Seminário Infraestruturas lineares e Biodiversidade

2 de Junho, 2016 - Évora

Cartography of invasive plants and robotic monitoring solutions for animals' roadkills

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LIFELINES
Rede de Infraestruturas Lineares com Soluções Ecológicas

https://lifelines.uevora.pt

Index

PRESENTATION STRUCTURE

Task A1 - Cartography of invasive plants

- Expansion patterns of invasive species
- Expansion spatial models and risk maps

Task A4 – Intelligent solutions for road ecology

- Monitoring animal mortality on roads
- Monitoring animals' point crossings
- Animals' proximity dissuasion

TASK A1

OBJECTIVE

To characterise the spatial distribution of invasive species identified along the roads to better equate the conservation measures to be adopted in those infrastructures

TASK A1

INVASIVE PLANTS

What are invasive plant?

- **Harmful exotic species that cause negative environmental and economic impacts**
- **Introduced with the purpose of ornamental, shade, soil stabilisation, etc.**

Ornamental

Shade

Soil stabilisation

METHODS

INVASIVE PLANTS

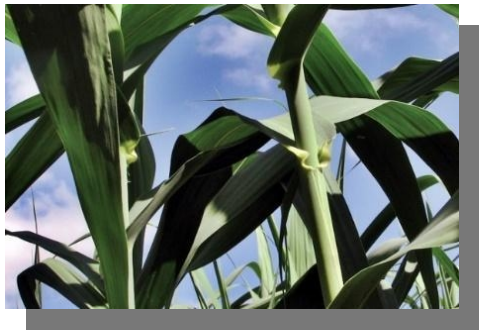
Acacia melanoxylon (austrália)

Ailanthus altissima (espanta-lobos)

Acacia dealbata (mimosa)

Robinia pseudoacacia (Robinia)

Arundo donax (cana)

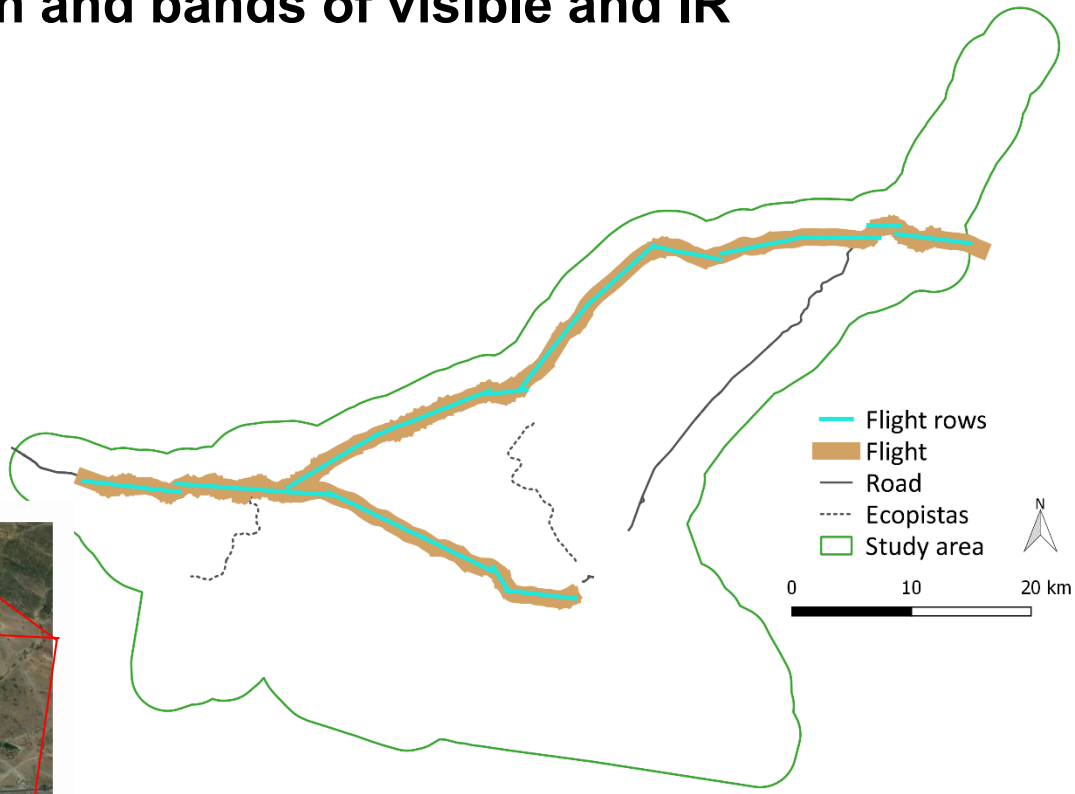


METHODS

AERIAL FLIGHT

Images with 10 cm of resolution and bands of visible and IR

Aerial photography



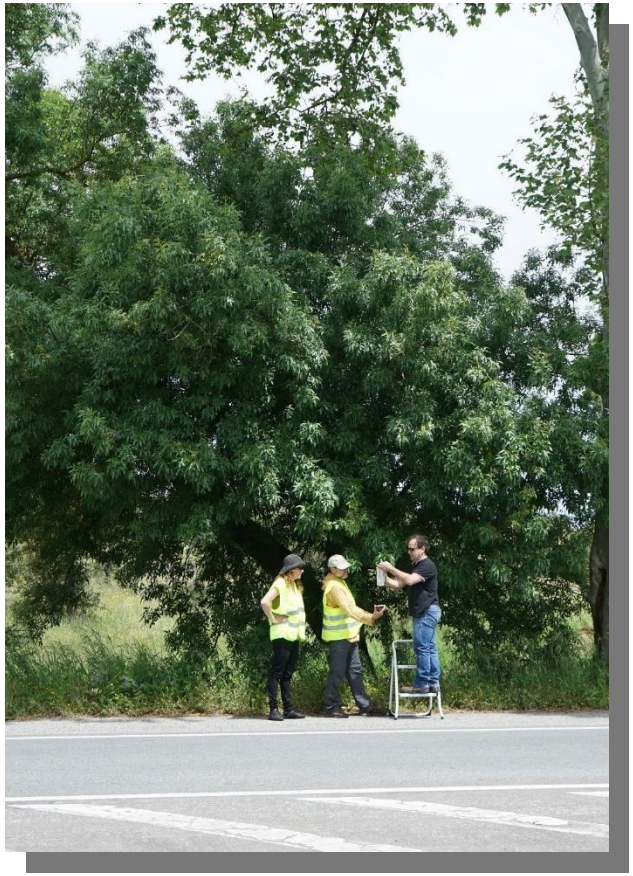
METHODS

REAL-TIME KINEMATIC (RTK)

METHODS

REFLECTANCE DATA (HANDHELD 2, ASD INSTRUMENTS)

325 nm and 1075 nm of the electromagnetic spectrum



METHODS

BIOLOGIC SAMPLING

Acacia dealbata
(mimosa)

Acacia melanoxylon
(austrália)

Robinia pseudoacacia
(Robinia)

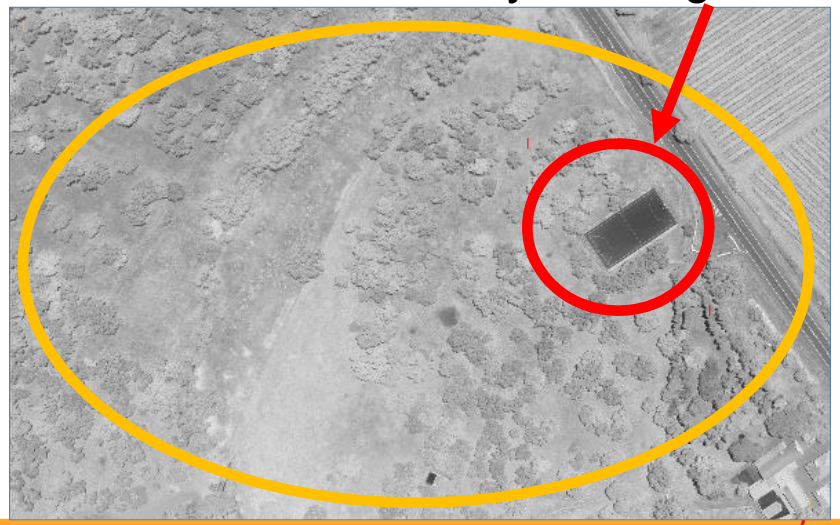
Ailanthus altissima
(espanata-lobos)

RESULTS

AERIAL PHOTOGRAPHY SAMPLE

True

Playground with synthetic grass

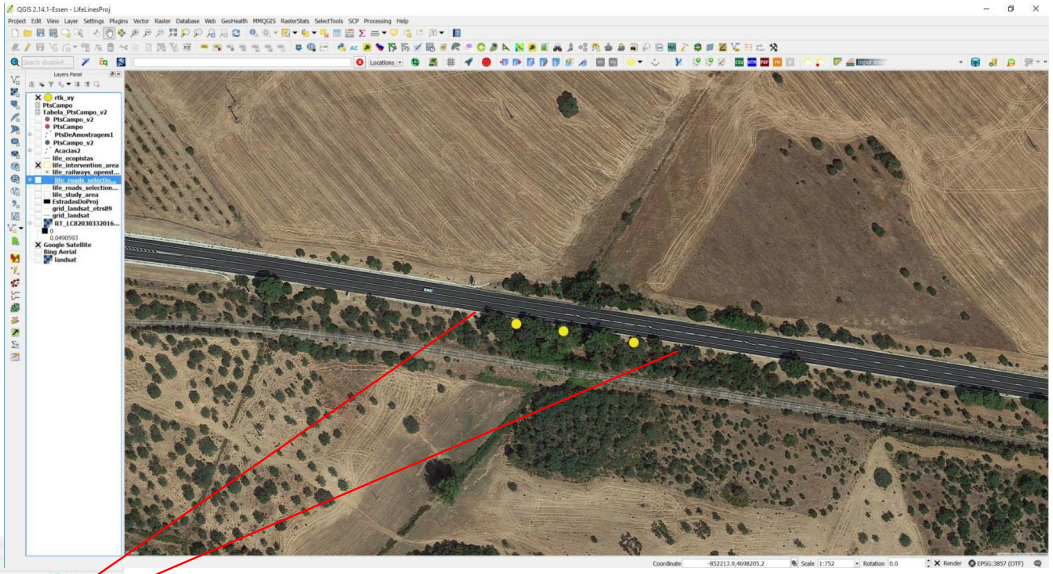


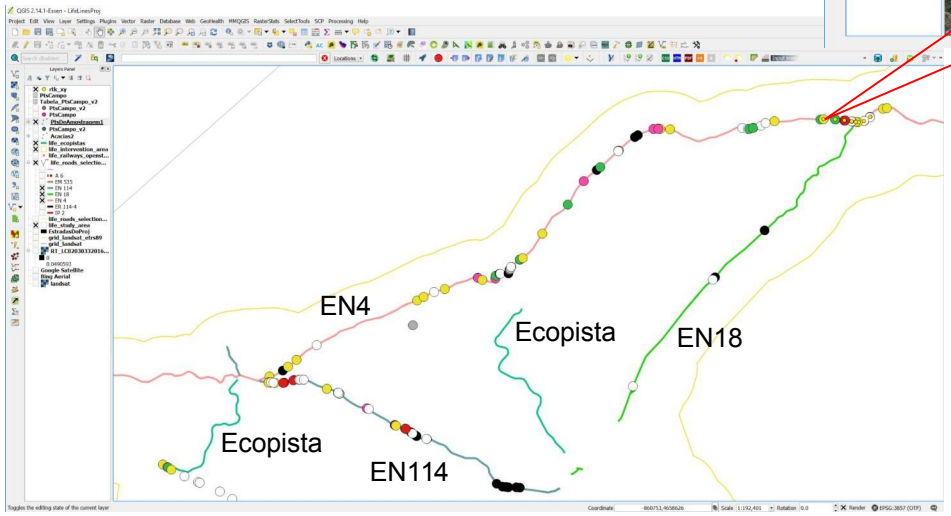
Infra red band

RESULTS

INVASIVE PLANTS LOCATION - RTK

Points of invasive plant species were identified on the field





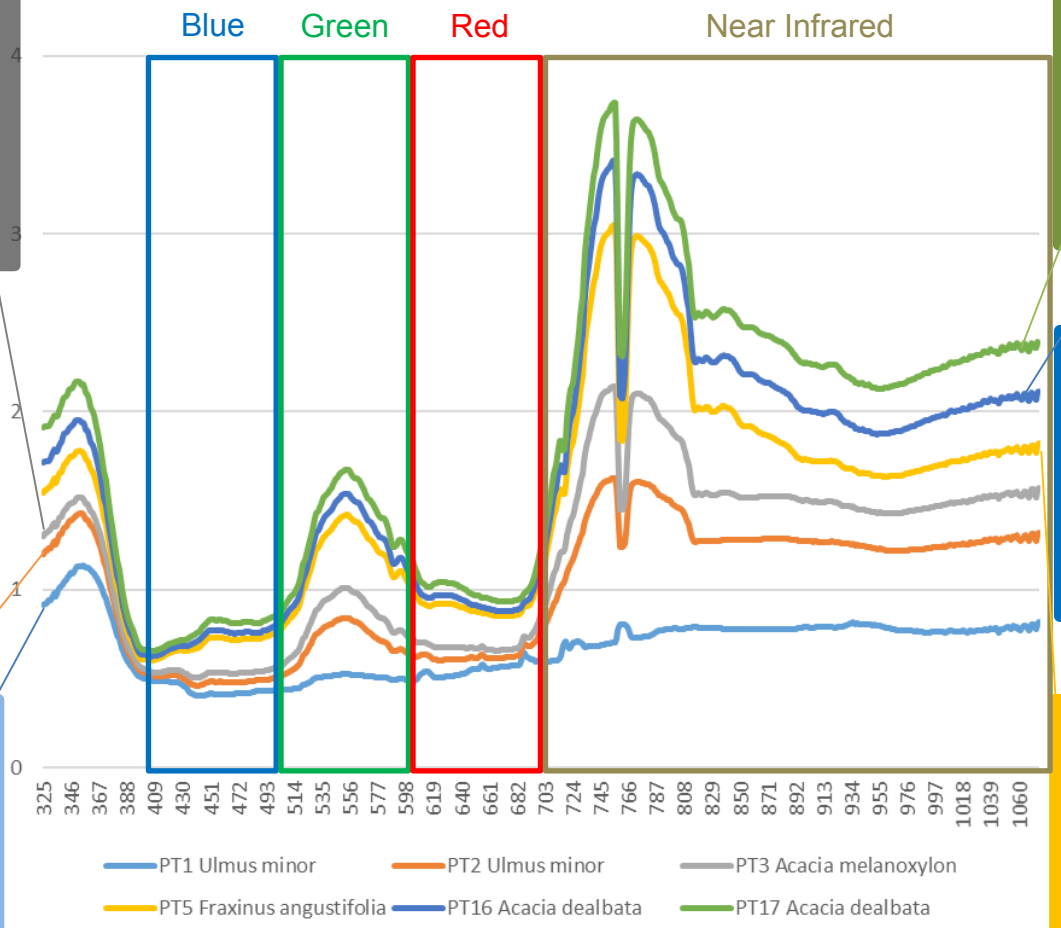
RESULTS

PLANTS SPECTRAL SIGNATURE

PT3 – *Acacia melanoxylon*

PT2 – *Ulmus minor*

PT1 – *Ulmus minor*



PT17 – *Acacia dealbata*

PT16 – *Acacia dealbata*

PT5 – *Fraxinus angustifolia*

ON GOING WORK…

EXPANSION OF INVASIVE PLANTS

- **Identification of expansion patterns of the invasive plant species along the roads**
  - **Multi-temporal aerial images between 1958 and 2016**
  - **Classification of multi-temporal images (QGIS)**

- **Analyse of expansion patterns of the invasive plant species**
  - **MAXENT**

- **Future prediction of plants' invasion in our study area based on current relationships between the invasive plant species occurrence and spatially explicit variables**
  - **Risk map**

TASK A4

OBJECTIVES

To develop cheap, easy to implement, and automatic methods using computer vision techniques from robotics:

- **For detecting road-kills on roads**
- **For monitoring passage points on roads**
- **For avoiding animal proximity to roads**

INTRODUCTION

METHODS FOR SURVEYING ROAD-KILLS

Project Roadkills

Intelligent systems for mapping amphibian mortality on Portuguese roads

PTDC/BIA-BIC/4296/2012

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

CENTROALGORITMI

Universidade do Minho
Escola de Engenharia

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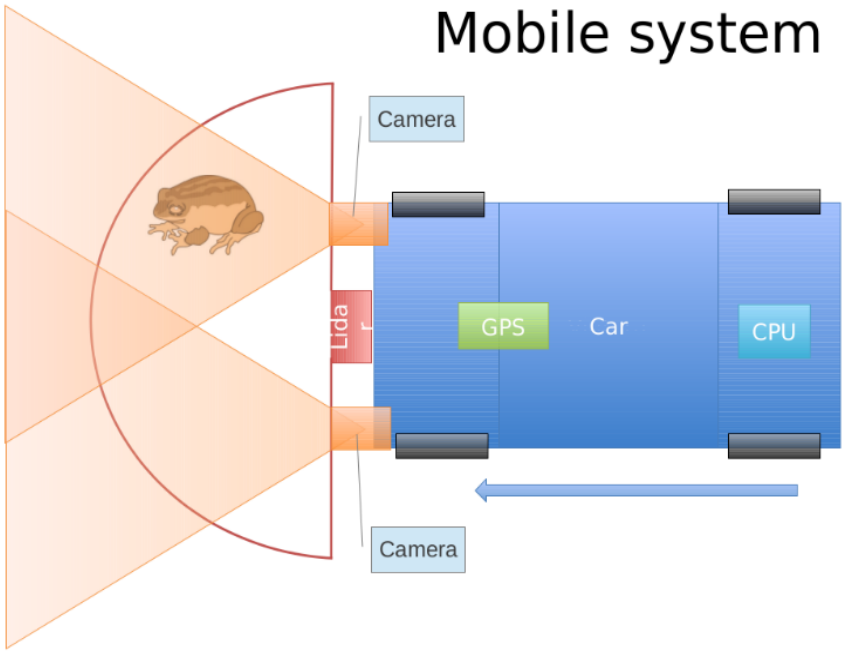
CICGE

METHODS

PROJECT ROADKILLS

Mobile Mapping System

To detect automatically amphibians' road-kills in roads



METHODS

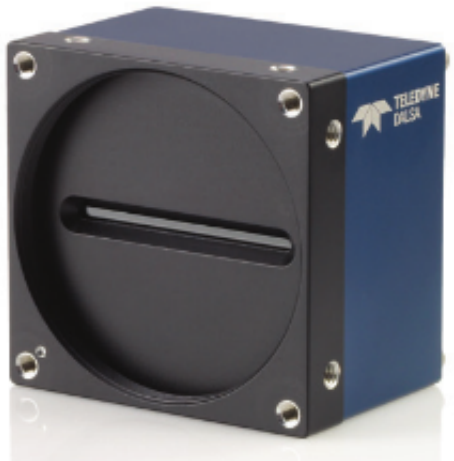
PROJECT ROADKILLS

- **Road kill casualties will be detected automatically in the image through a classification algorithm**
- **Algorithms will be trained with existing data**

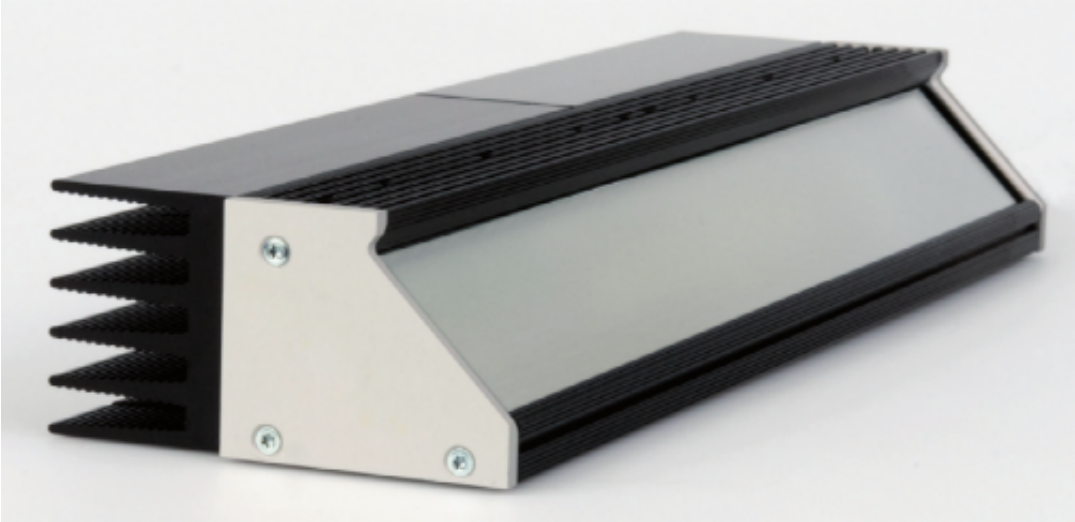
Camera → **Software** → **Algorithm** → **Library of images** → **Road-killed identification**

METHODS

HARDWARE



Linear camera



Linear illumination system

Industrial computer

GPS unit

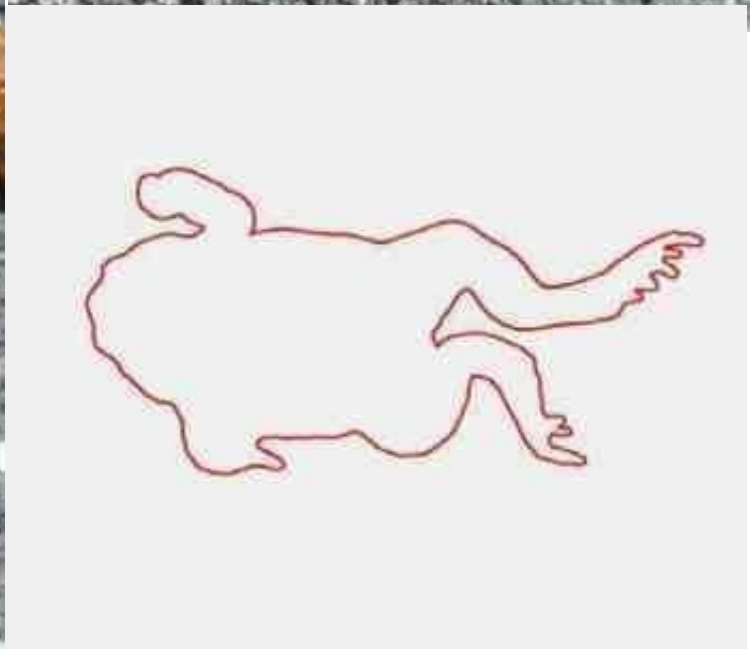
METHODS

Image library

Library of images with digitized anatomical parts of amphibians

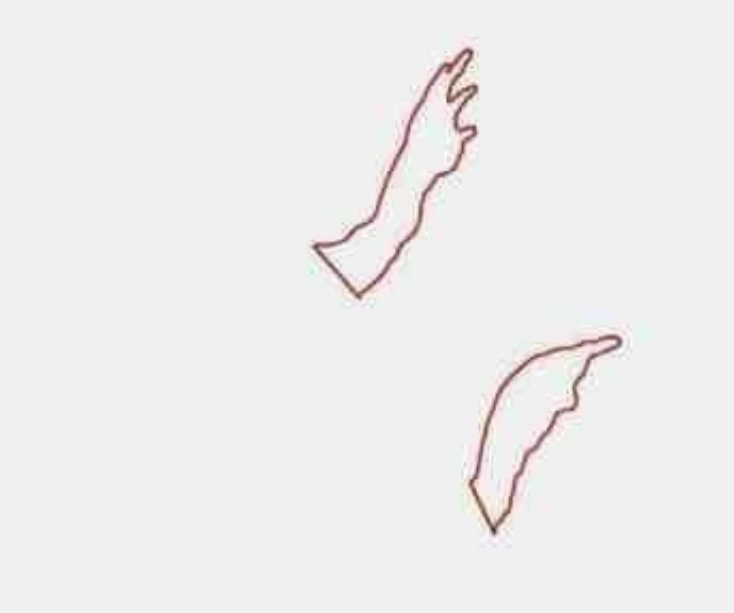
METHODS

Image library

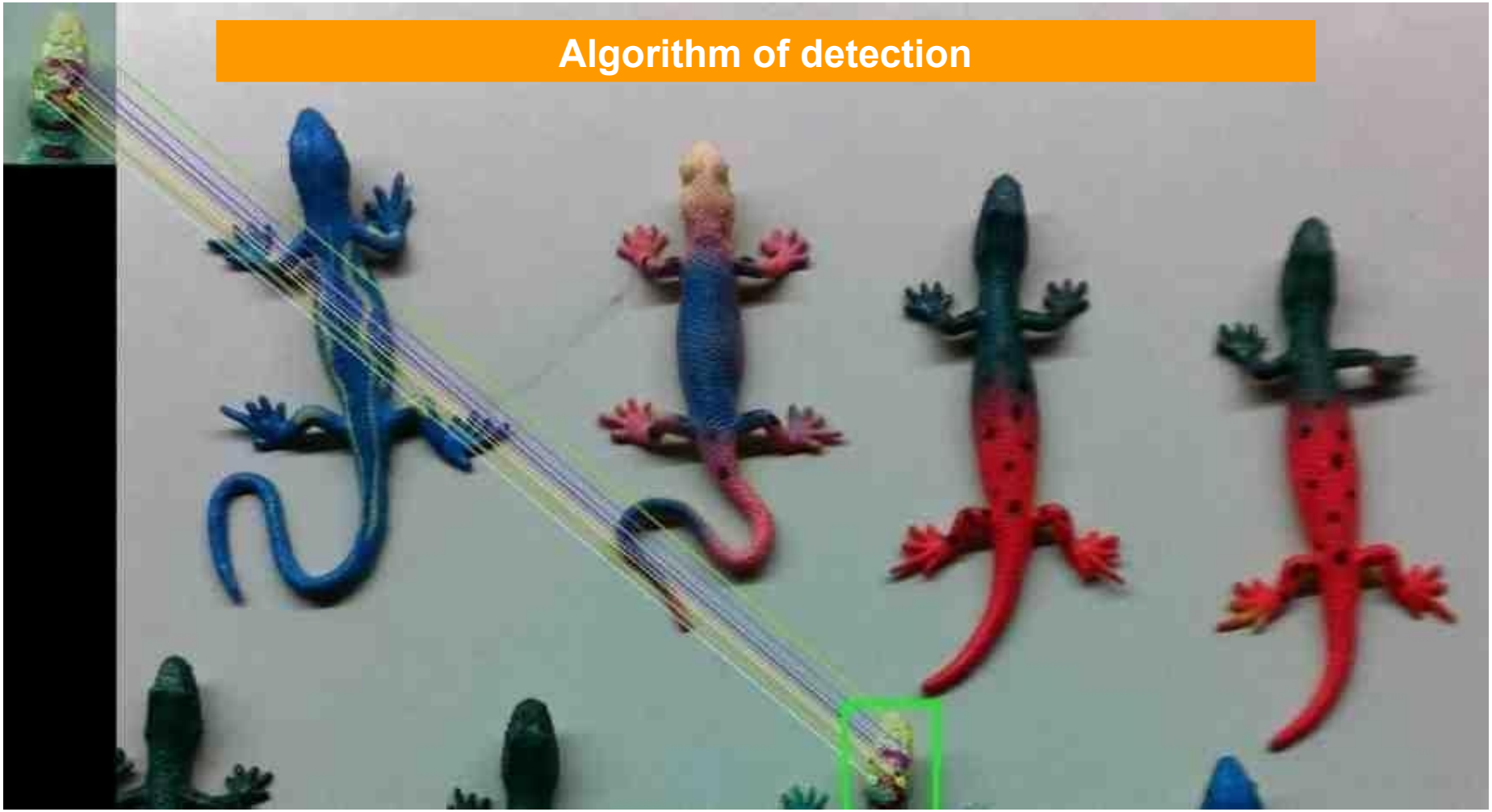


METHODS

Image library

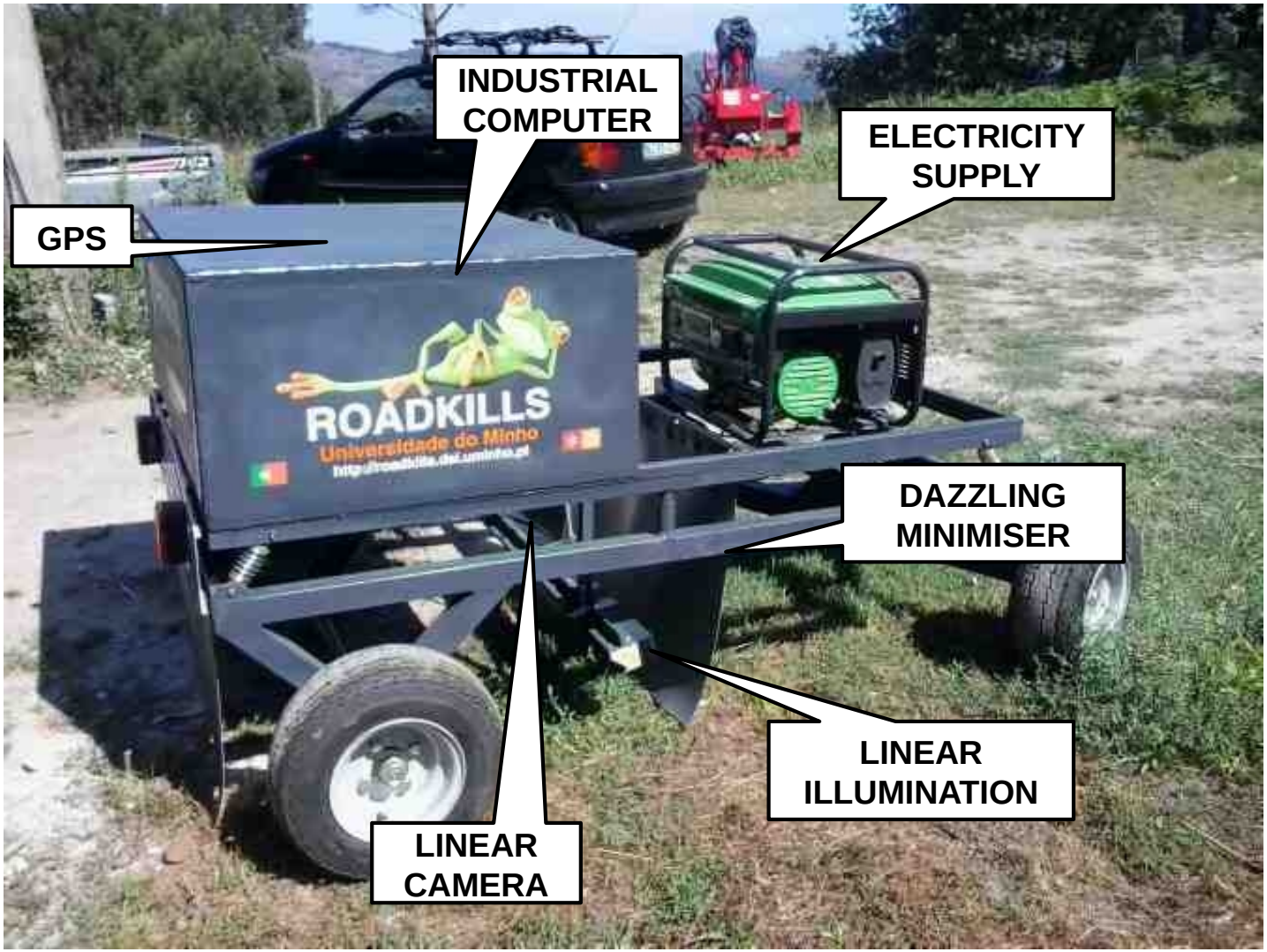


METHODS



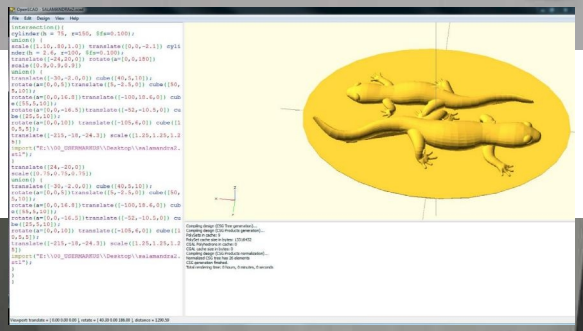
RESULTS

MOBILE SYSTEM



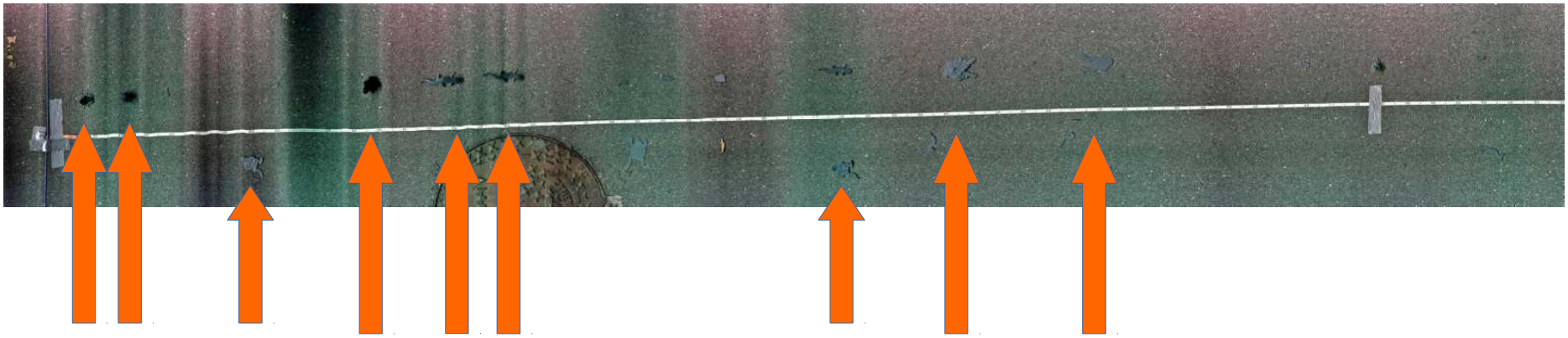
RESULTS

MOBILE SYSTEM



RESULTS

MOBILE SYSTEM



ON GOING WORK

- **Good for passive sampling**
- **Camera resolution with a very high spatial resolution (i.e. 2 mm)**
- **Car speed might be higher than normal surveys (i.e. 70 km/h)**
- **Analysis can be done in real time**
- **Application to other groups (i.e. birds)**

THANK YOU!