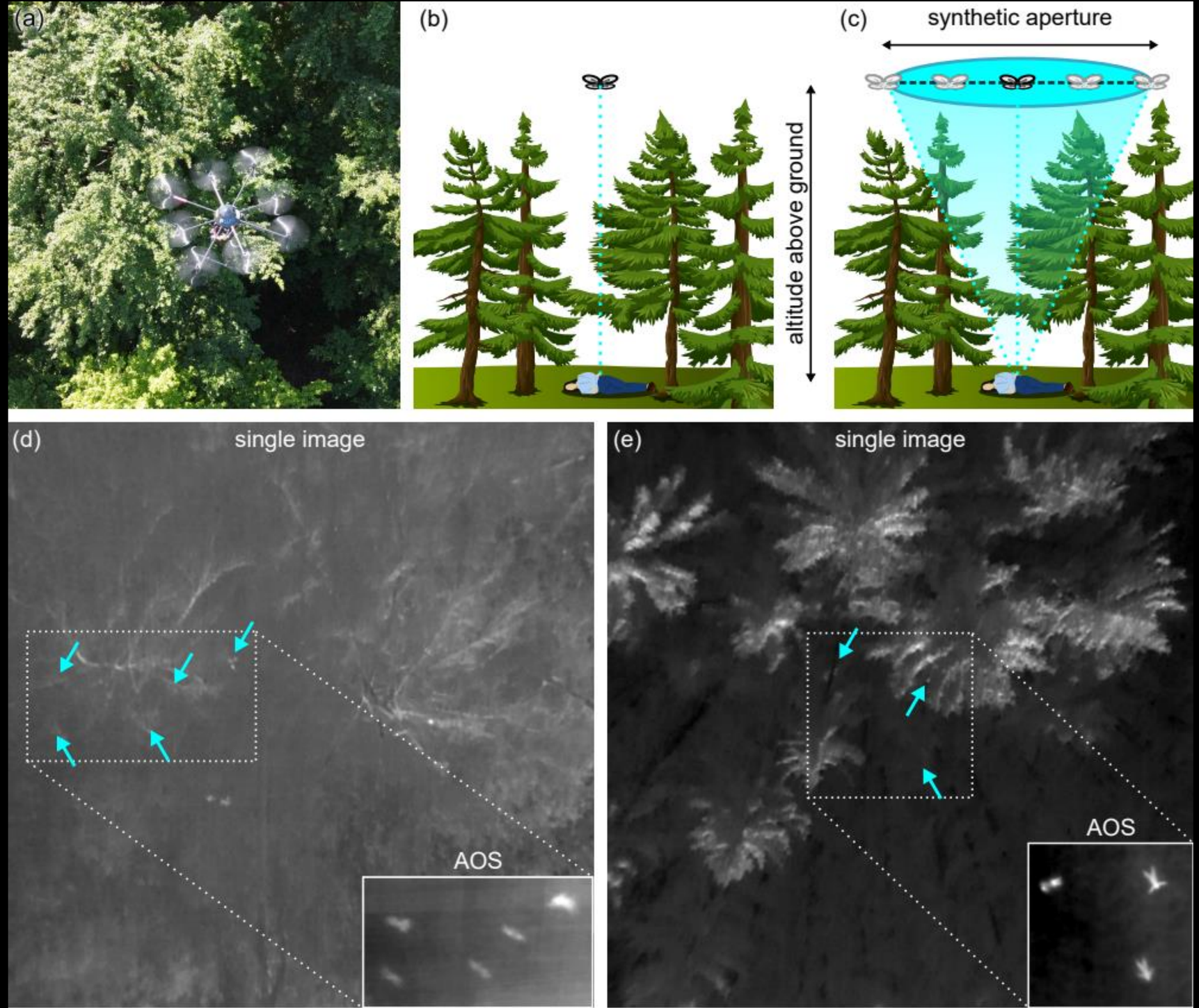


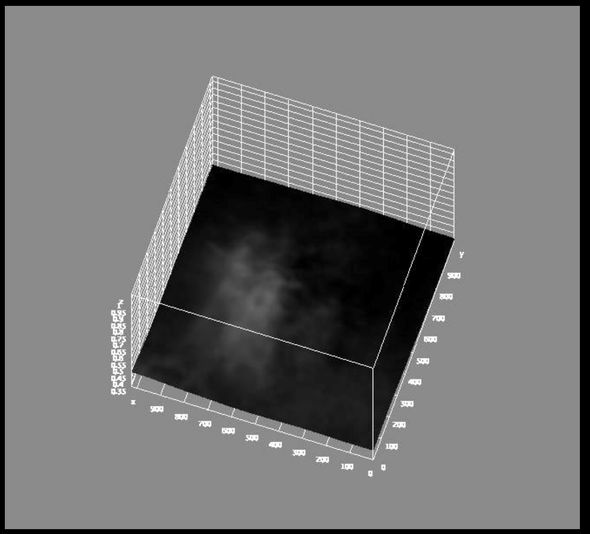
12 empty nests (01-12)
21 birds in 15 nests (13-27)
44 birds not in nests (28-65)
3 unknown (65-67)

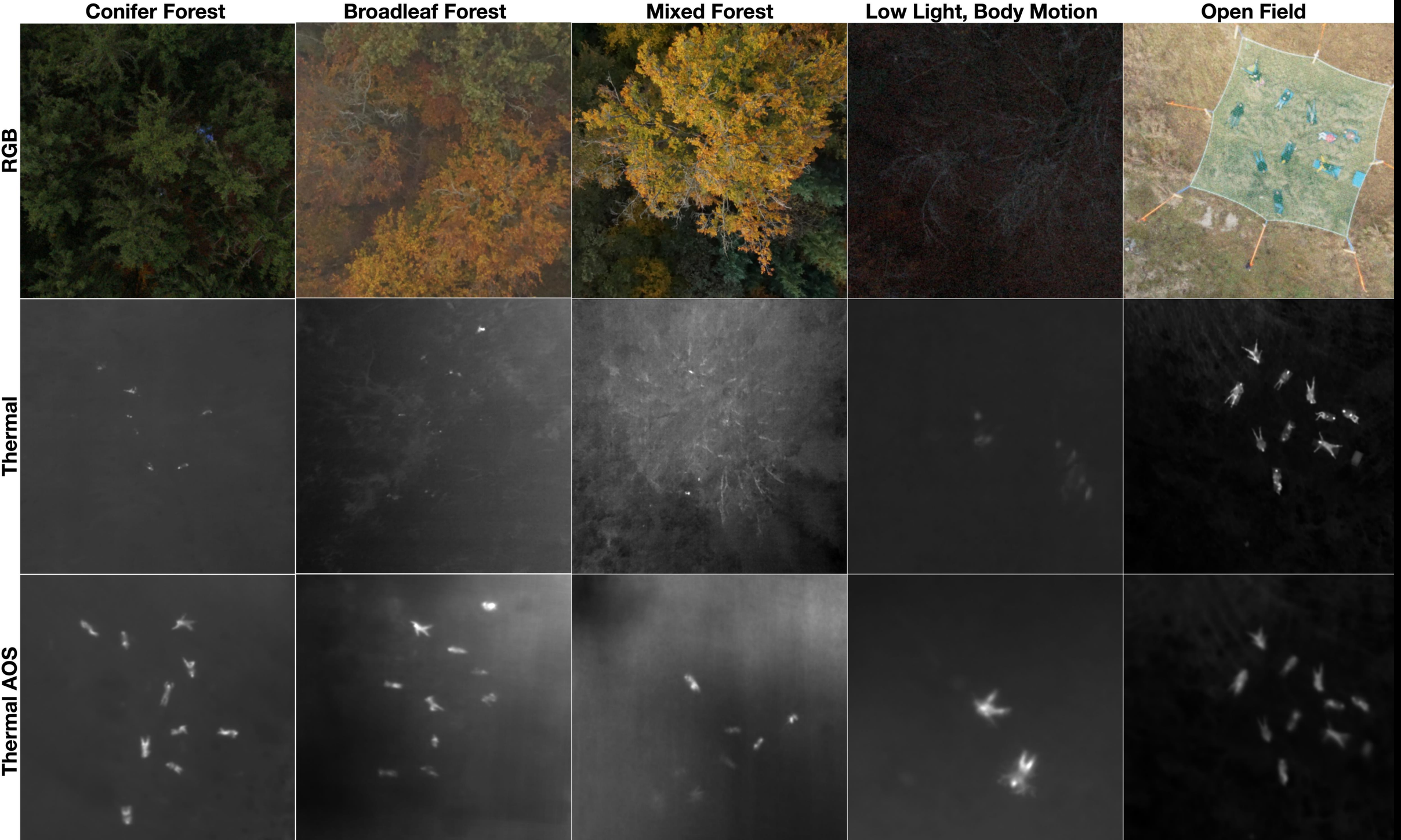
total: 27 nests and 65 birds

Airborne Optical Sectioning for Nesting Observation, Nature SciRep, 2020

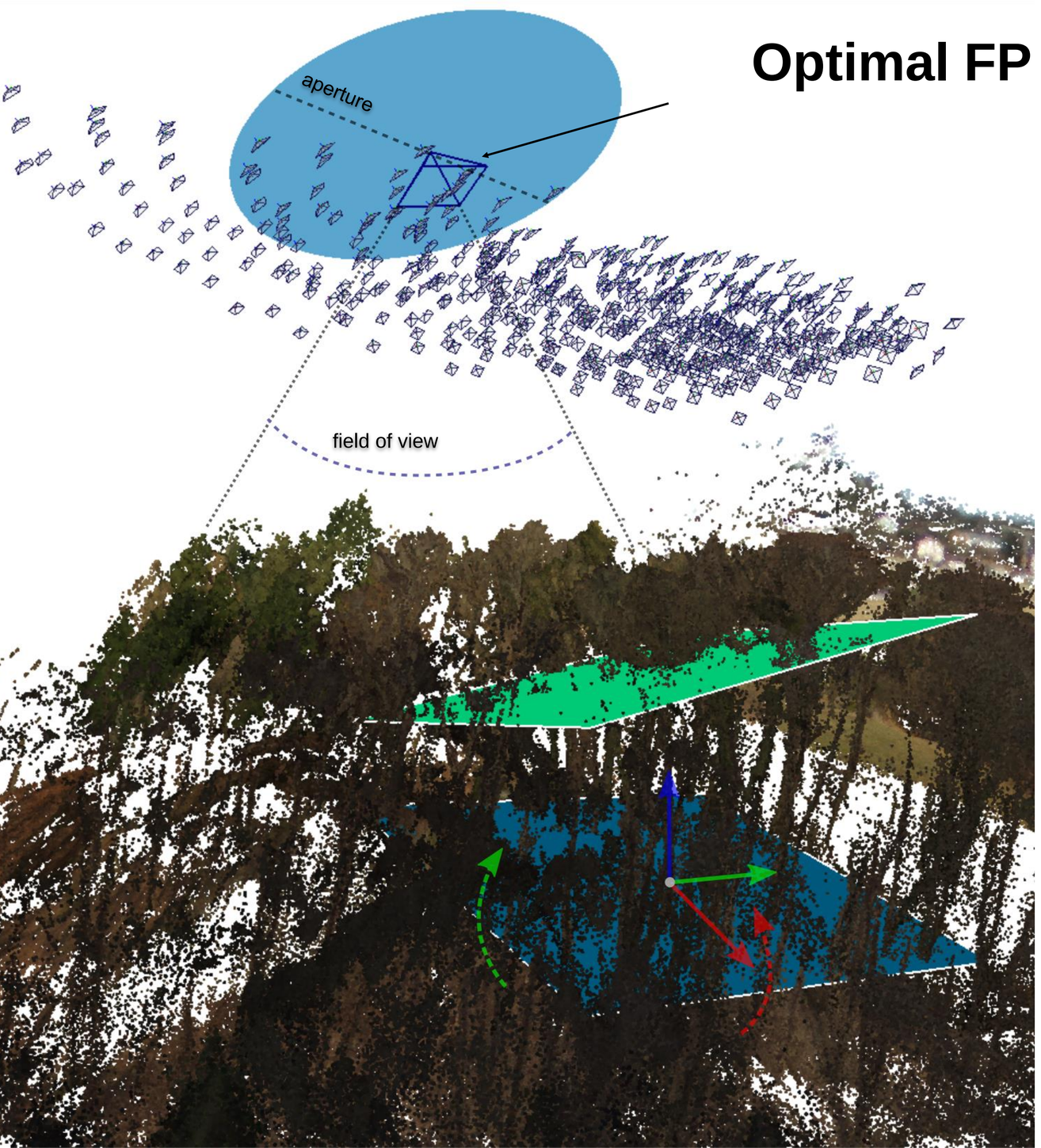
Search and Rescue by Airborne Optical Sectioning (SARAOS)

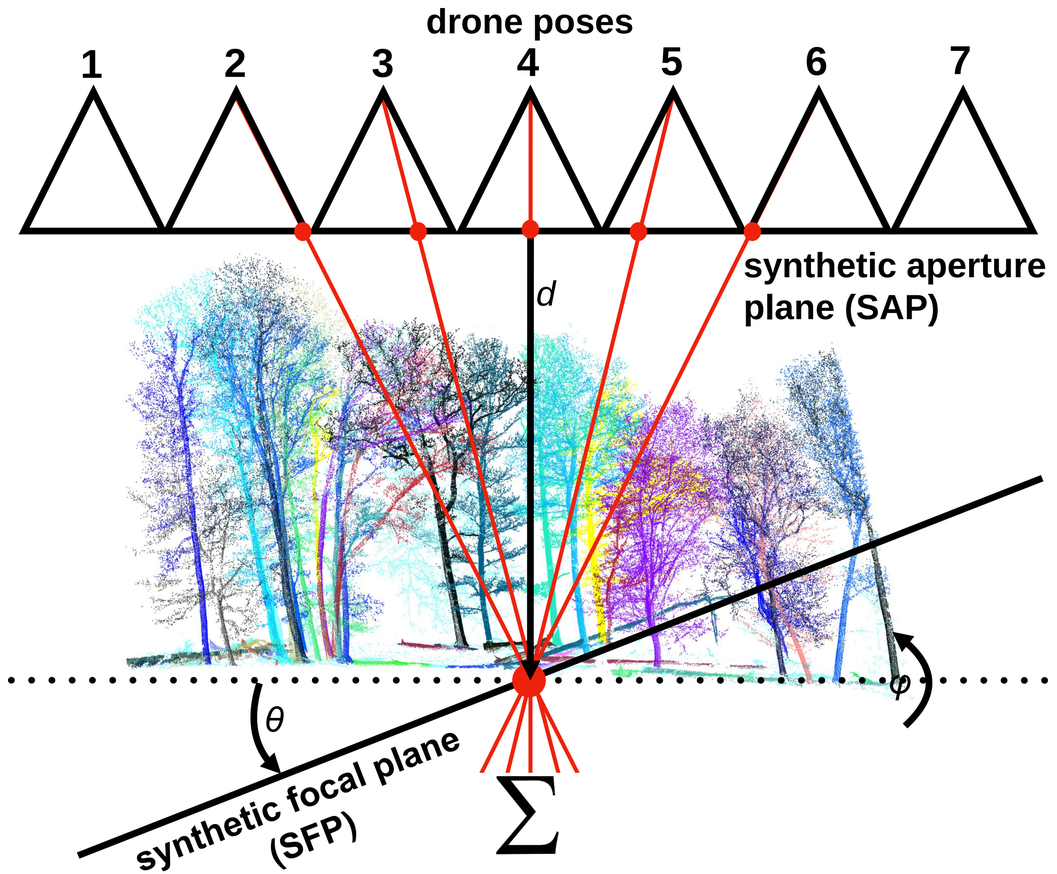





Conifer Forest
Broadleaf Forest
Mixed Forest
Low Light, Body Motion
Open Field
RGB
Thermal
Thermal AOS
Fast Automatic Visibility Optimization for Thermal Synthetic Aperture Visualization, IEEE Geoscience and Remote Sensing, 2020

Optimal FP parameters - automatic and fast?





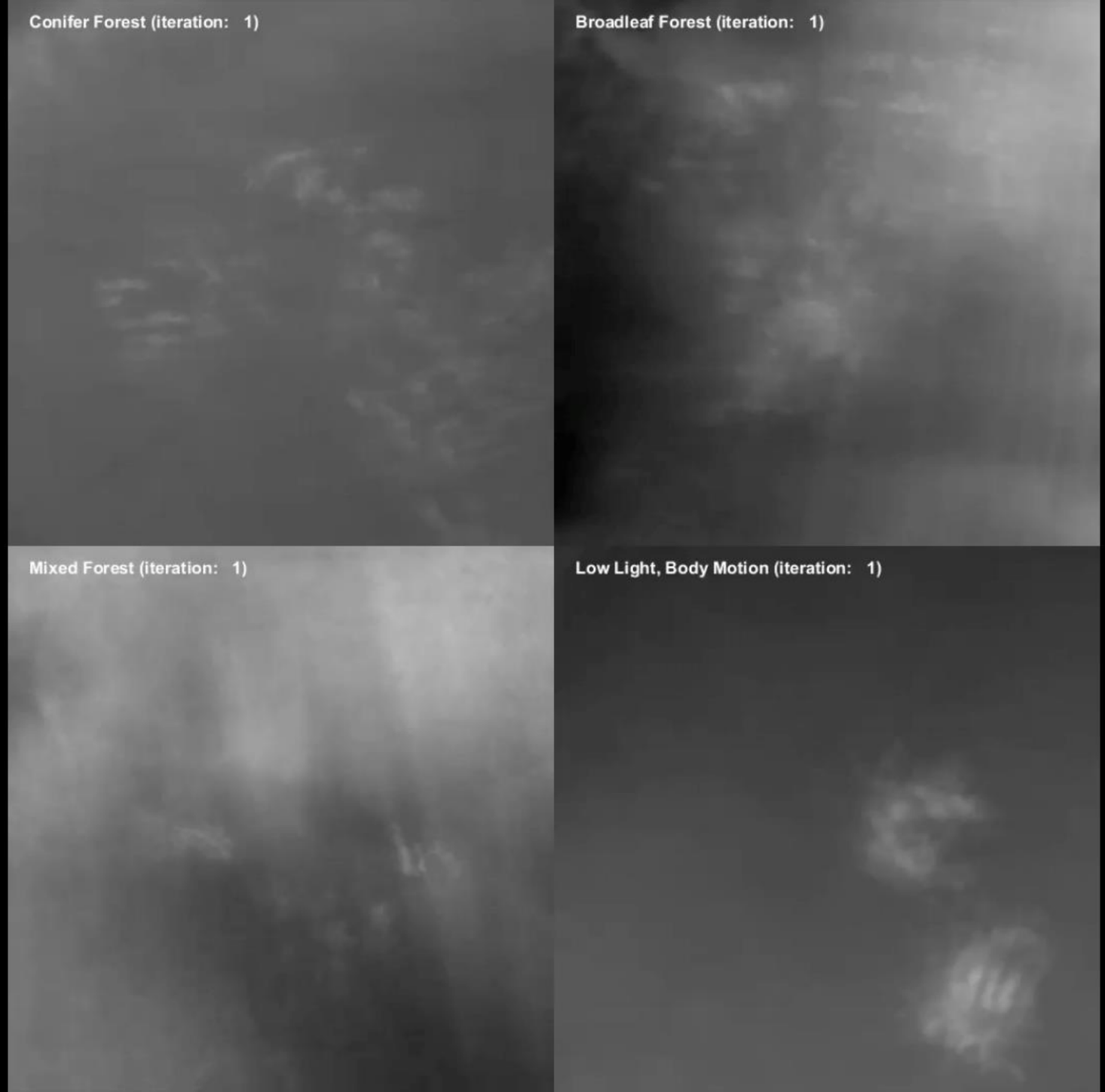
Fast Automatic Visibility Optimization for Thermal Synthetic Aperture Visualization, IEEE Geoscience and Remote Sensing, 2020

4 Scenes

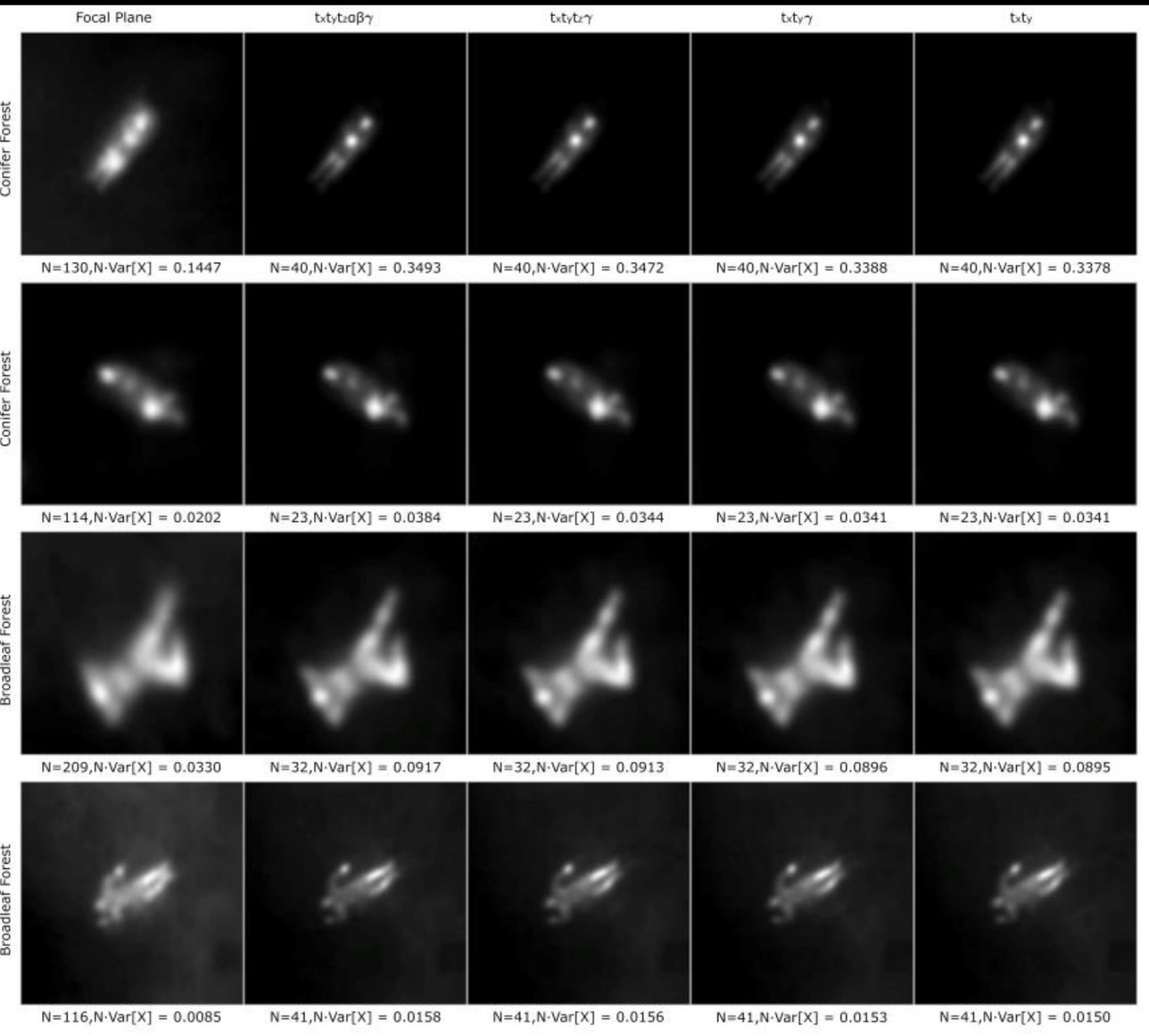
Iterations for
Gray-Level Variance Metric
using Sequential
Quadratic Programming

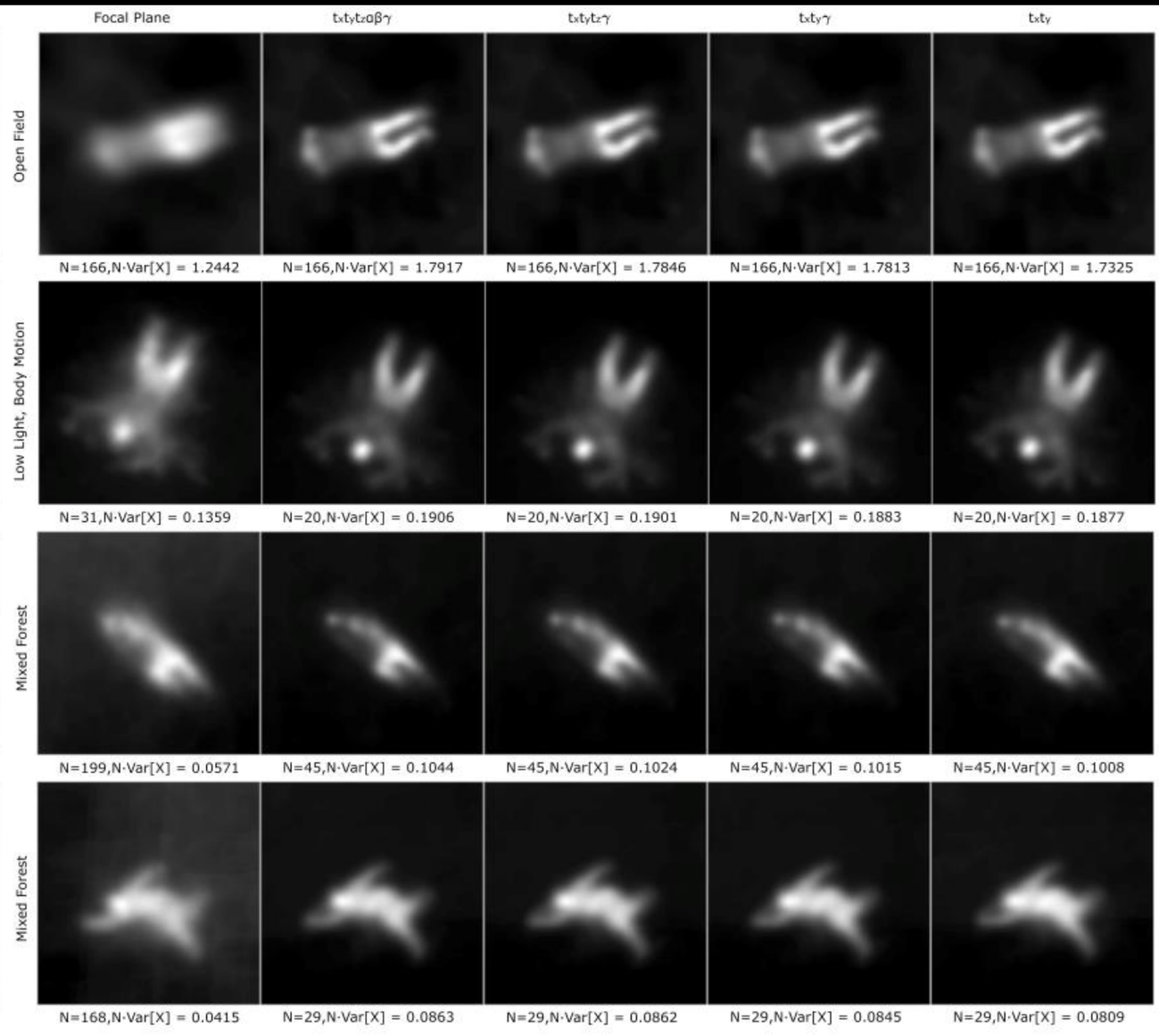
(Realtime)

Parameters Bounded to
d being 22 to 38 m away
and θ,φ being ±10° off
from the Synthetic
Aperture Plane



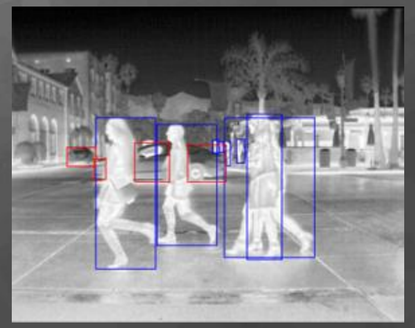
Fast Automatic Visibility Optimization for Thermal Synthetic Aperture Visualization, IEEE Geoscience and Remote Sensing, 2020





Pose Error Reduction for Focus Enhancement in Thermal Synthetic Aperture Visualization, IEEE Geoscience and Remote Sensing Letters, 2020 (submitted)

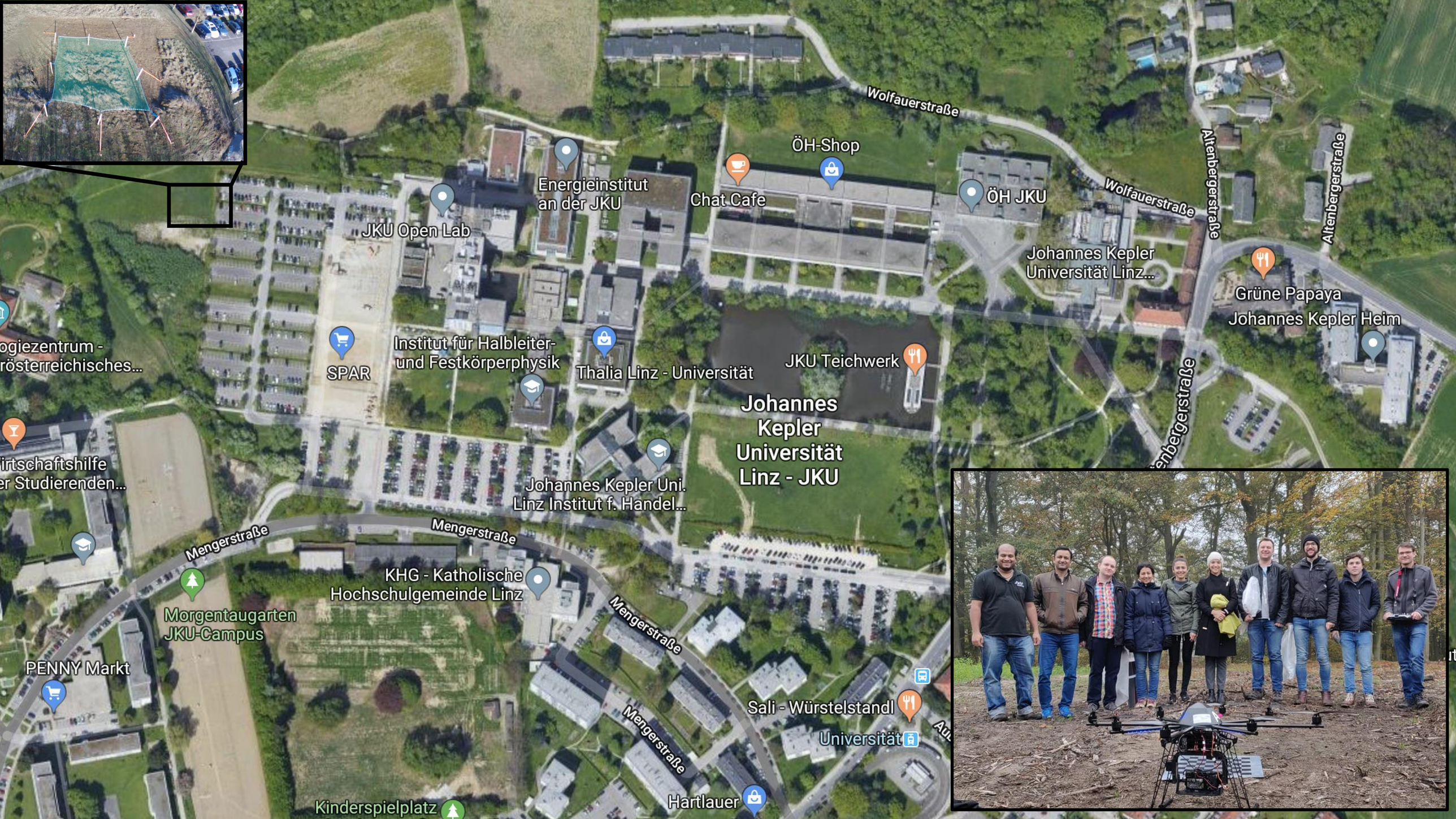
Search and Rescue by Airborne Optical Sectioning (SARAOS)



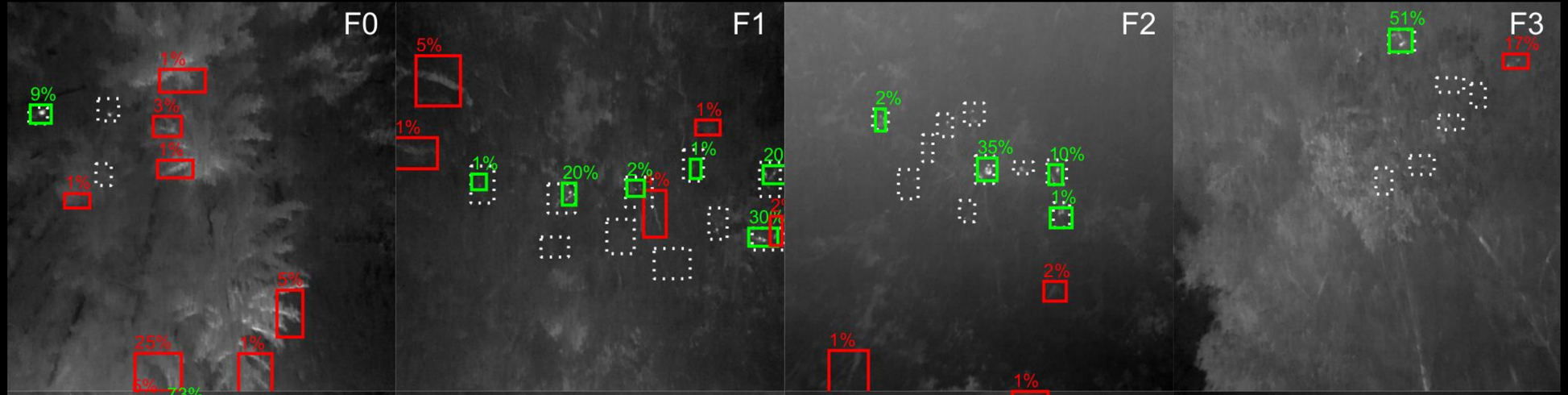
FLIR thermal dataset

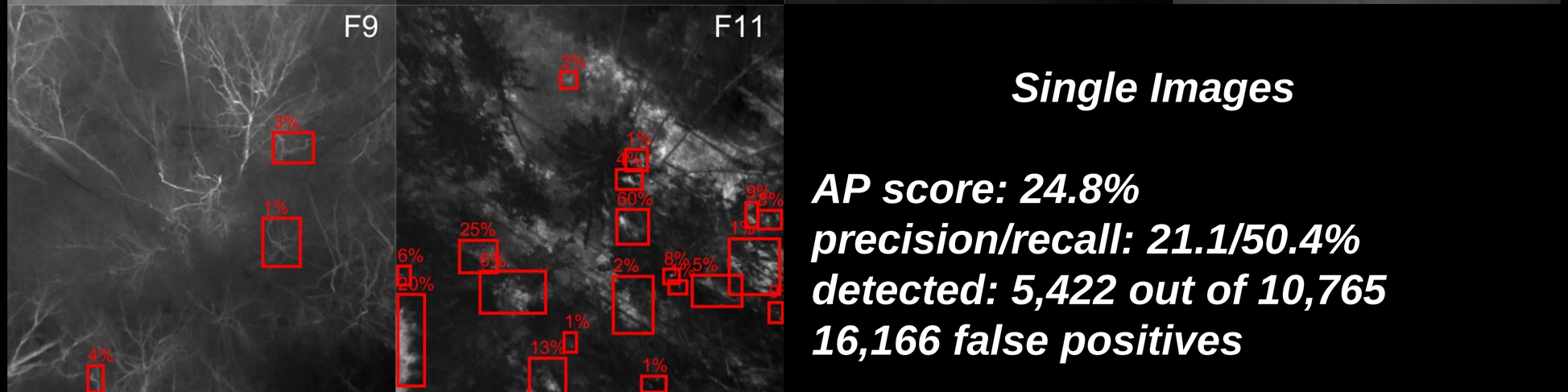
occlusion (forest)

no occlusion (open field)


Wolfauerstraße
Energieinstitut an der JKU
ÖH-Shop
Chat Cafe
ÖH JKU
JKU Open Lab
Wolfauerstraße
Altenbergerstraße
Altenbergerstraße
Johannes Kepler Universität Linz...
Grüne Papaya
Johannes Kepler Heim
ogiezentrum -
rösterreichisches...
SPAR
Institut für Halbleiter- und Festkörperphysik
Thalia Linz - Universität
JKU Teichwerk
Johannes Kepler Universität Linz - JKU
irtschaftshilfe
er Studierenden...
Johannes Kepler Uni. Linz Institut f. Handel...
Mengerstraße
Mengerstraße
Mengerstraße
Mengerstraße
KHG - Katholische Hochschulgemeinde Linz
Morgentaugarten JKU-Campus
PENNY Markt
Sali - Würstelstandl
Universität
Hartlauer
Kinderspielplatz

Search and Rescue with Airborne Optical Sectioning, Nature Machine Intelligence 2020

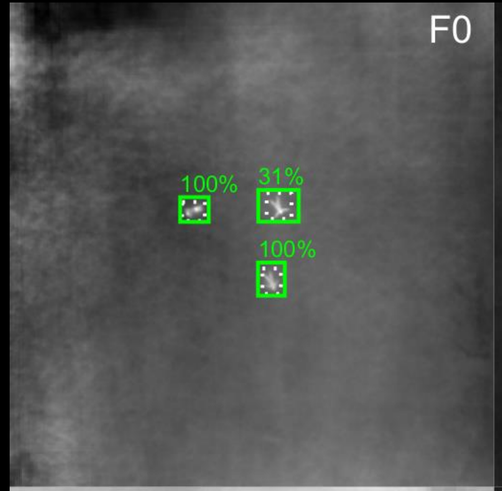


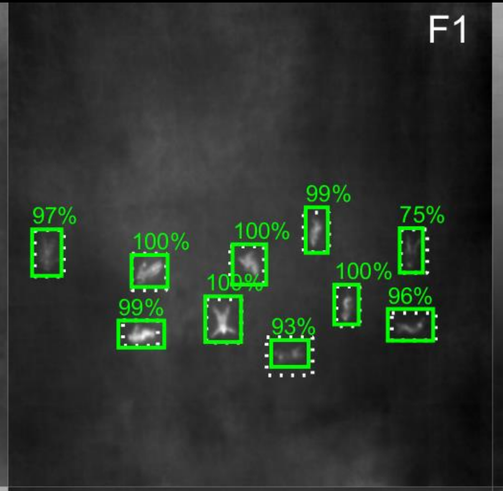


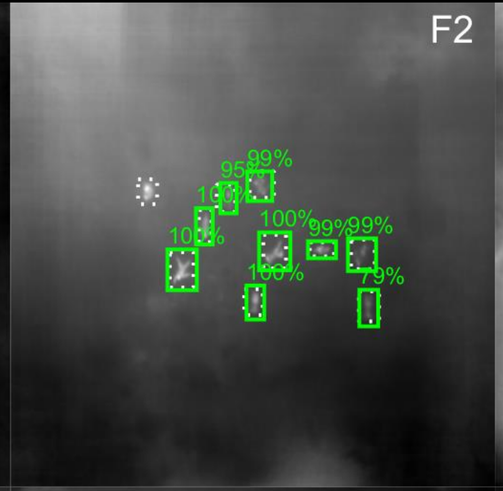
Single Images

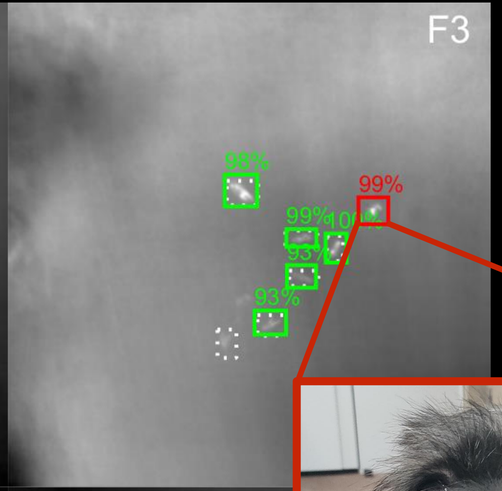
AP score: 24.8%
precision/recall: 21.1/50.4%
detected: 5,422 out of 10,765
16,166 false positives

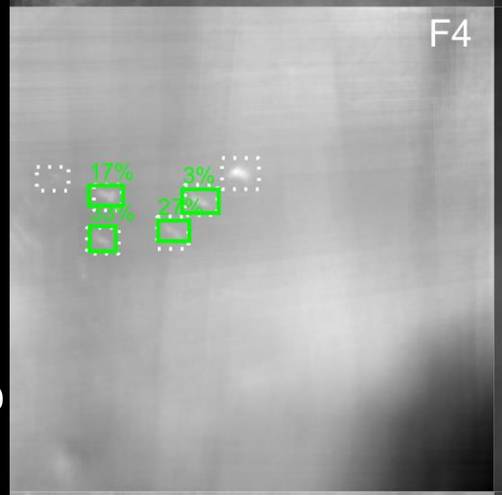
Search and Rescue with Airborne Optical Sectioning, Nature Machine Intelligence 2020

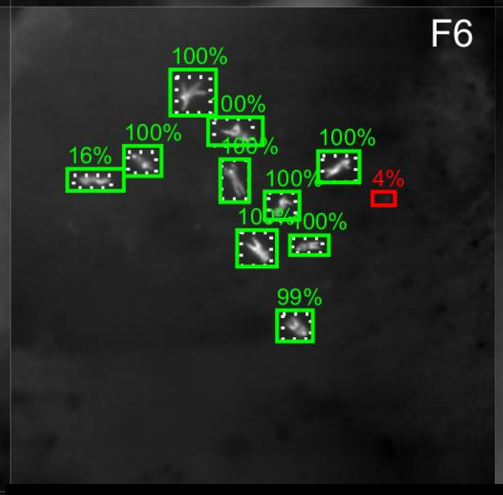


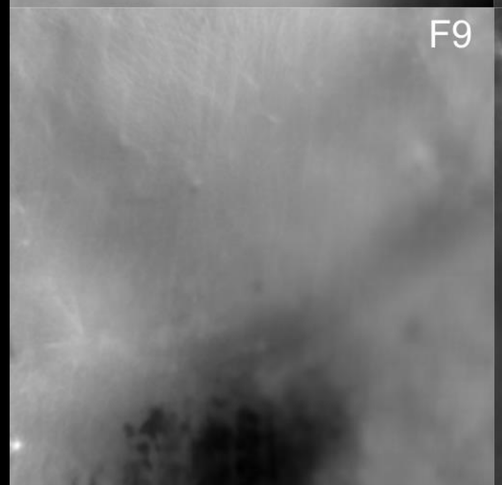


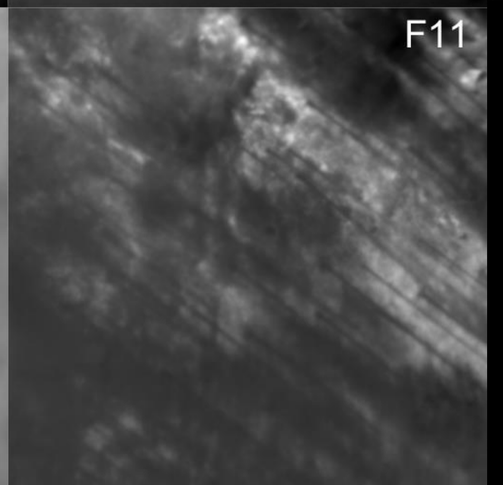








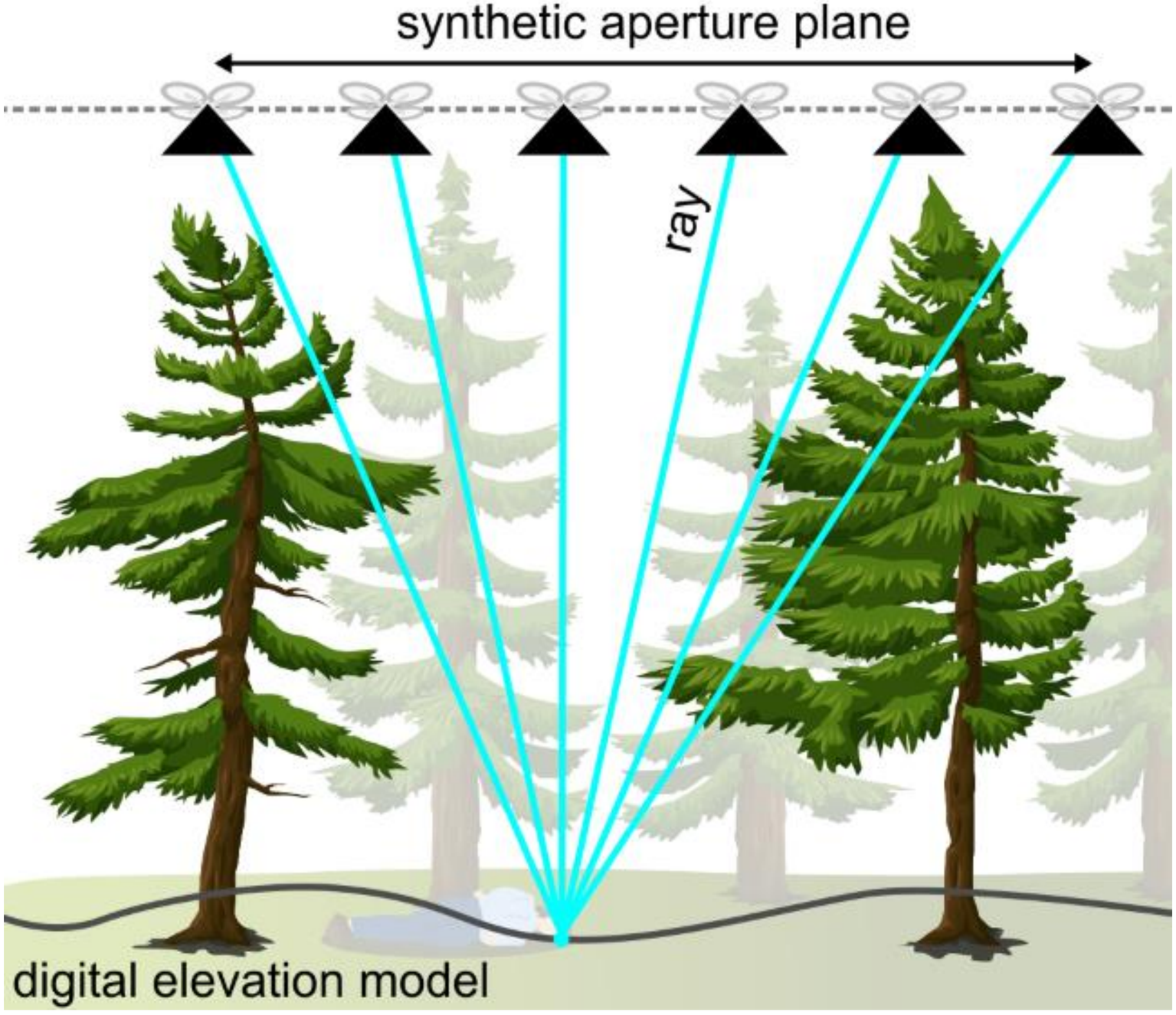




AOS Integral Images

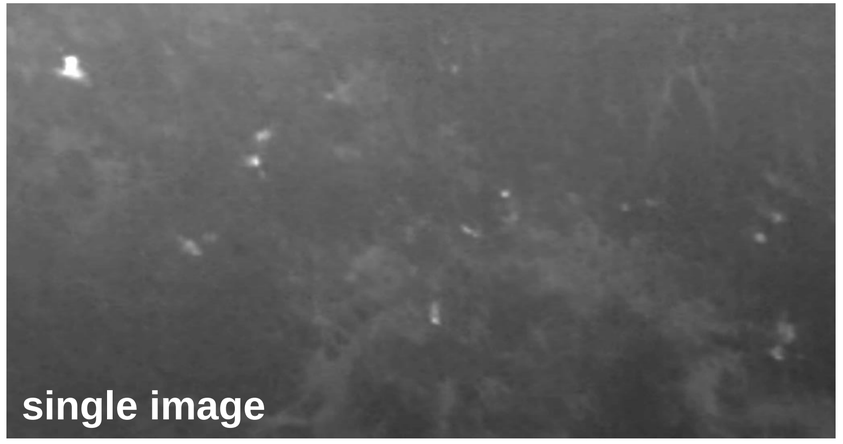
AP score: 92.2%
precision/recall: 96.4/93%
detected: 53 out of 57
2 false positives (branches and a dog)

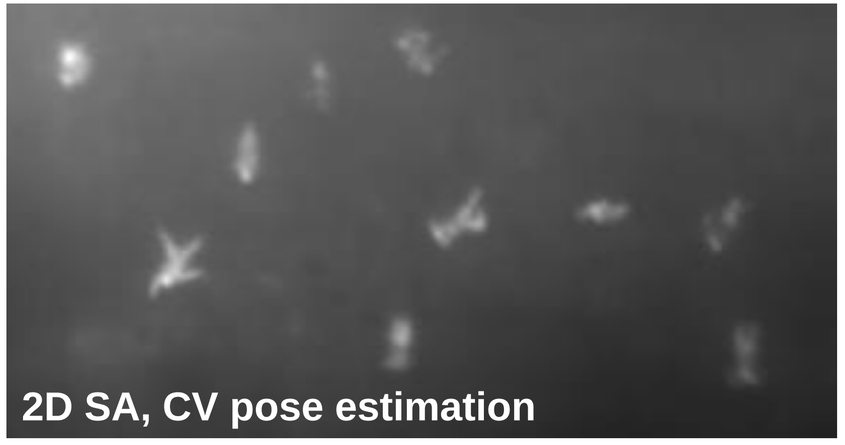
Real-Time

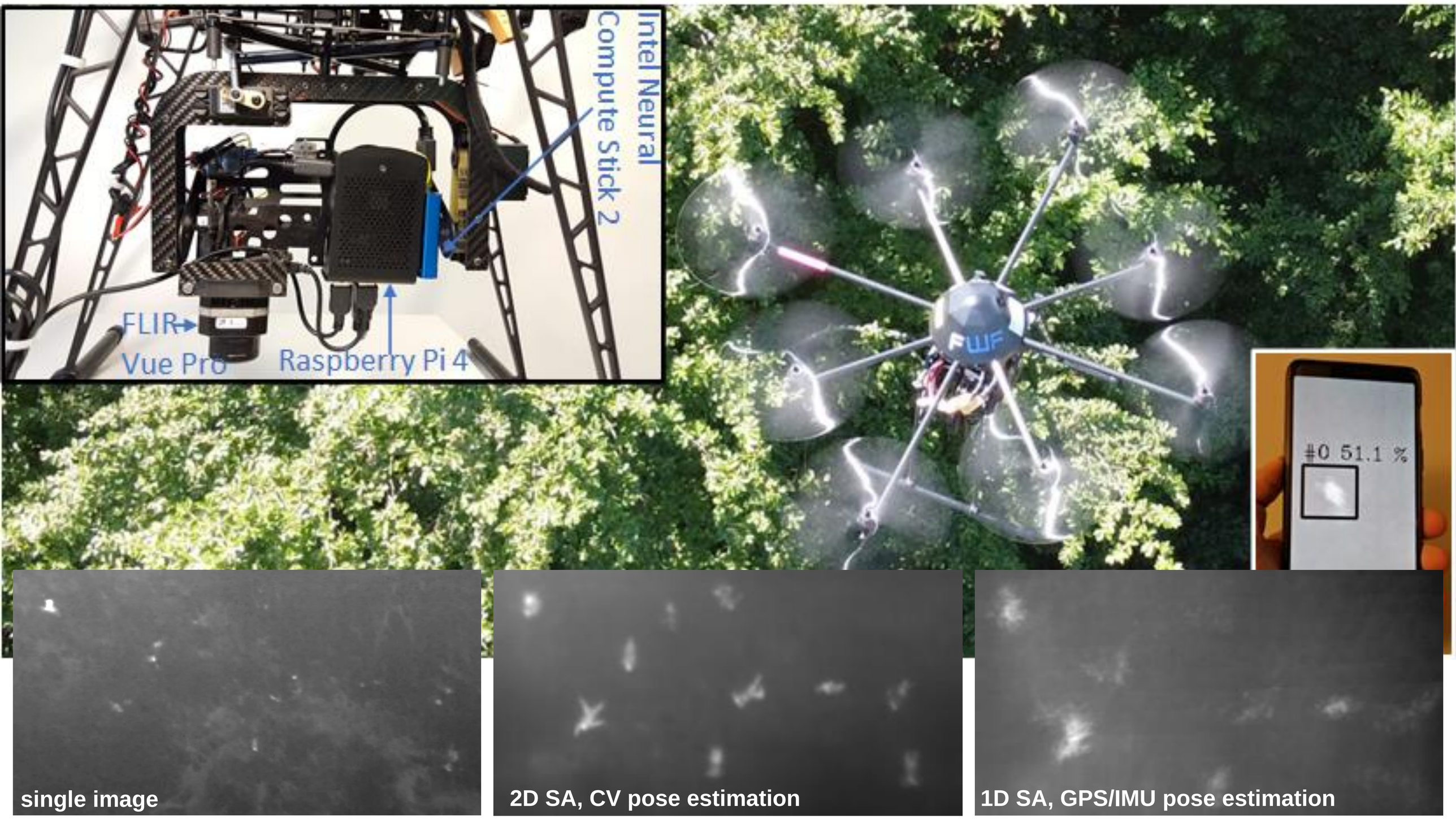


To get this running fast on the drone and during flight:

- short linear (1D) apertures
- GPS/IMU-based pose estimation
- digital elevation model to compute integral image for focal surface and drone control on Raspberry Pi
- classification with YOLO4-tiny on Intel Neural Compute Stick
- training set = test set of the previous study

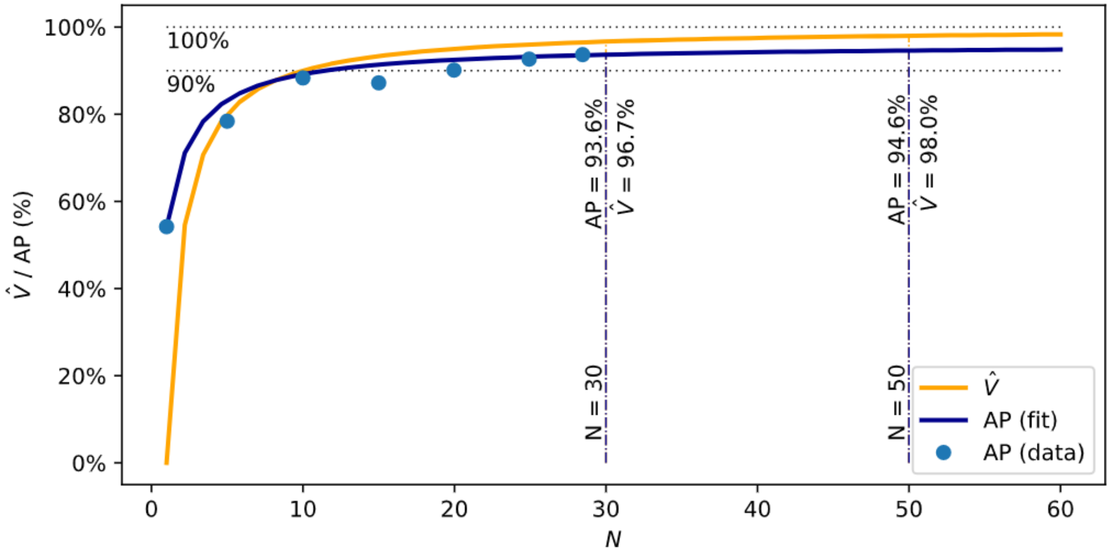


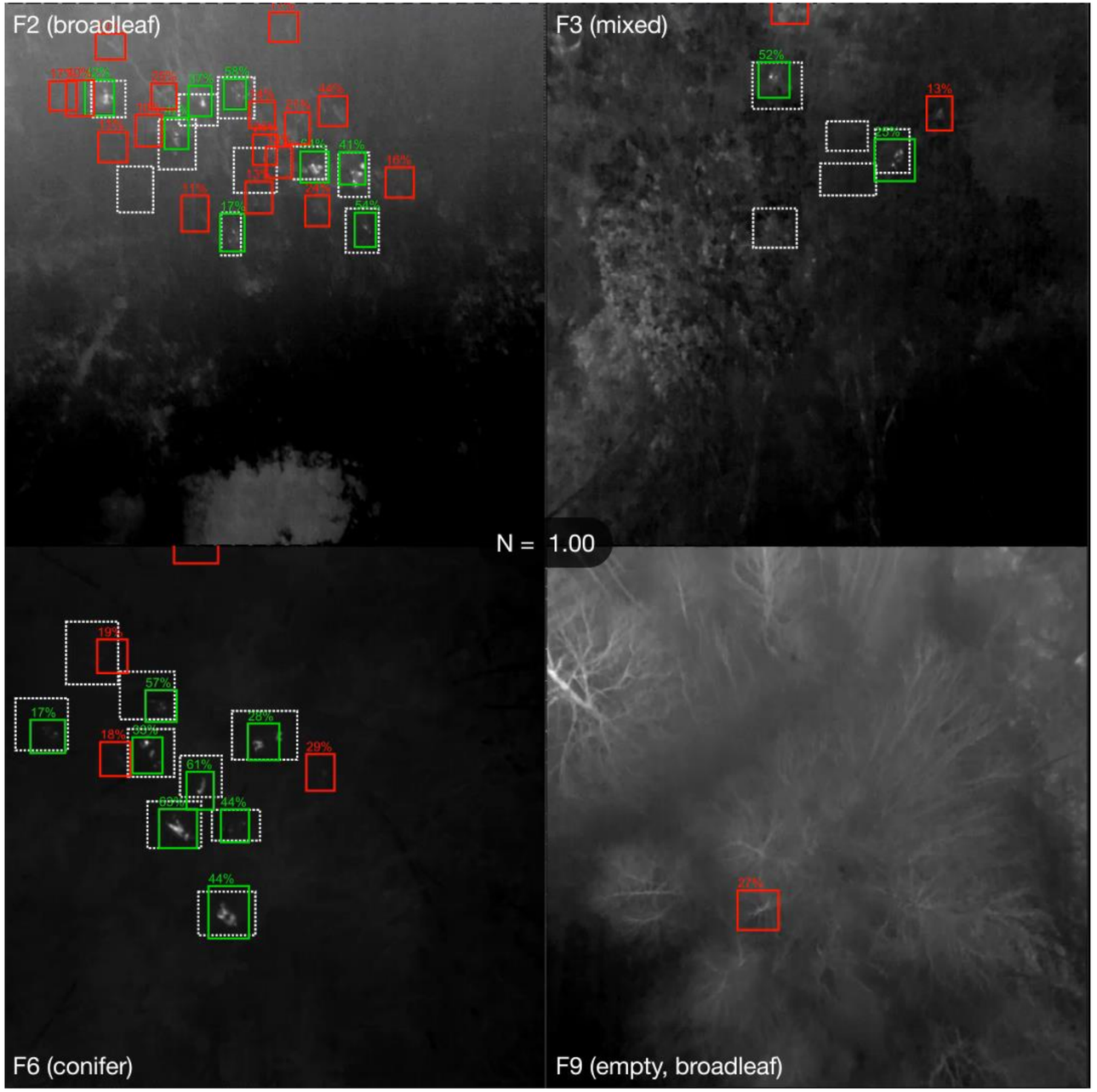



Intel Neural
Compute Stick 2
FLIR
Vue Pro
Raspberry Pi 4
#0 51.1 %
single image
2D SA, CV pose estimation
1D SA, GPS/IMU pose estimation

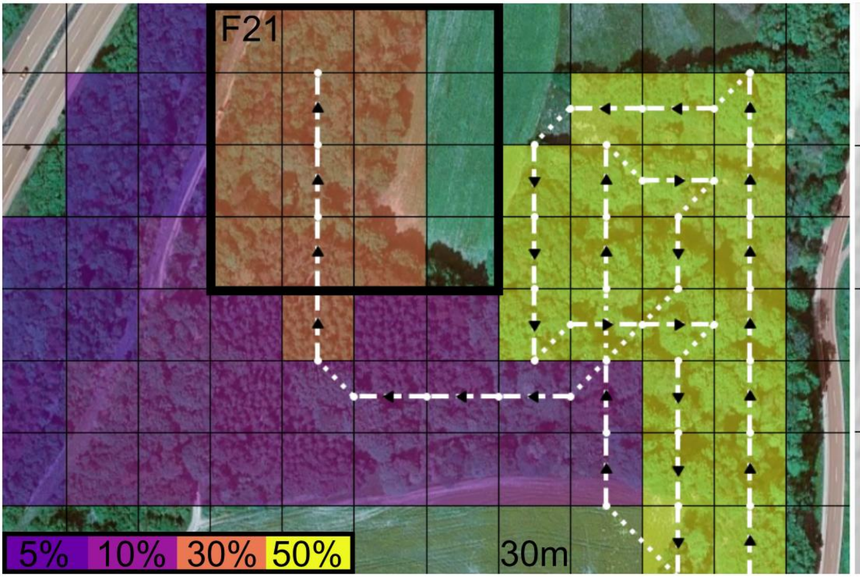

AOS

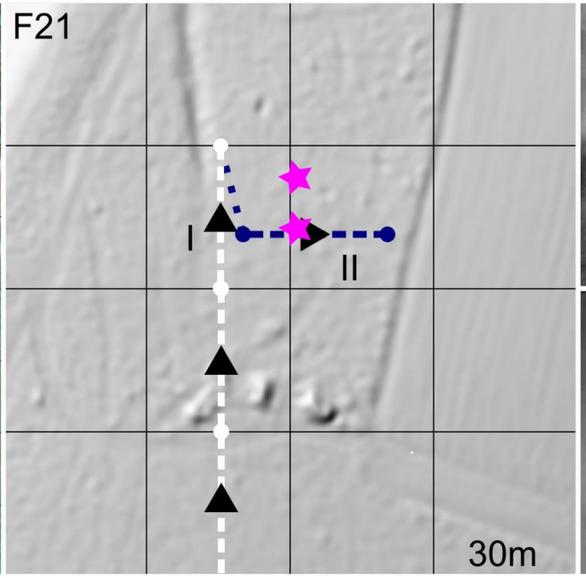
1D Synthetic Aperture

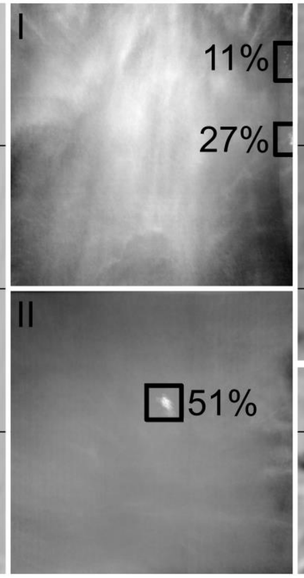


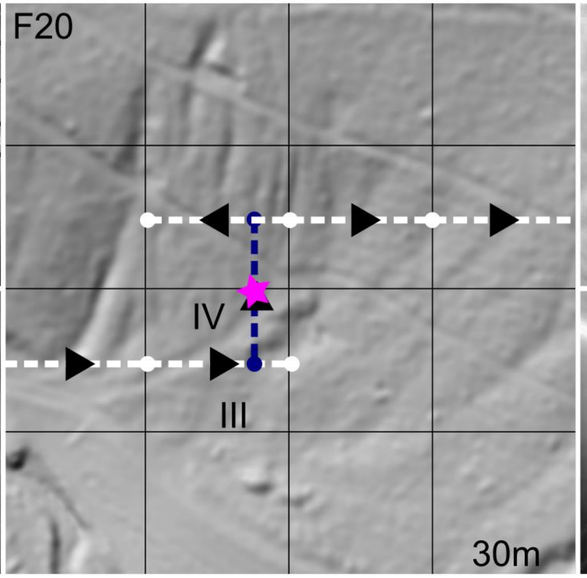


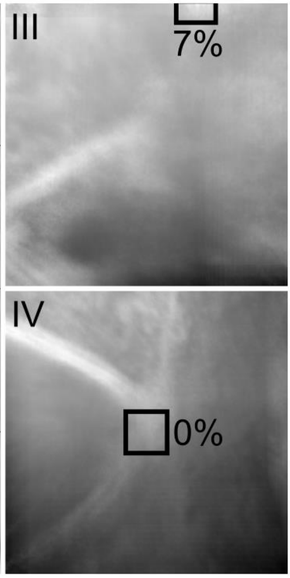
Adaptive Path Planing

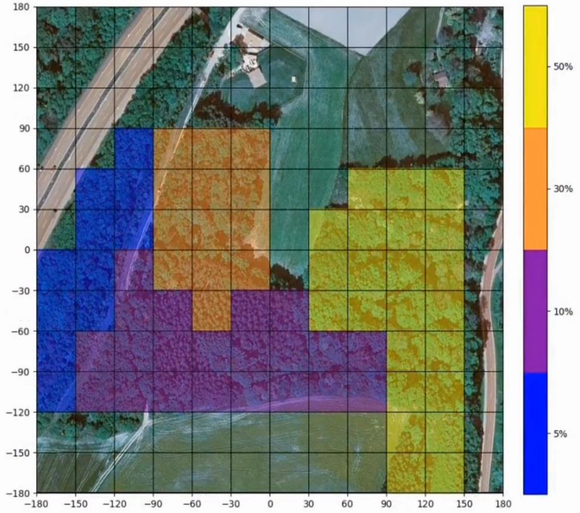


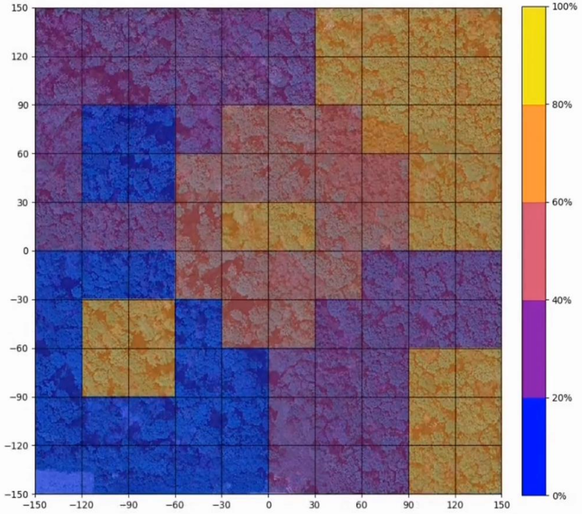


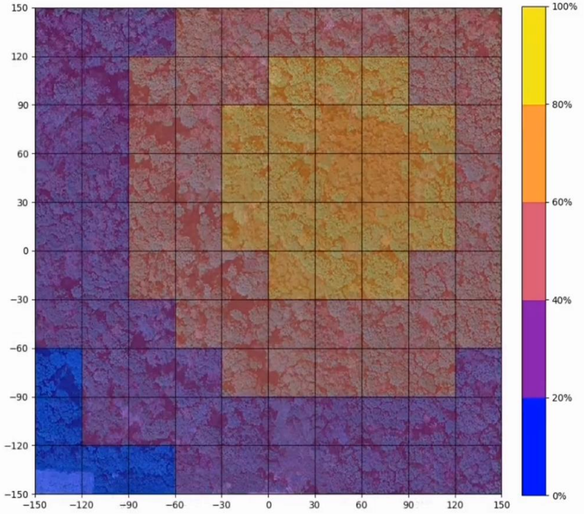


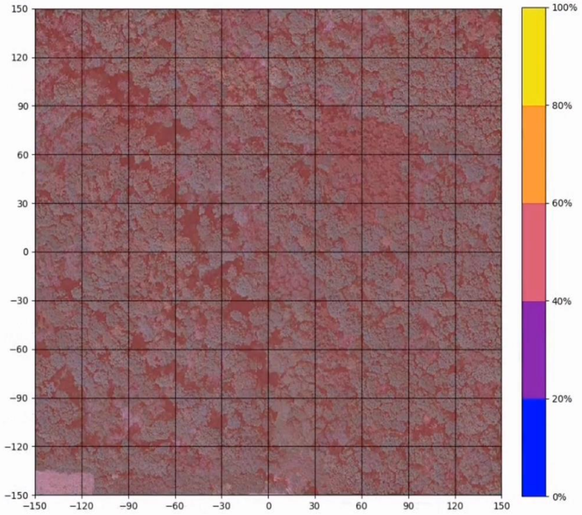




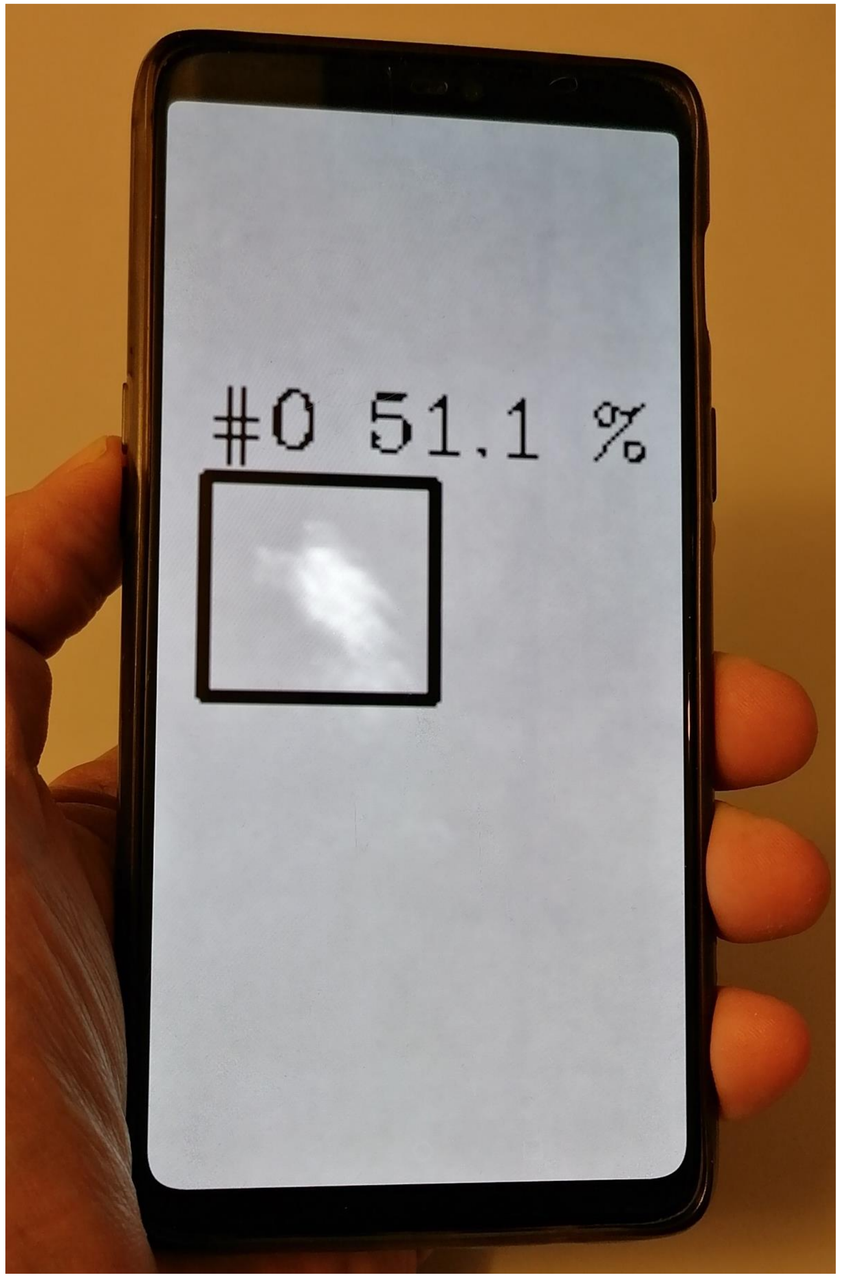


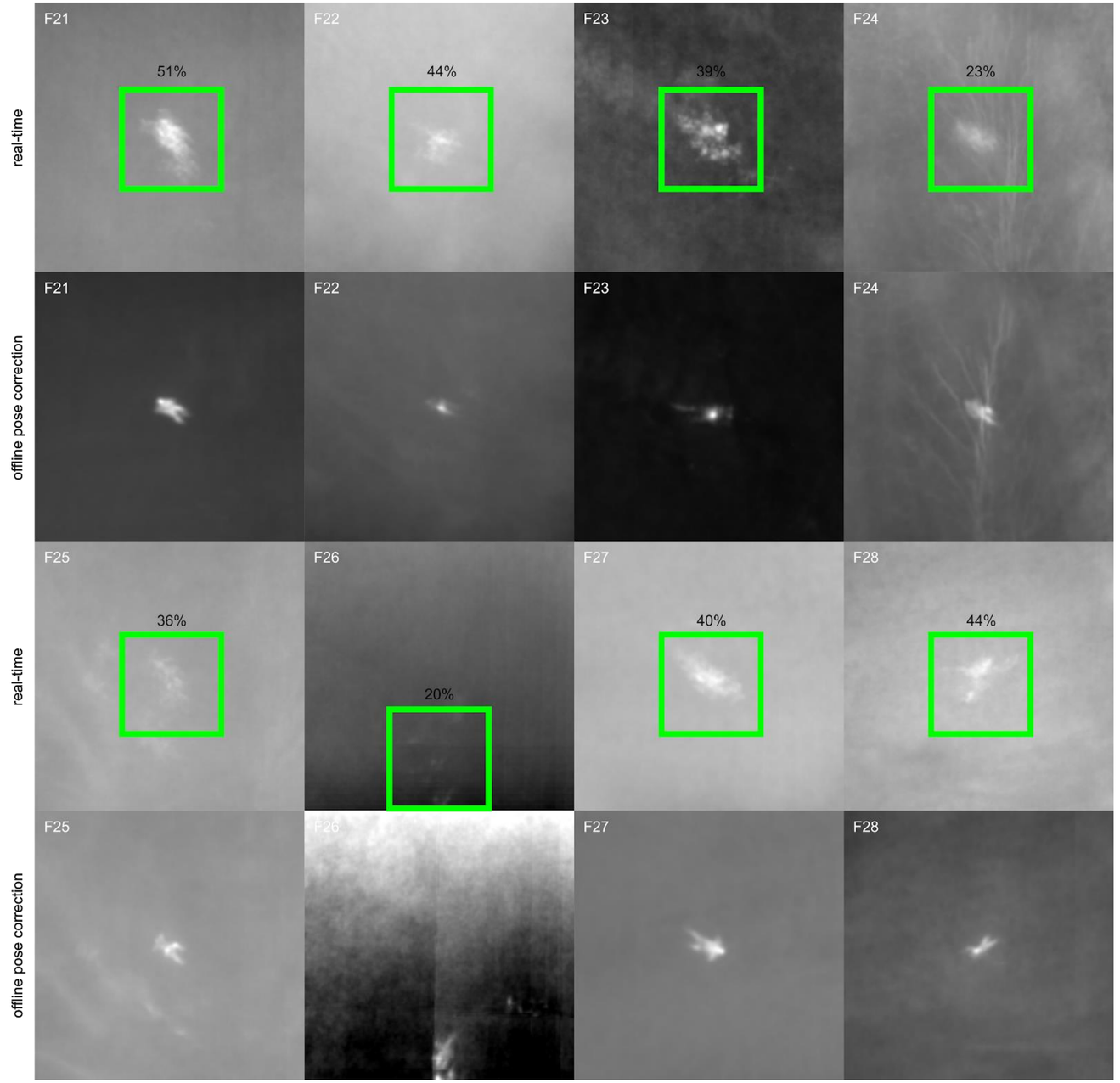






Visual Enhancement





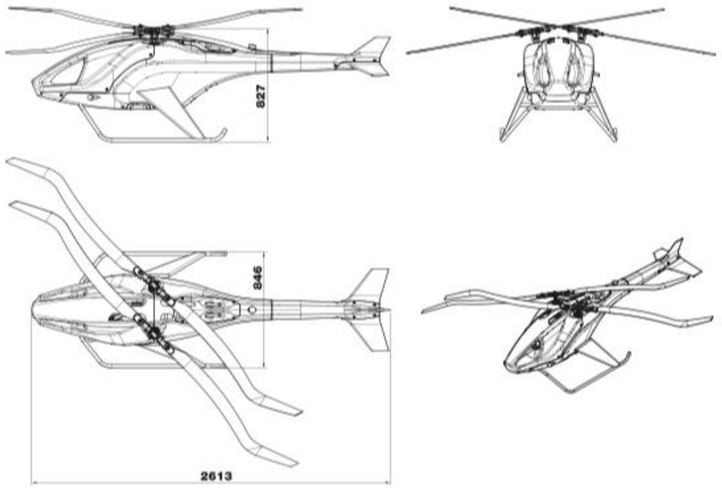
What‘s next?

- better unmanned aircraft (several-hundred km range) and cooperation with manufacturer
- possible integration into manned aircrafts (helicopters)
- trial missions with rescue teams (ÖAMTC, police, Bundesheer)
- more training data, better classifiers, improved occlusion removal
- autonomous path-planning (on the fly)
- …

Schiebel S-100

Endurance

STR - 35



specs

Engine	Length	Width	Rotor height
Boxer *	2600 mm	850 mm	830 mm
12 kw			

Rotor diameter	Endurance
2950 mm	3. h **

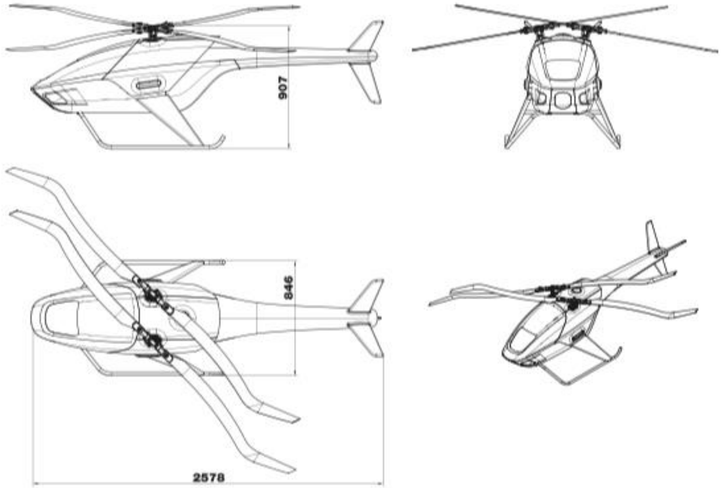
Weight (Empty)	Max. take off weight
75 kg ***	150 kg

* also available with an electric motor 12 KW

** depending on playload and flight profile / Electric up to 1,5 h

*** eletric + 40 kg for battery

STR - 50



specs

Engine	Length	Width	Rotor height
Wankel *	2600 mm	850 mm	910 mm
15 - 25 kw			

Rotor diameter	Endurance
2950 mm	6. h **

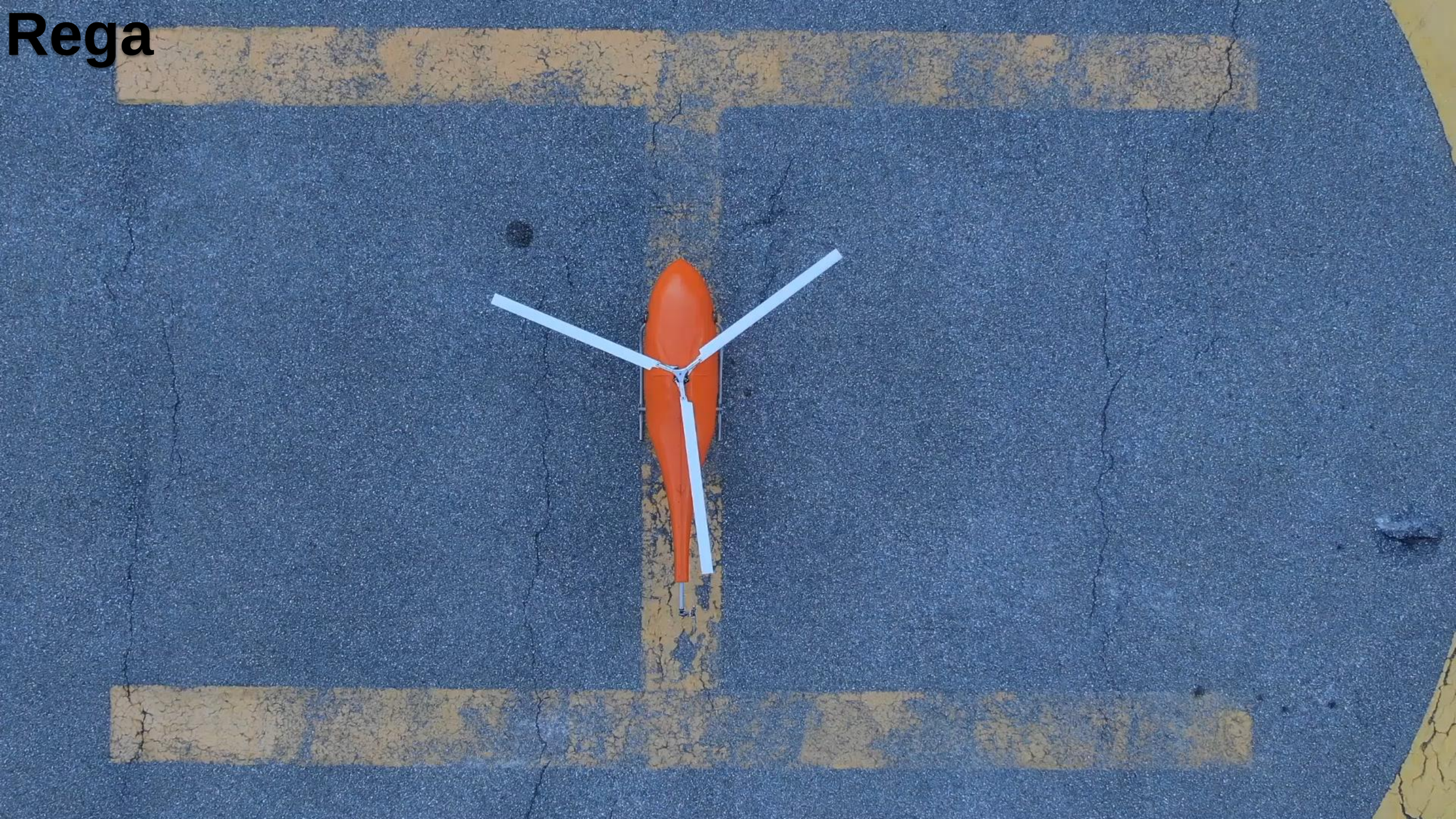
Weight (Empty)	Max. take off weight
80 kg ***	150 kg

* also available with an electric motor 12 KW

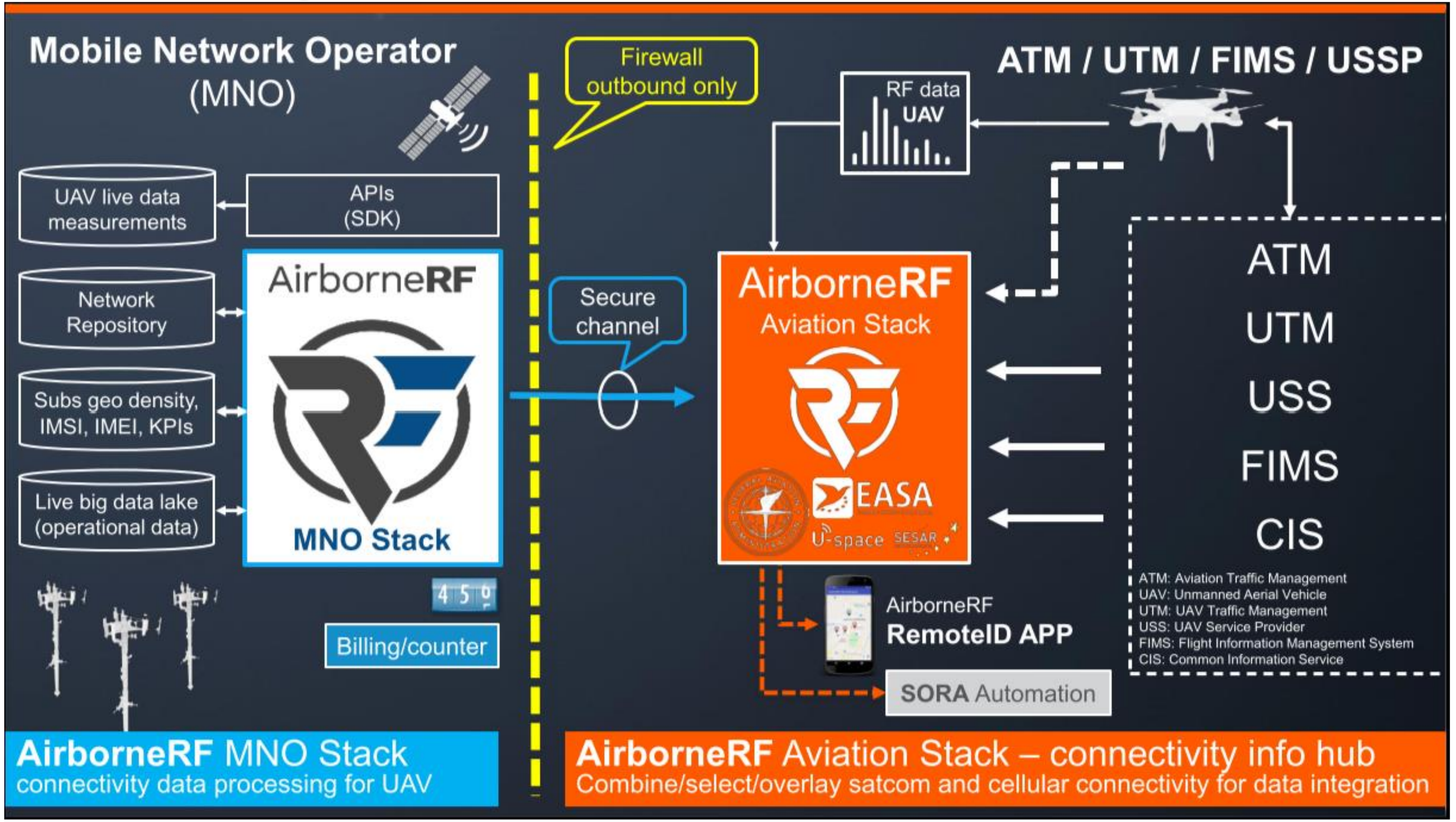
** depending on playload and flight profile / Electric up to 1,5 h

*** eletric + 40 kg for battery

Rega



Connectivity



JKU

JKU LINZ INSTITUTE OF TECHNOLOGY

LAND OBERÖSTERREICH

FWF Der Wissenschaftsfonds.

Thank you!

www.jku.at/cg