NLS FGI

Remote Sensing and Photogrammetry

Mika Karjalainen

Finnish EO meeting, 23 May 2018

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Basic facts, Dept. of RS&P

- Located in Masala, Kirkkonummi
- Director, Prof. Juha Hyyppä
- Research groups
  - Mobile mapping systems, Prof. Antero Kukko, Prof. Harri Kaartinen
  - Photogrammetry, Dr. Eija Honkavaara
  - Mapping & Map-updating applications Terrestrial-Airborne-EO, Dr. Eetu Puttonen
  - Forest digitalization, Dr. Xinlian Liang
- ~40 researchers
- ~30 outside funded projects
  - Academy of Finland, EU, TEKES/BF, ESA, and others

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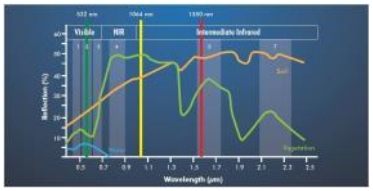
Airborne Laser Scanning

Multispectral ALS (Optech TITAN, …)
Single Photon ALS



Satellite images

Copernicus
Europe's eyes on Earth

EU Sentinels

DigitalGlobe, WorldView

Dense point clouds

(airborne and terrestrial)

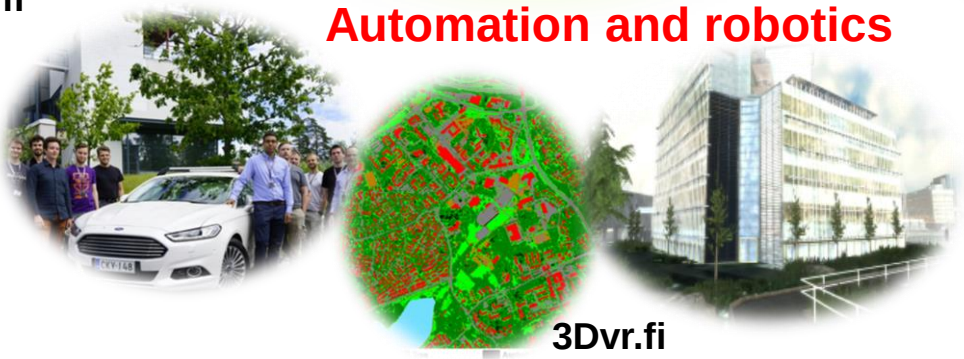
pointcloud.fi

FGI/RS&P

Drones

DroneFinland.fi

Automation and robotics



3Dvr.fi

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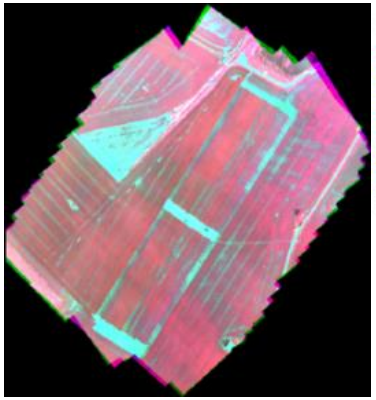
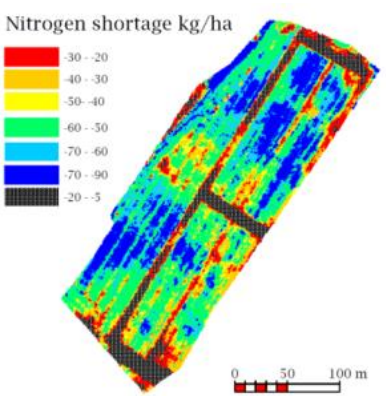
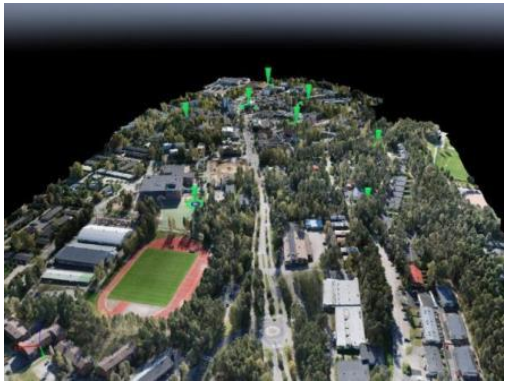
DroneFinland.fi

DroneFINLAND
ilmasta näkee paremmin – smarter aerial sensing

- Research and innovation center for drone remote sensing, established and led by Dr. Eija Honkavaara
- Photogrammetry, Hyperspectral imaging, Laser scanning, Spectrometry, Thermal imaging
- Rigorous calibration of the data, analysis using machine learning techniques
- Applications: Forests, Agriculture, Water, Mapping, Safety etc.
- 20+ scientific publications on drone remote sensing and photogrammetry during the past year, new publications monthly







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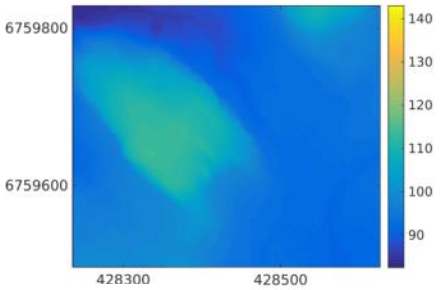
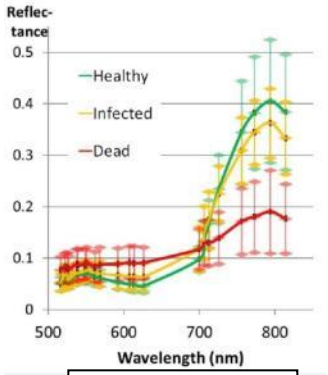
Process for drone data





ALS DTM

Data capture

Data pre-processing

Georeferencing

Pointcloud generation

Individual tree detection

Field reflectance reference

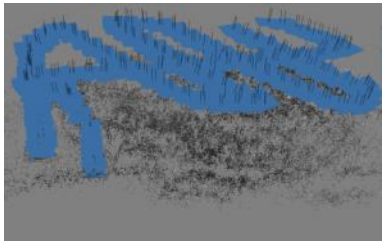
Radiometric block adjustment

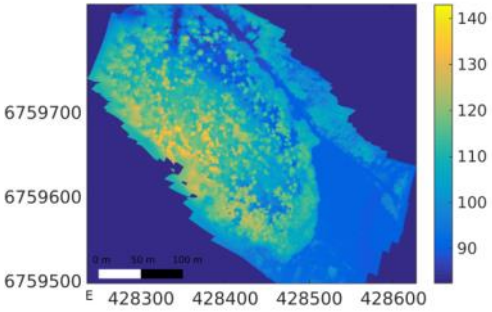
Mosaic generation

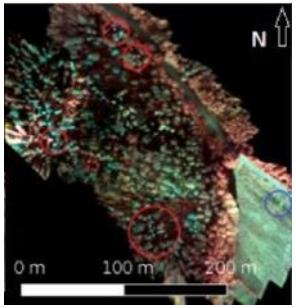
Spectral characteristics of trees

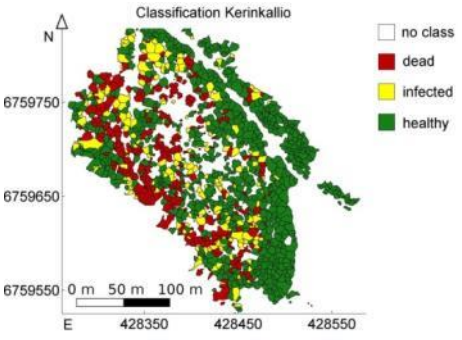
Forest reference plots

Classification









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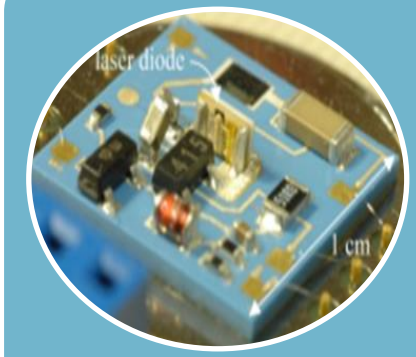
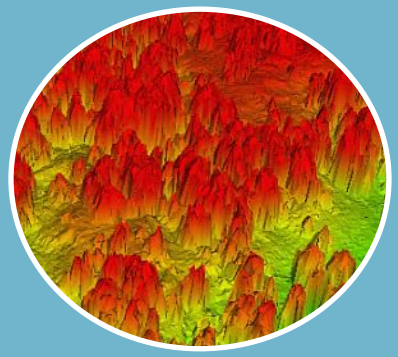
Centre of Excellence in Laser Scanning Research

ACADEMY OF FINLAND

“Together what is otherwise impossible”





Hardware-driven approach

Pulsed time-of-flight laser radar

Juha Kostamovaara Univ. Oulu

Mobile and ubiquitous Laser Scanning

Juha Hyyppä FGI

Laser scanning for precision forestry

Markus Holopainen Univ. Helsinki

Laser scanning for built environment

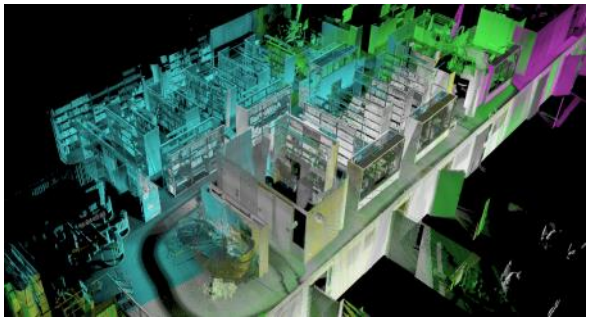
Hannu Hyyppä Aalto Univ.

COMBAT project

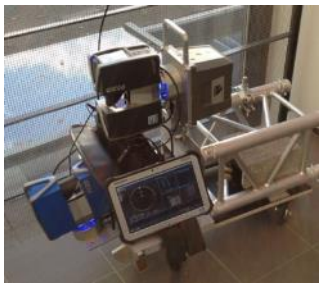
- Consortium leader prof. Harri Kaartinen/FGI
- Competence-Based Growth Through Integrated Disruptive Technologies of 3D Digitalization, Robotics, Geospatial Information and Image Processing/Computing – **Point Cloud Ecosystem**
- Pointcloud ecosystem: high-quality research, great societal impact, growth of the Finnish 3D industry



Indoor 3D mapping systems



	Matterport	NavVis	Zebedee	FGI Slammer
Sensors	3 x Kinect	3 x LS 6 x camera IMU, compass WLAN + Bluetooth	1 x LS MEMS IMU	2 x LS Tactical grade IMU
Range	4 m	30 m	15-30 m	270 m
Price	$4500 + $50-150 / month	~ 100000 €	$37000 (2014)	~150000 €



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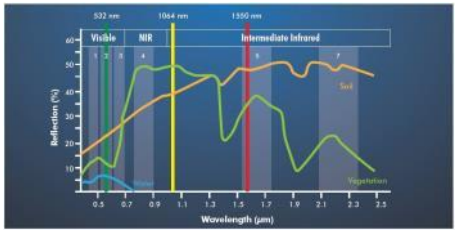
Mobiili laserkeilaus

- Laserkeilausjärjestelmät kevenevät, halpenevat ja nopeutuvat
- Yksi mittausyksikkö, monta alustaa

Multispectral Airborne Laser Scanning



- Benefits
  - 3D and spectral information simultaneously
  - No shadows, no need for sunlight
  - Ground surface can be seen through the forest canopy

→ Towards higher level of automation in mapping tasks

Aerial image (© MML)

Titan MS-ALS intensity

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Sentinel-2 change detection

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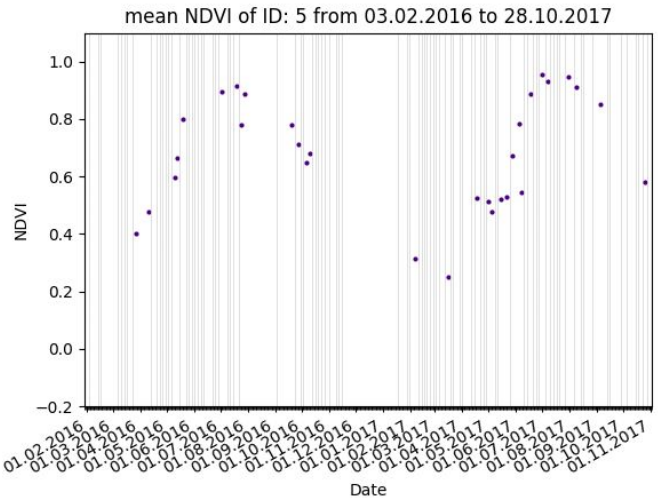
- Was developed in the SA project (BIG DATA): ICT 2023: Suurten tietomassojen ja avoimen tiedon hallinnan ja analyysin menetelmät ja sovellukset, PI: Eetu Puttonen
- Automated process for satellite-2 change detection



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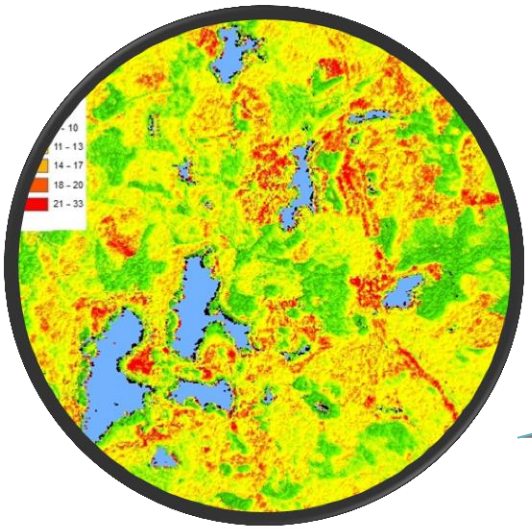
3D SAR techniques (satellite)

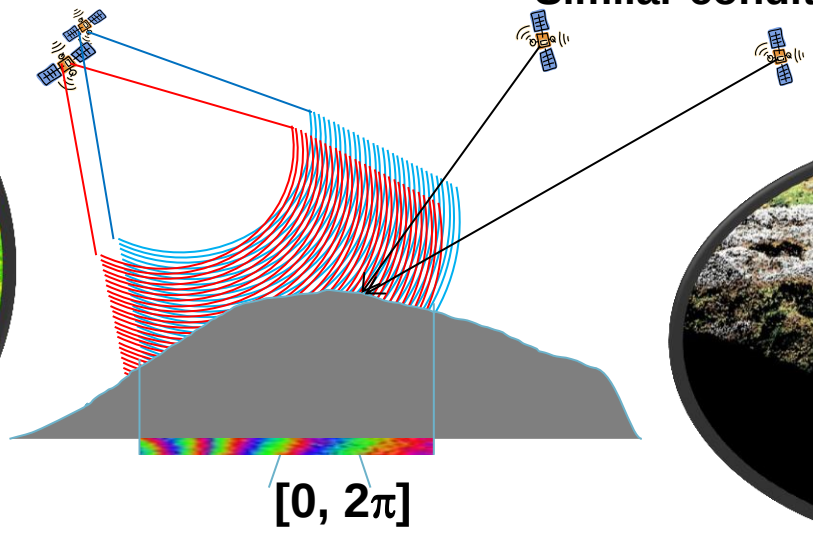
INSAR

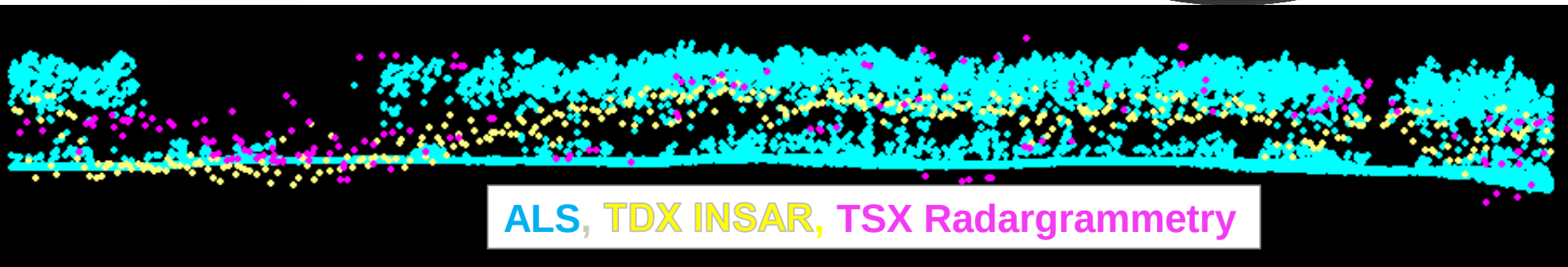
- Phase difference, relative elevation differences
- Baseline of hundreds of meters
- Simultaneous imaging

Stereo-radargrammetry

- Stereoscopic measurement (automatic image matching), absolute elevation measurements
- Baseline of hundreds of kilometers
- Similar conditions







ALS, TDX INSAR, TSX Radargrammetry

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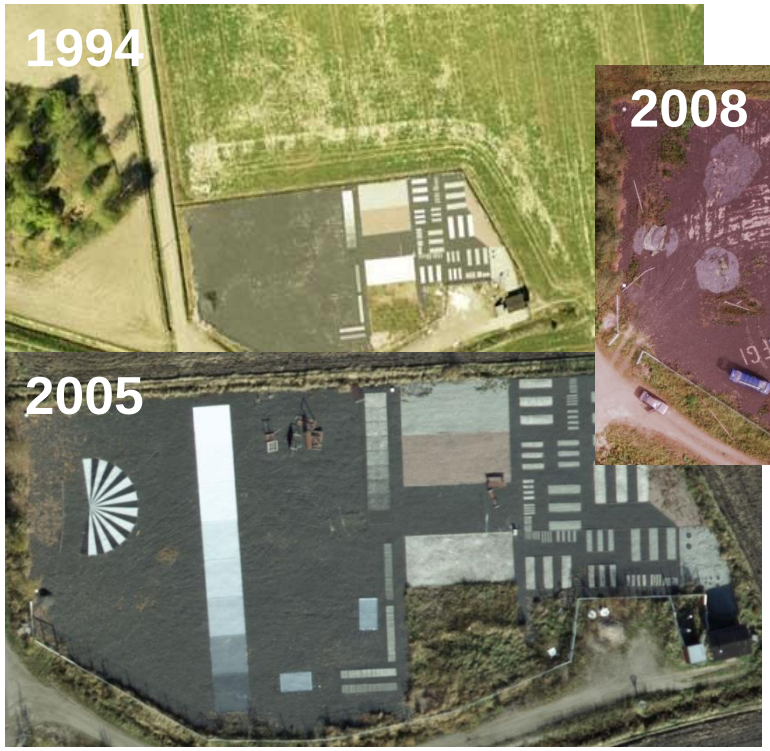
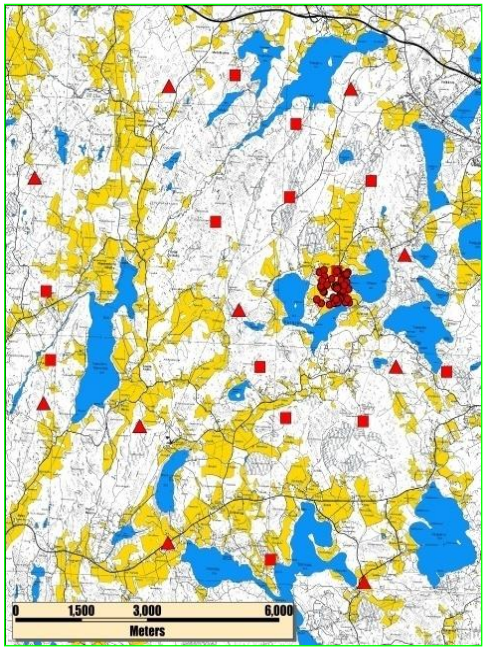
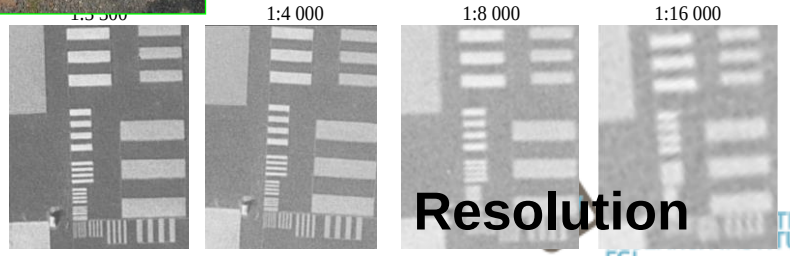
Photogrammetric test field for Photogrammetric Digital Imaging



Geometry



Radiometry



Resolution