



WEED DETECTION AND CLASSIFICATION USING HIGH RESOLUTION UAV-IMAGERY

Dr. Gilles Rock



GEOCOPTIX

Parc d'activités 85 – 87
L-8303 Capellen / Luxembourg

Max-Planck-Straße, 6
54296 Trier / Germany

<http://www.geocoptix.com>

Weed detection and classification using high resolution UAV-imagery

Precision Agriculture



(1) [marketresearch.biz](https://www.marketresearch.biz)

(2) <https://www.dronethusiast.com/agricultural-drones/>

(3) [independent.ie](https://www.independent.ie)

Weed detection and classification using high resolution UAV-imagery

Precision Agriculture

Motivation

- Efficiency
- Increasing world population
- Climate change
- Sustainability

Produce more with less: Less water, less land and fewer resources

- (1) marketresearch.biz
- (2) <https://www.dronethusiast.com/agricultural-drones/>
- (3) independent.ie



Weed detection and classification using high resolution UAV-imagery

Precision Agriculture

The need for data

- “the right dose at the right place at the right moment”
- data quality
- high potential of remote sensing
 - satellite, airborne and UAV remote sensing

- (1) marketresearch.biz
- (2) <https://www.dronethusiast.com/agricultural-drones/>
- (3) independent.ie



Weed detection and classification using high resolution UAV-imagery

EFFO-Project

„Effiziente Fruchtfolgen“

Optimizing crop rotation and agricultural systems

Goals:

- optimizing cultivation of rapeseed while reducing use of herbicides
- reducing freshwater pollution
- prevention of erosion
- increasing the biodiversity



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Agriculture,
de la Viticulture et de la
Protection des consommateurs



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère du Développement durable
et des Infrastructures

LUXEMBOURG
INSTITUTE
OF SCIENCE
AND TECHNOLOGY



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Enseignement supérieur
et de la Recherche



Chambre d'Agriculture
Chambre Professionnelle
des Agriculteurs, Viticulteurs
et Horticulteurs Luxembourgeois



Lycée Technique
Agricole

Weed detection and classification using high resolution UAV-imagery

EFFO-Project

UAV-study

- image analysis for weed detection and classification
- rapeseed
- 3 treatments with *Metazachlor*

Goals:

- Method for weed detection
- Suited for an practical, operational service



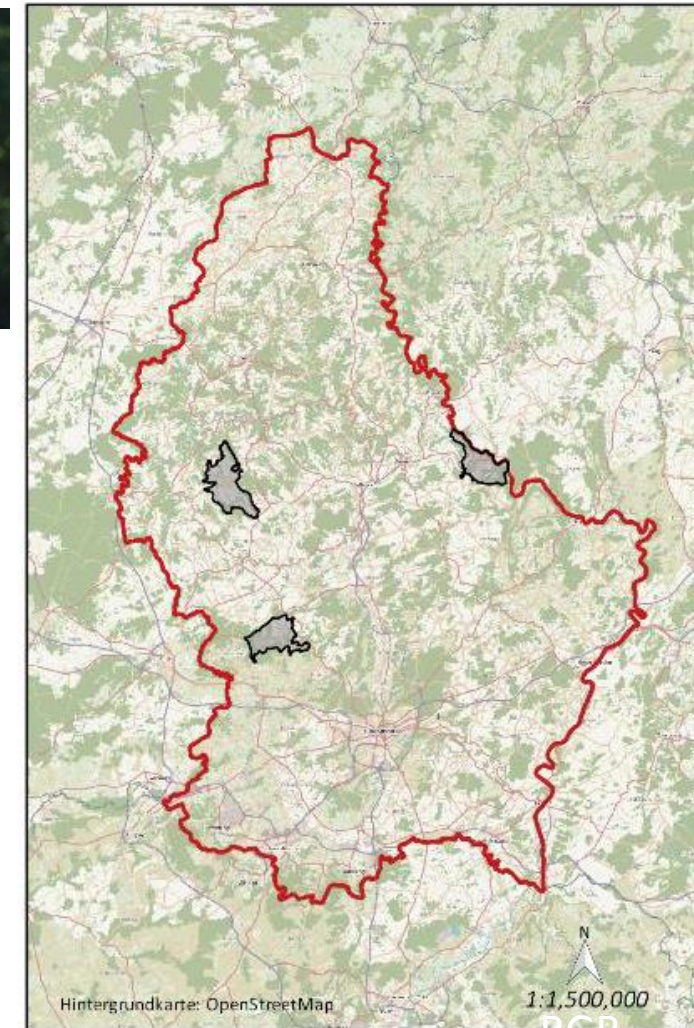
Weed detection and classification using high resolution UAV-imagery

EFFO-Project

UAV data acquisition:

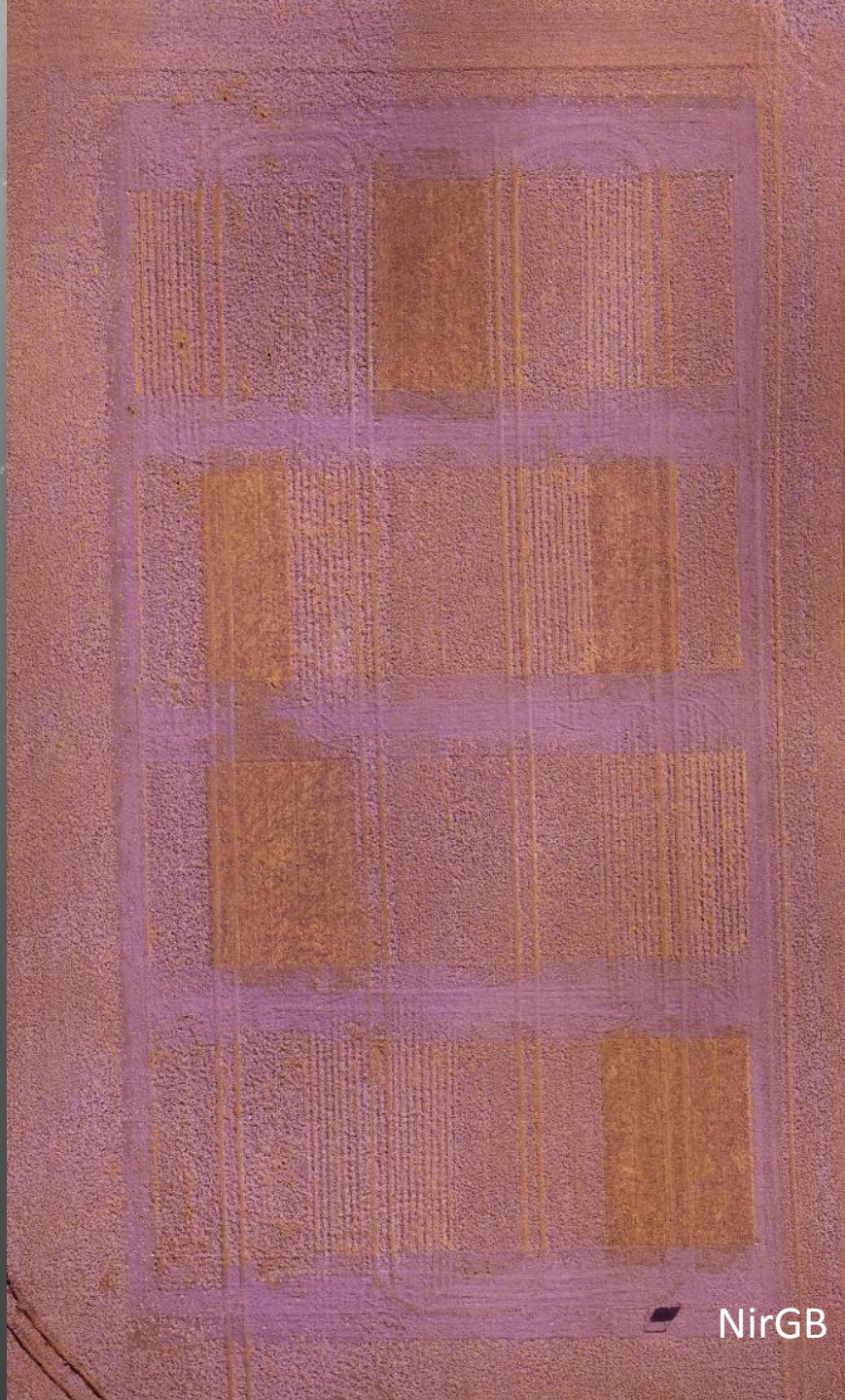


UAV	MAVinci Sirius Pro RTK
Sensors	RGB + NirGB
Flight altitude	77m
GSD	2 cm / pixel
XY-Precision	< 4 cm
Acquisition dates	06.10.2016 14.03.2017





DEM



NirGB



RGB

Weed detection and classification using high resolution UAV-imagery

EFFO-Project

Classification:

datasets	RGB, NIR, nDEM, 3 GLCM texture features (ENT, DIS, COR)
method	CART
sampling method	Poisson Disk (3m)
validation	50:50 crossvalidation
Result	class membership probability

sampling



Weed detection and classification using high resolution UAV-imagery

EFFO-Project

$prob_{\text{rapeseed}}$



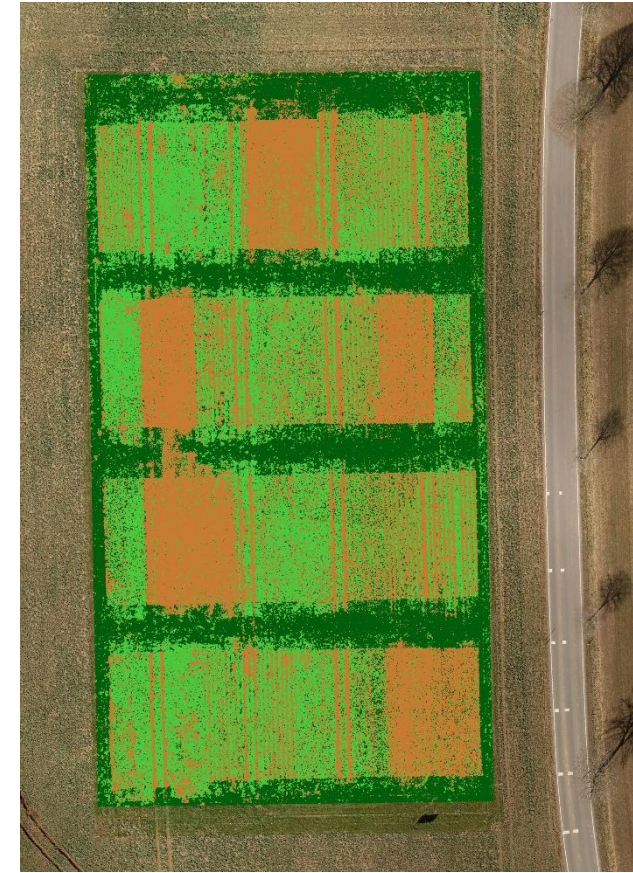
$prob_{\text{weeds}}$



$prob_{\text{soil}}$

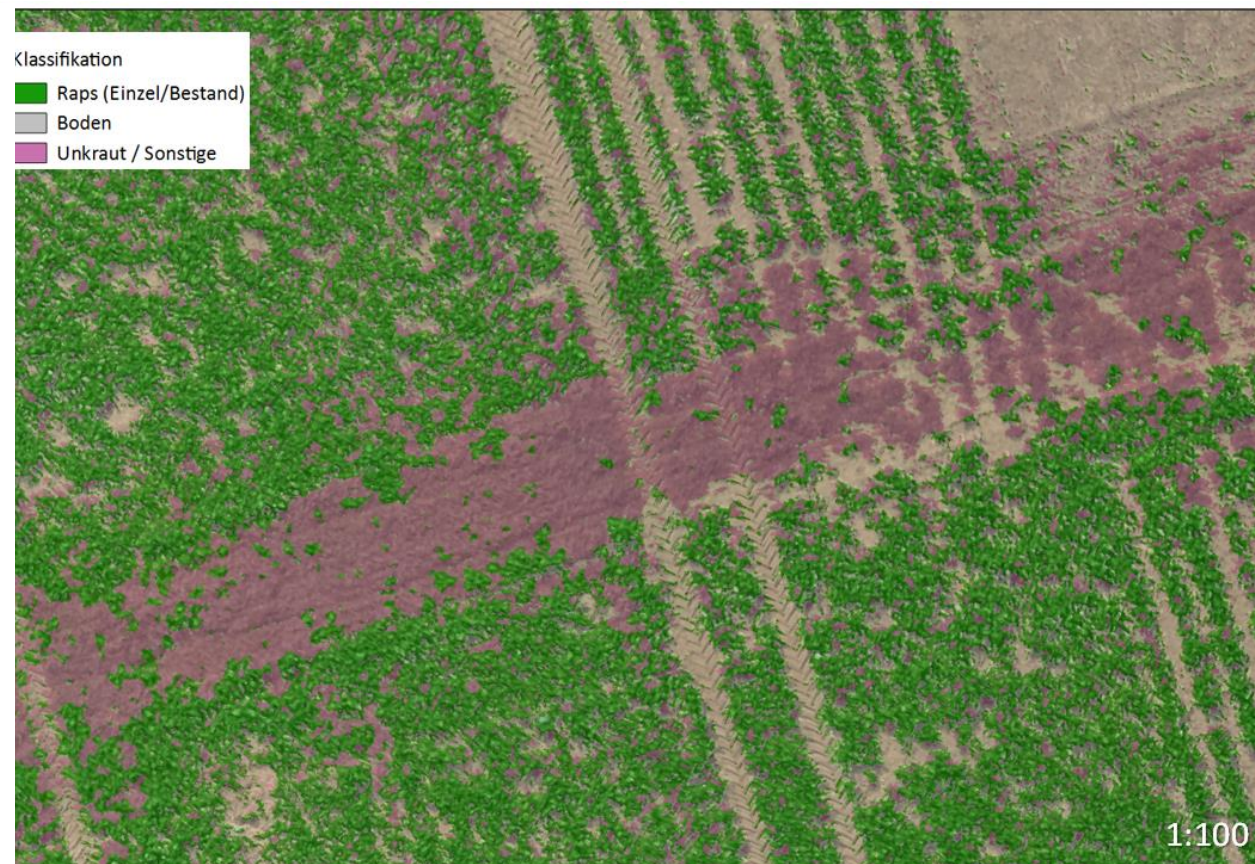


$classification$



Weed detection and classification using high resolution UAV-imagery

EFFO-Project

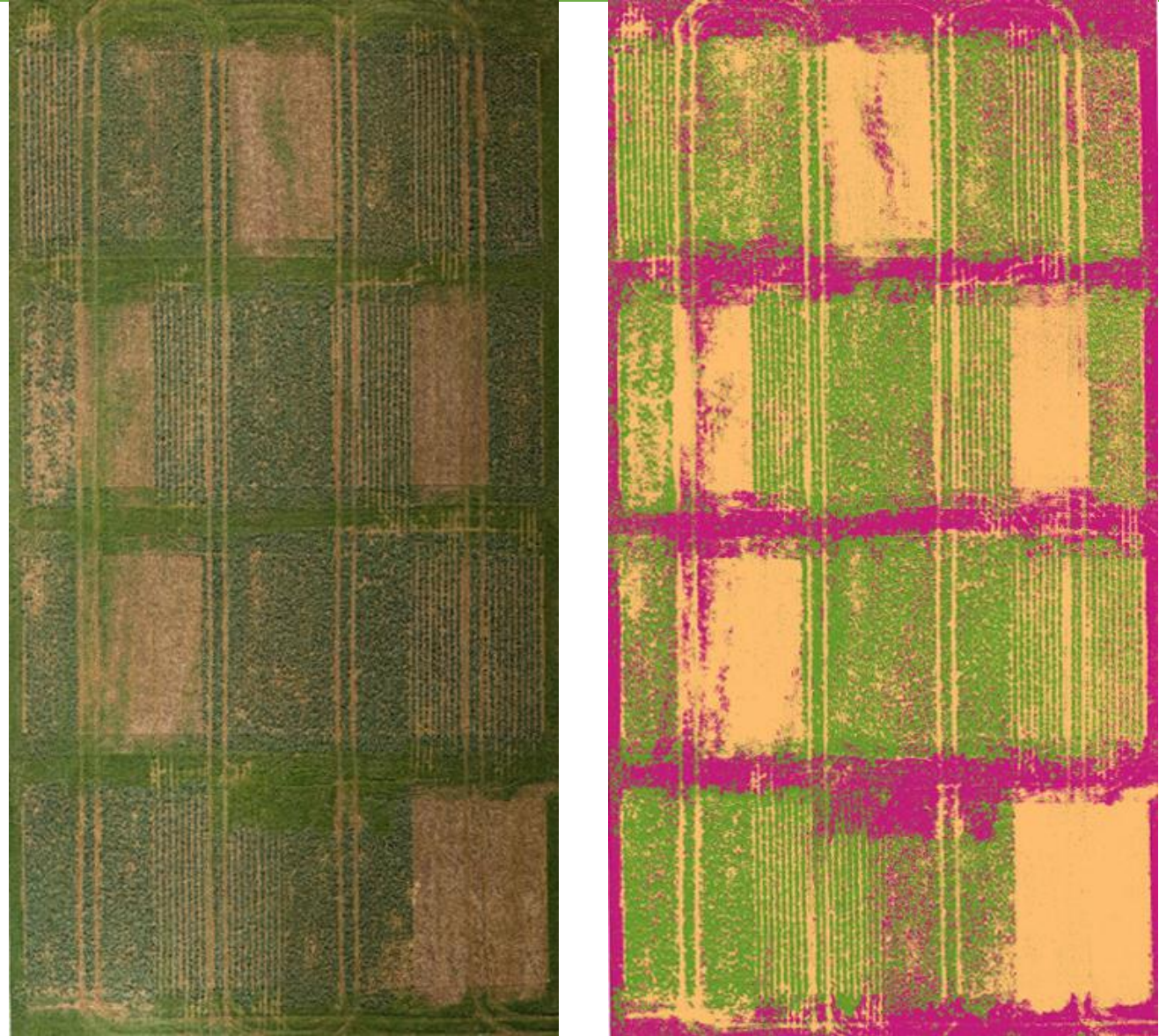


Weed detection and classification using high resolution UAV-imagery

EFFO-Project

Classification results:

- Autumn:
min: 50% , max: 83%
- Spring:
min: 69% , max: 84%
- Further processing into task maps
- > 50 ha within 18 hours
- no species discrimination @ 2cm/pix

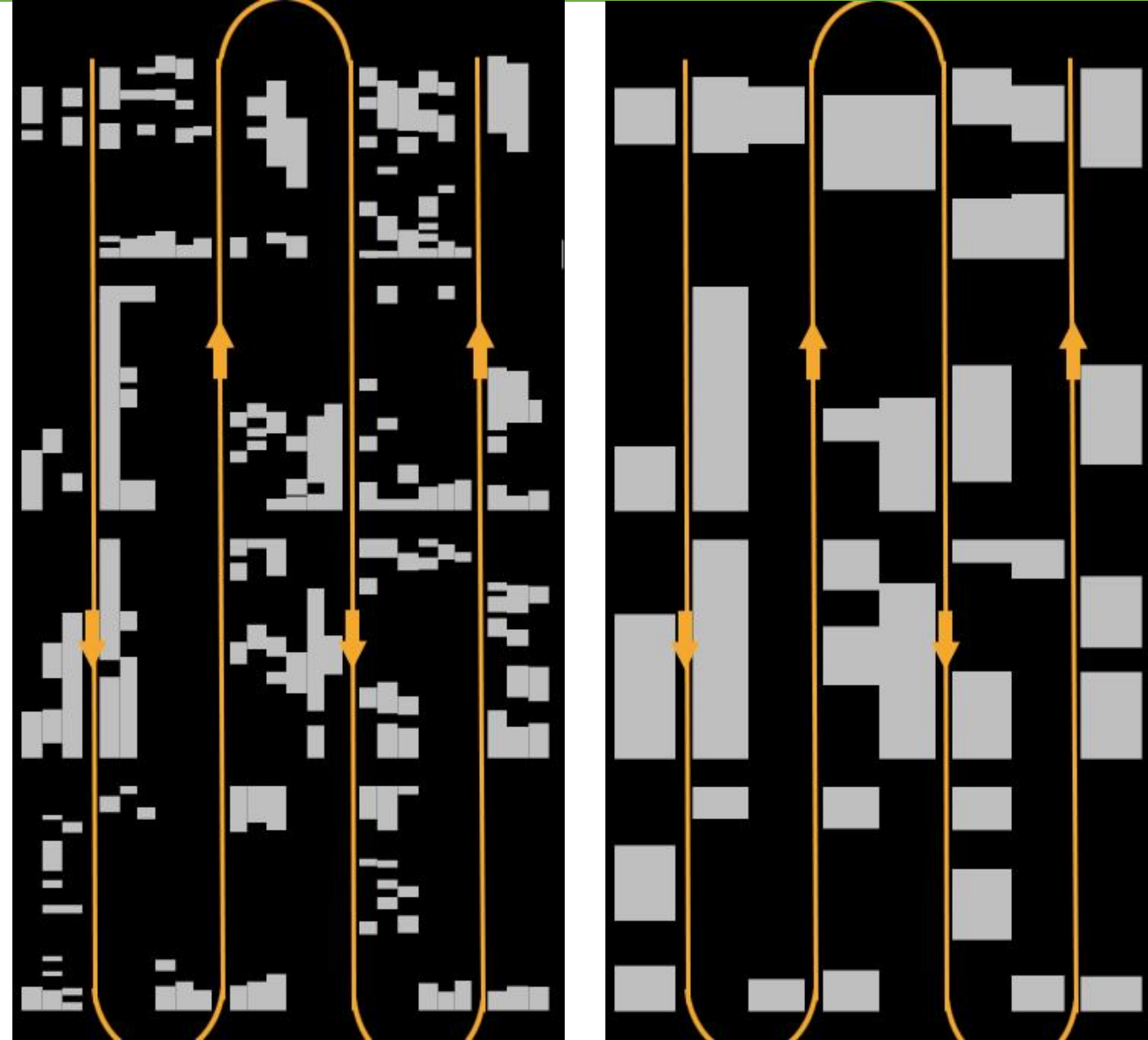


Weed detection and classification using high resolution UAV-imagery

EFFO-Project

Classification results:

- Autumn:
min: 50% , max: 83%
- Spring:
min: 69% , max: 84%
- Further processing into task maps
- > 50 ha within 18 hours
- no species discrimination @ 2cm/pix



Weed detection and classification using high resolution UAV-imagery

Precision Agriculture

Exciting future

Complete change in agriculture

- laws
- jobs
- technology

Use of remote sensing and UAVs in agriculture!

Weed detection and classification using high resolution UAV-imagery

Parc d'activités 85 – 87
L-8303 Capellen / Luxembourg

Max-Planck-Straße, 6
54296 Trier / Germany

<http://www.geicoptix.com>



GEOCOPTIX