

Better intelligent systems for mapping amphibian and small bird roadkills

Neftalí Sillero¹, Diana Sousa Guedes¹, Hélder Ribeiro¹

¹CICGE: Research Centre on Geo-Spatial Science/ University of Porto



PROJECT ROADKILLS PTDC/BIA-BIC/4296/2012

We previously developed a **cheap**, **easy to implement**, and **automatic** solution for detecting road-kills using **computer vision** techniques from robotics

- over large areas (broad monitoring)
- over time (continuous monitoring)

Intelligent systems for mapping amphibian mortality on Portuguese roads



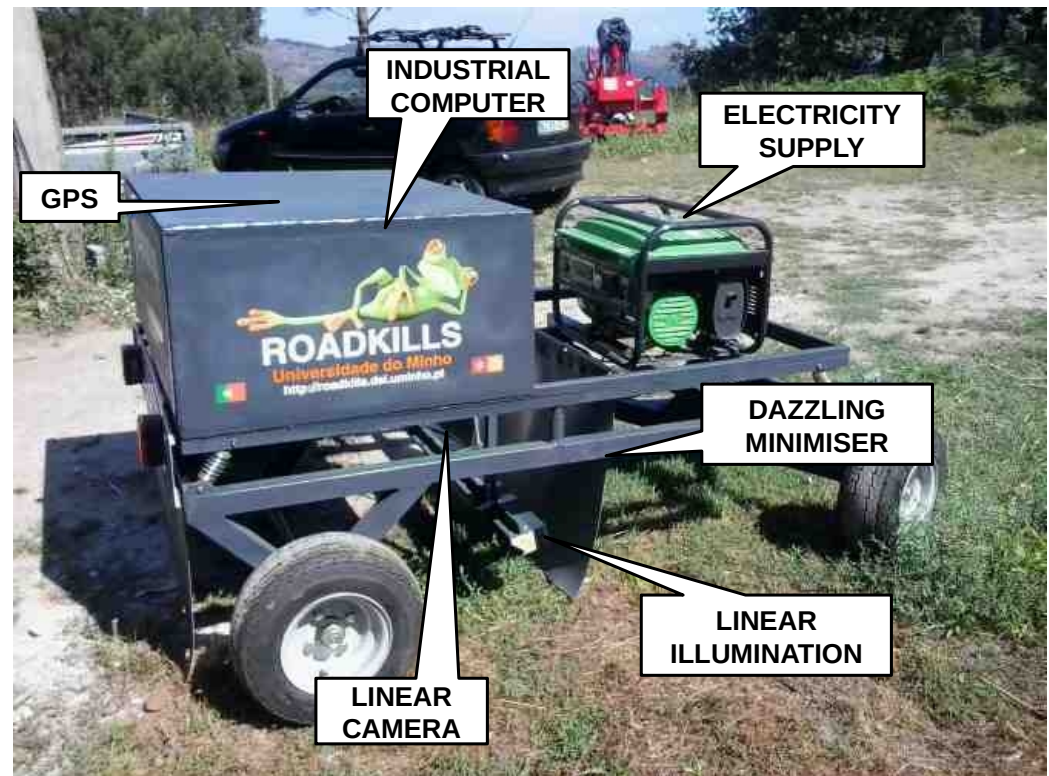
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Lopes et al (2016) Sensors, 16(4), 1–16



Mobile Mapping System 2

- Preliminary results from the research project Life LINES
- Improved version of the Mobile Mapping System 1
- A better system for detecting amphibians and small birds road-kills



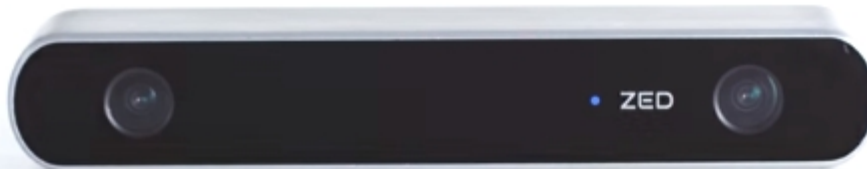
Mobile Mapping System 2



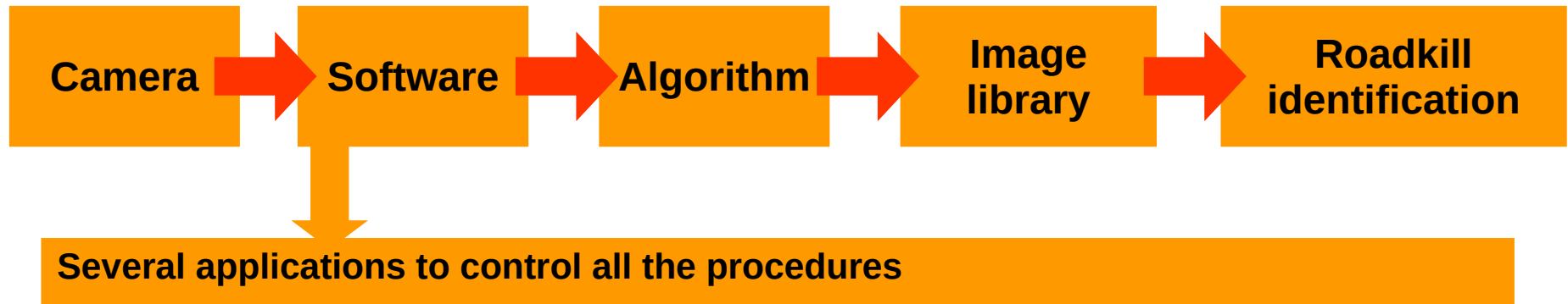
ZED camera: multi-spectral, with 3D laser technology, and high definition

- Device attached directly to the back of any car
- Reduced size and energetic consumption

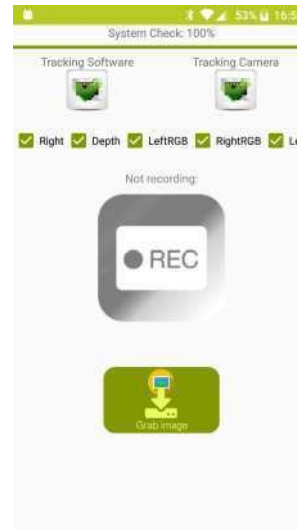
ZED



Mobile Mapping System 2



- Mobile software to turn on/off device, written in Java
- Desktop software to collect and save ZED images, written in C++
- Desktop software to detect animals in ZED images, written in C++, Java, Python, and PHP



Mobile Mapping System 2

Camera

Software

Algorithm

Image
library

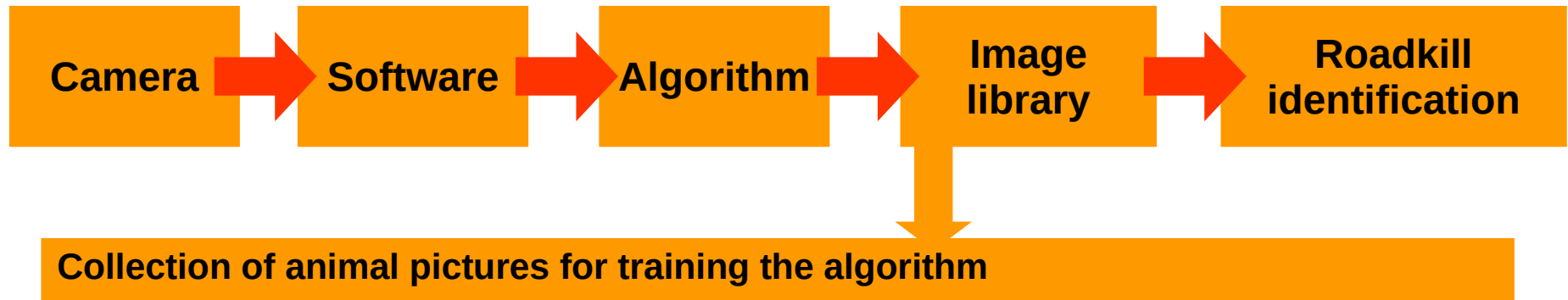
Roadkill
identification

Haar Cascade algorithm from the OpenCV library

- Algorithms trained with previously collected pictures of road-killed amphibians and small birds
- Now using also the AI library tensorflow, improved by Google

```
100 // This function displays 200 camera information
101
102 void printCameraInformation(s::Camera Root) {
103     qDebug() << "200 Serial Number" << " " << red.getCameraInformation().serial_number;
104     qDebug() << "200 Firmware" << " " << red.getCameraInformation().firmware_version;
105     qDebug() << "200 Camera Resolution" << " " << red.getResolution().width << "x" << red.getResolution().height;
106     qDebug() << "200 Camera FPS" << " " << (int) red.getCameraFPS();
107 }
108
109 // This function displays help
110
111 void printHelp() {
112     cout << endl;
113     cout << endl;
114     cout << "Camera controls help:" << endl;
115     cout << "  Increase camera settings value" << " " << endl;
116     cout << "  Decrease camera settings value" << " " << endl;
117     cout << "  Switch camera settings" << " " << endl;
118     cout << "  Reset all parameters" << " " << endl;
119     cout << endl;
120     cout << "Exit : q" << endl;
121     cout << endl;
122     cout << endl;
123     cout << endl;
124 }
125
126 void startVideoWindow(Mat Input) {
127     // Mapping between 0-255 and 0-1000
128 }
```

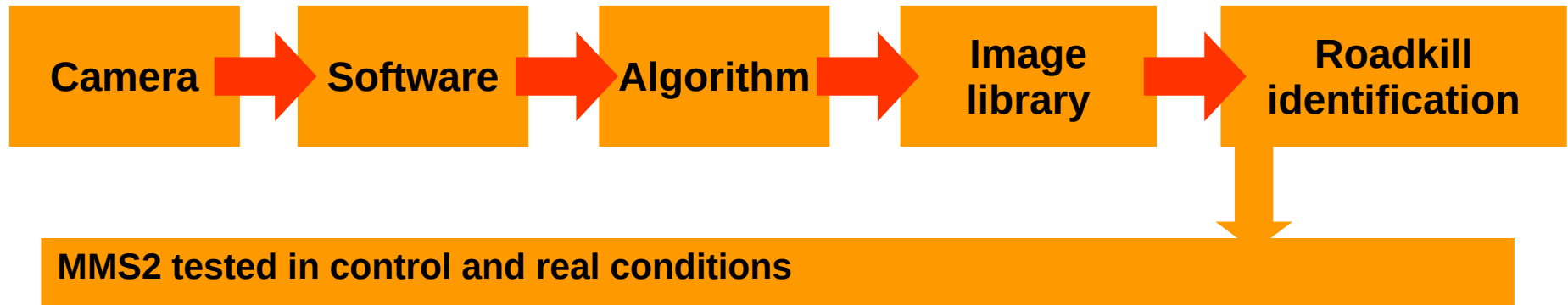
Mobile Mapping System 2



- 600 pictures of animals and other objects
- Learning process by successive generations
- Long time computing process



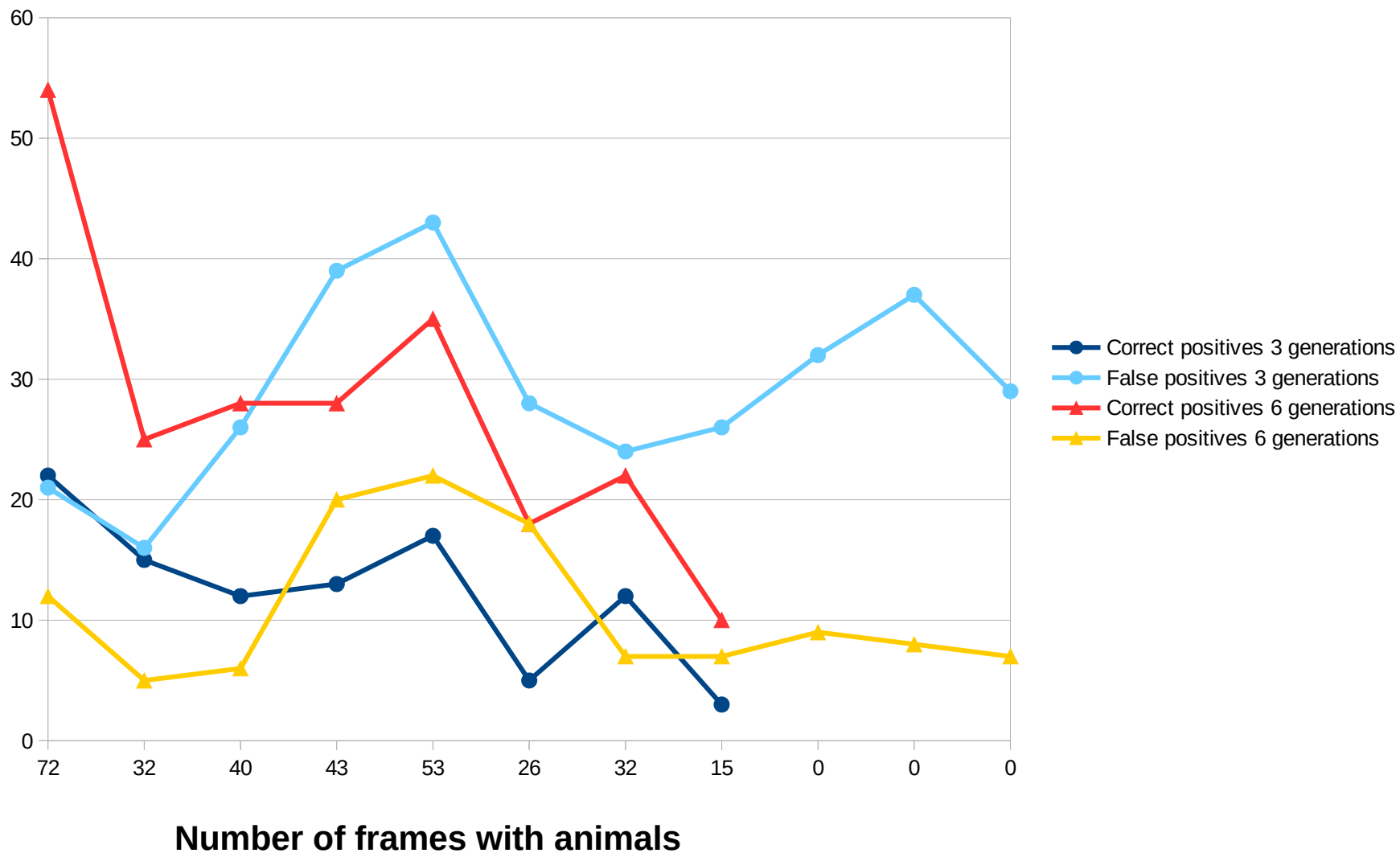
Mobile Mapping System 2



- Control tests with collection specimens of amphibians and birds
- Real tests on road surveys in Portugal



Learning process with 6 generations



Learning process with 6 generations

Resolution	FPS	Frames	Frames with animals	Correct positives	False positives	Speed	%
2208x1242	15	274	72	54	12	30 Km/H	75.0
1920x1080	30	494	32	25	5	40 Km/H	78.1
1920x1081	30	444	40	28	6	30 Km/H	70.0
1280x720	60	1400	43	28	20	30 Km/H	65.1
1280x720	60	1160	53	35	22	40 Km/H	66.0
1280x720	60	1076	26	18	18	80 Km/H	69.2
1280x720	60	658	32	22	7	20 Km/H	68.8
2208x1242	15	305	15	10	7	100 Km/H	66.7
2208x1242	15	1155	0	-	9	30 Km/H	0
1920x1081	30	1066	0	-	8	30 Km/H	0
1920x1081	30	740	0	-	7	30 Km/H	0

- **Successful identification of animals on roads**
- **Algorithms can be trained with other animal groups or objects**
- **Successfully reduced the size and energetic consumption**
- **Developed using low cost components**
- **Attachable to any vehicle**
- **Saved funds, time and personal resources**





SAR-Solucões De Automação e Robótica, LDA

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Thank you!