VELES SENSE

smart farming

Project: **ReConEsca**

Plants as never seen before!

Grape(vine) diseases turn Dream vineyard to Nightmare

- Grapevine trunk diseases
- **ESCA** is the deadliest
- **Damage EUR 8-9 billion**/year/world
- 5% - 19% of vineyards affected worldwide

- In 2003 was banned sodium-arsenate – the only efficient solution against esca (harmful for people and the environment)
- In the period 2003 – 2007 in Spain esca escalated from 1.5% to 10.5% *
- Grape diseases "migrate" with the climate change

*: Alltech.com

With PlantYsense farmers get

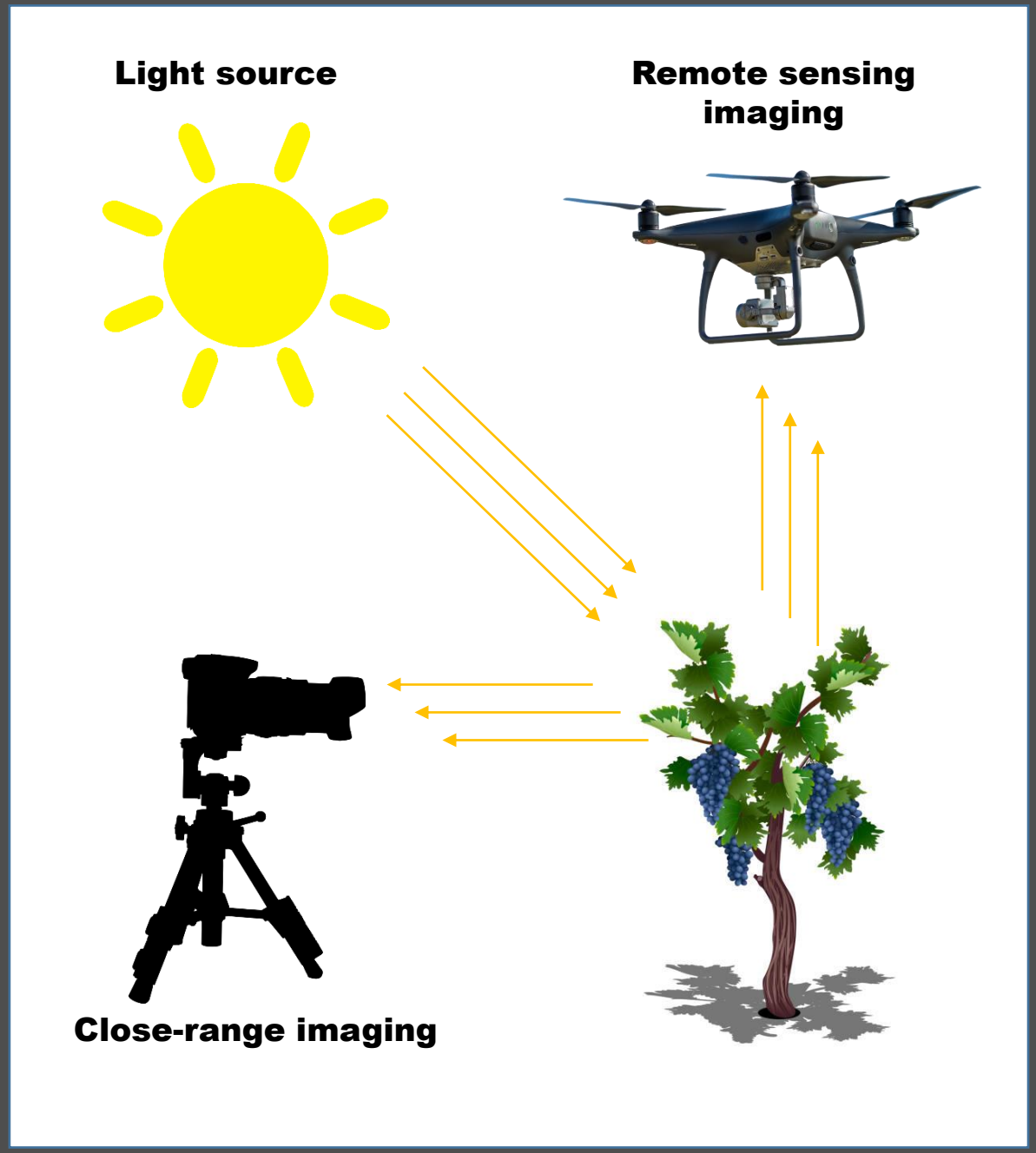
- **Automatic early grapevine disease detection (saves up to 1.060 EUR/ha)**

- Faster vineyard monitoring (saves time & money)
- Expend timeframe for disease mitigation
- Lower dependence on scarce manual labor
- Offers agronomic insights into agricultural resources
- Economizes protection material usage
- Promotes environmentally sustainable vineyard management

Solution - PlantYsense software

ELIMINATES UNCERTAINTY

- Combination of REMOTE SENSING and CLOSE-RANGE imaging for EARLY disease detection
- Reaching the lower parts of a plant not visible from above
- Imaging from different sources with affordable cameras



Market potential

Crop monitoring SERVICES

Total vineyards area in Serbia: **22.110** ha

Target market in Serbia (vineyards above 2ha): **7.940** ha (36%)

Target wine companies: 819

Crop monitoring LICENSES

World total vineyards area: **7.328.000** ha

World **target market,** EU & USA, (vineyards above 10ha): **2.294.400** ha

Target wine companies: 81.946 (70.400 in the EU)

Competitors

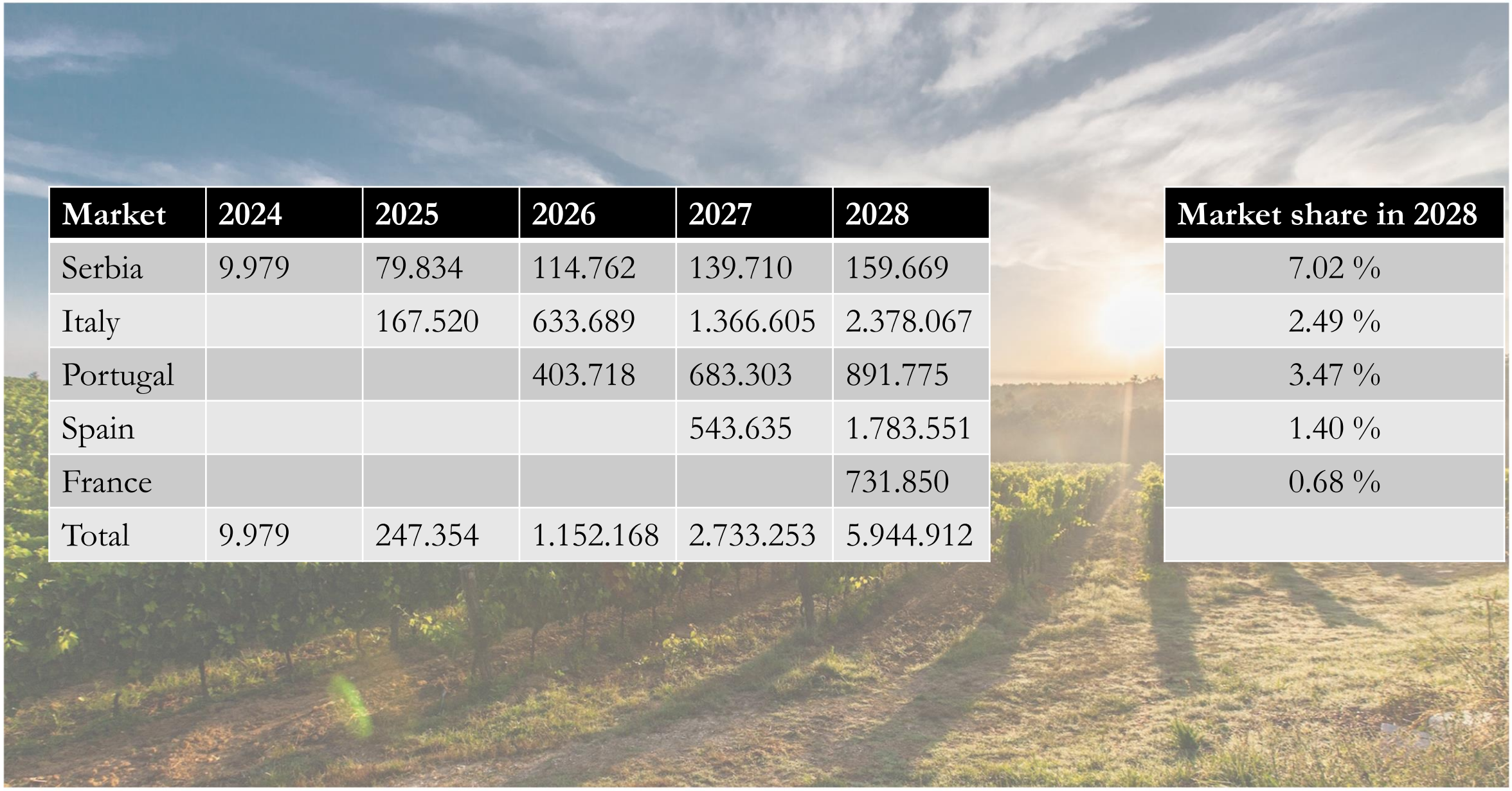
- Vineview (imaging) - (Veles Sense has a more holistic approach: remote sensing + close-range)
- Terraview - (Veles Sense has a more focused approach)
- Atfield Technologies (sensors) – (Veles Sense has a more precise approach; detect particular diseases and exact locations)

Business model & Revenue forecast

- **Direct crop monitoring services** for vineyards in Serbia with our own drone
- Price: 119 EUR/ha/year
- **Crop monitoring licensing** for vineyards in the EU and the USA (with the help of local drone service providers)
- Price: 3.490 license/year
- **Break-even: 2026**

	2024	2025	2026	2027	2028
Revenue (€)	9,979	247,354	1,152,169	2,733,253	5,944,912
Profit (€)	- 104,605	- 335,119	38,464	763,862	2,282,427

Markets (Revenue in EUR)



Market	2024	2025	2026	2027	2028	Market share in 2028
Serbia	9.979	79.834	114.762	139.710	159.669	7.02 %
Italy		167.520	633.689	1.366.605	2.378.067	2.49 %
Portugal			403.718	683.303	891.775	3.47 %
Spain				543.635	1.783.551	1.40 %
France					731.850	0.68 %
Total	9.979	247.354	1.152.168	2.733.253	5.944.912	

PlantYsense pipeline

Disease Healthy

1. Image collection

2. Ground truthing

3. Augmentation method development (6 months)

4. Drone protocol (3 months) Image collection

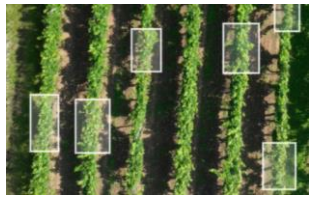
5. Data labeling (3 months)

6. Data augmentation

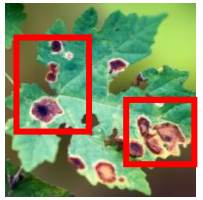
7. Data classification
* PlantYsense core

ReConEsca

Data evaluation



Testing of preliminary classification



Beta version of PlantYsense software

Project steps

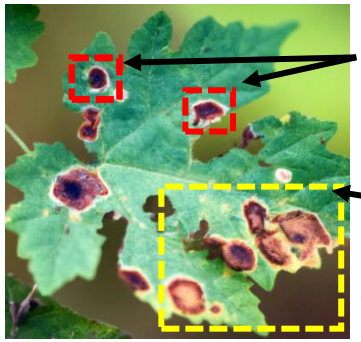
1. Drone protocol & Data collection

Data collected in: Winery Bajilo, Sremski Karlovci, Winery Radovanović, Krnjevo, Winary Plavinac, Winary Plavinci (organic), Smederevo

2. Data labeling and Ground truth mapping

Healthy plant

Plant under stress



Local labeling
*marked single feature

Semi-global labeling
*grouped several features

Damaged plant

Global labeling
*marked the whole damaged leaf

3. Data augmentation

Labeled image

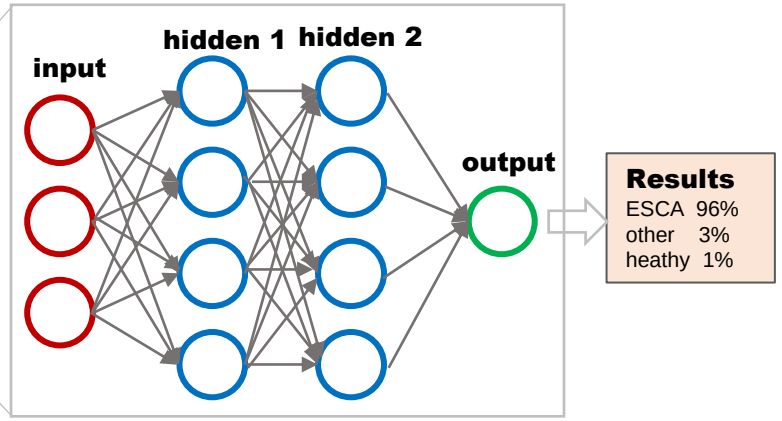
Data augmentation
GAN: Generative Adversarial Networks

Change of the orientation, angle, light

Various disease appearance

4. Data classification

- Core of the PlantYsense software
- Automatic recognition and identification of grape vine diseases
- Powerful AI-based solution with neural networks



Funding & Accelerators

Accelerator + funding
15.000 CHF
Drone purchasing
Preliminary data labeling
and ground truthing

Accelerator
Business model
Pitching
Investment seeking

Accelerator + funding
30.000 EUR
Market research
Product development
Project proposal writing

Funding
24.698 USD
Development of an AI-based augmentation method
Robust database creation -> new markets
Drone protocol creation for reliable data collection
Marketing activities; Stronger positioning

ReConEsca Budget

Item	Cost (USD)
Salary – Zarko Ljubenovic	8.880
Image labeling – 2 Agronomists	2.000
Machine learning engineer	6.000
Licence for a wb app for image labeling	3.062
Laptop	1.400
Box with 2 processing units	5.500
Promo video	600

Startech	**24.698 USD**	**90%**
Veles Sense	2.744 USD	10%
Total	27.442 USD	100%

Key members TEAM Other members

Žarko Ljubenović

Economist (Sales & Marketing)

Marina Ljubenović, PhD

Researcher
(Research & Development)

Marijana Ljubenović

Economist (Finance & Project management)

Sara Ferro

Machine learning programmer

Lina Zhuang, PhD

Remote sensing expert

Ivan Buzarski

Agronomist

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STARTECH

Thank you!

Project activities

- **Drone mapping protocol** (3 months) –
  - Defining the best drone height, and consequently time of the flight and the amount of collected data

DJI M3M Flighttimes & Speeds: Altitude vs. Sensor based on a 2.5ha field.						
Altitude [m]	RGB [min/Ha]	RGB GSD [cm]	RGB Speed [m/s]	RGB+MSP [min/Ha]	RGB+MSP GSD [cm]	RGB+MSP Speed [m/s]
10	4.96	0.54	4.2	13.92	0.92	1.7
25	3.21	0.67	5.3	9.13	1.15	2.2
30	2.25	0.81	6.3	6.33	1.38	2.6
40	1.32	1.07	8.4	3.65	1.84	3.5
50	1.15	1.34	10.6	2.23	2.31	4.4
60	0.69	1.61	12.7	1.71	2.77	5.3
70	0.51	1.88	14.8	1.28	3.23	6.2
80	0.52	2.15	15	0.88	3.69	7.1
90	0.35	2.42	15	0.80	4.15	8
100	0.35	2.69	15	0.73	4.61	8.9
110	0.35	2.95	15	0.46	5.07	9.8
120	0.35	3.22	15	0.43	5.53	10.7

Source: Pix4D

- **Data labeling** (3 months)
  - Mapping parts of vineyard under stress, and marking images that contain diseased plants.
  - Labeling will be performed by 2 agronomists, as it is a highly subjective process.

- **Data augmentation** (6 months)
  - Creation of methods for data augmentation using mathematical manipulations (zooming and rotations),
  - and methods based on neural networks (StyleGAN, FastGAN), change of lighting, angle etc.
    Methods must be adjusted for multispectral images.

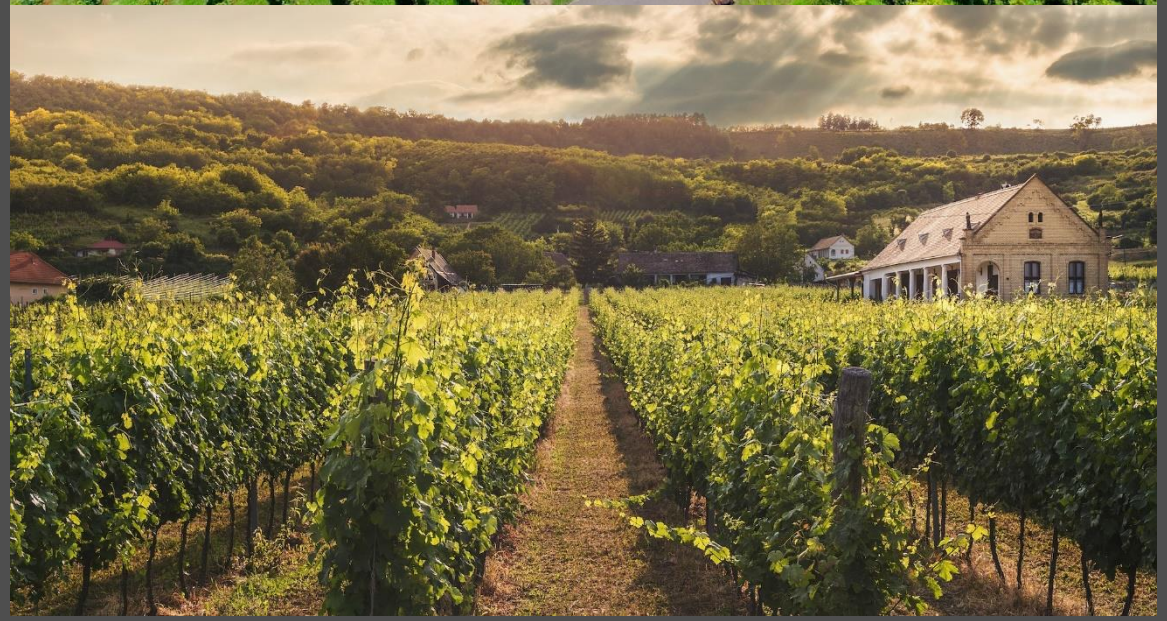
Remote sensing – drone (multispectral camera)

- Protocol for drone mapping: flight height, number of flights

  Lower altitude -> higher resolution -> increased time of flight -> increased dataset size

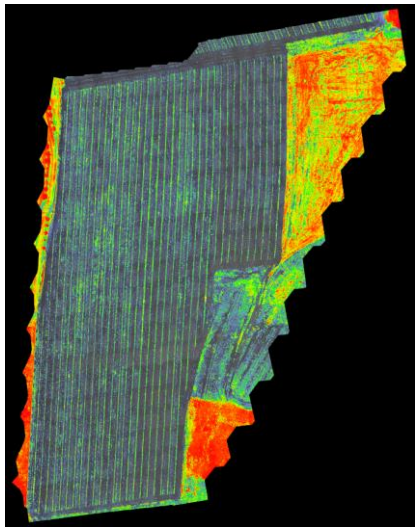
- We chose optimized altitude between image resolution and flight duration/dataset size

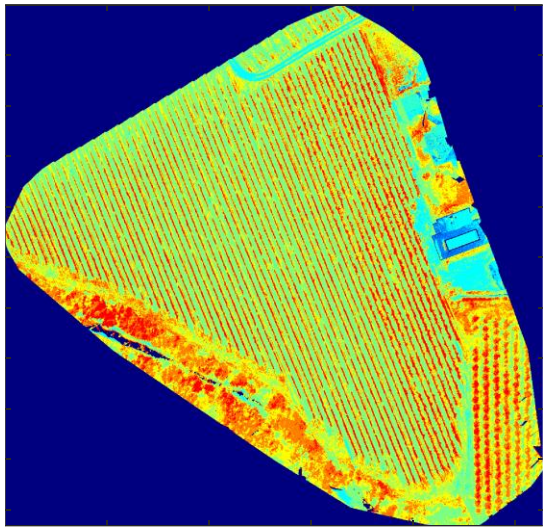
- Multispectral data: Green, Red, RedEdge, NIR



Land mapping

- Use of Vegetation/Soil Indices to detect areas of a vineyard under stress
- Monitoring of health conditions of the crop:
  - Before treatment for targeted intervention
  - After treatment for an assessment of the consequences
  - In different plots to understand different reactions to equal interventions
  - In different seasons for monitoring growth and health

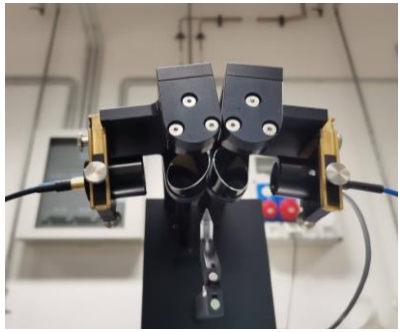




Close-range imaging

- **Multispectral/hyperspectral imaging**
  - Reaching lower parts of a vine
  - Handheld camera or camera mounted on robot/working machine
  - Low-cost solution

- **THz imaging**
  - Non-destructive and non-ionizing
  - See-through layered structures
  - High sensitivity to water
  - Can be used in plant nurseries



Marketing Channels

Direct Marketing Channels

- E-mail campaigns
- Direct mail
- On-site visits
- Agricultural/wine fairs and conferences

Indirect Marketing Channels

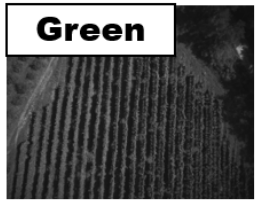
- Website
- Social media (LinkedIn, Instagram)
- Agronomists (who serve several wineries in the region)
- Referral programs

PlantYsense software

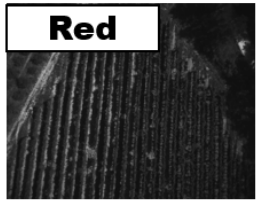
1. Image acquisition

RGB

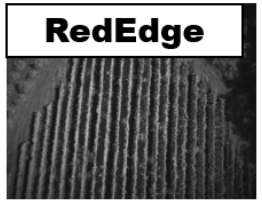
Green



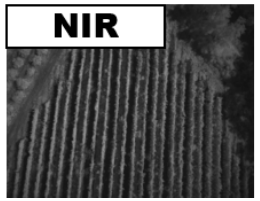
Red



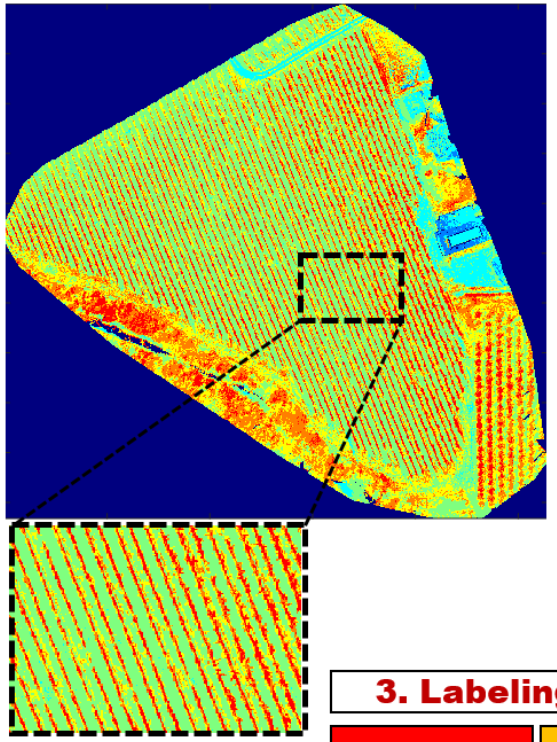
RedEdge



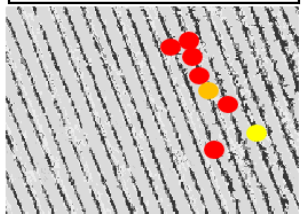
NIR



2. Vineyard mapping with Vegetation Indices

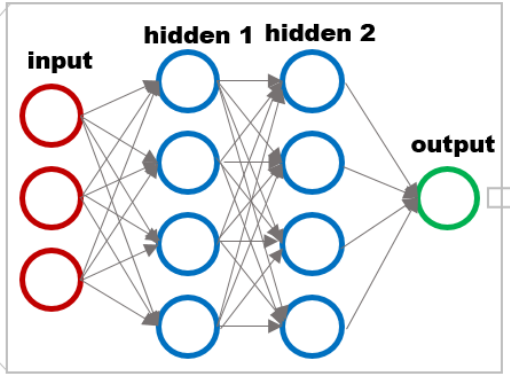


4. Ground truth



5. PlantYsense disease detection

AI-based classifier



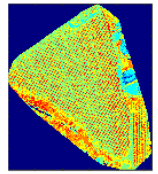
Results
ESCA 96%
other 3%
heathy 1%

6. Reporting

3. Labeling

Report

Vineyard monitoring results for the August 2024.



Evaluation of a vineyard and next steps

ESCA 96%
other 3%
heathy 1%

Equipment (Bought from the Raising Starts project)

- Drone: DJI Mavic 3 Multispectral
- DJI D-RTK2 High Precision GNSS Mobile Station

Wineries we work/talked with

1. **Winery Radovanović**
2. **Winery Bajilo**
3. **Winery Plavinci**
4. **Winery Plavinac**

In these wineries we performed data collection

5. Winery 13th July – Plantaže
6. Winery Aleksandrović
7. Winery Arsenijević
8. Winery Mrđanin
9. Winery Jeremić
10. Winery PIK Oplenac
11. Winery Miglio Rosso, Italy
12. Winery Vini Molon, Italy

In the following period we will contact:

13. Vinarija Sto žena
14. Vinarija Todorović
15. Vinarija Cilić
16. Vinarija Bikicki