“LitterDrone: monitorización de basura marina empleando drones y análisis de imagen”
DRONE-BASED IMAGE ACQUISITION
+
COMPUTER BASED IMAGE ANALYSIS
¿WHAT IS MARINE LITTER?

Man made solid waste that, for any cause, are abandoned in marine or coastal environment

SOURCE: PNUMA
LITTERDRONE ORIGIN

- Marine litter **characterization** as a key factor to eradicate them
- Official **monitoring** program for marine litter on beaches (MAPAMA)
- **Standardization** and **automation** of marine litter characterization

SOURCE: Surfrider España
FUNDED BY EU (BLU-LABS PROGRAM)

- EASME/EMFF/2016/1.2.1.4
  Blue Labs
  Innovative Solutions for Maritime Challenges

- Supported by:

- With Collaboration of:

- Partners:
Litter Drone

DRONES & FLIGHTS
UAV’S & CAMERAS

20-50 meters

Visible

Multi-spectral

Thermal
UAV’S & CAMERAS

Visible

Multi-spectral

Thermal

10-15 meters
REAL FLIGHTS
IMAGE ACQUISITION: ORTHO-PHOTO
IMAGE ACQUISITION: ORTHO-PHOTO

Photomodeler: from photos to Ortho-photo (geo-referenced, exact)
TEST ZONE

- Flying on one of the monitored beaches: “playa de Rodas” (Galician Atlantic Islands Maritime-Terrestrial National Park)
- Detection of true marine litter and comparison with official data
- Flying on another (non monitored) beach

With the collaboration of
REAL FLIGHTS

Flight transects

Flight with individual photo shots labelled
IMAGE PROCESSING

Litter Drone
IMAGE PROCESSING

Objects detection with beta version: sand characterization

IMAGE TYPE: RGB
VISIBLE CONVENTIONAL CAMERA
SAND CHARACTERIZATION

Recognition:
- 1-NN with K-means prototypes, nearest prototype: $P_{NN}$.
- $\text{Dist}(\text{pixel\_actual}, P_{NN}) < U \Rightarrow \text{FONDO}$. 

Normalization $[0,1]$ 

K-means with calibration examples
OBJECT DETECTION

IMAGE TYPE: RGB
VISIBLE, CONVENTIONAL CAMERA
GLOBAL REPORT

FAST & AUTOMATIC
IMAGE SUPERPOSITION
OBJECT RECOGNITION

Automatic recognition of more common objects: lids, bottles, cans, sticks… and also auxiliary objects (white targets)
OBJECT RECOGNITION

Object classification

Regular thickness
- White targets
- stakes
- lids
- bottles
- cans

Fishing nets
- beach shovel
- pegs

Small radius S.E.

Small thickness
- cords
- sticks
- signalling wires

Regular radius S.E.
OBJECT RECOGNITION

Decision tree is implemented computing discriminant functions. For class \(i\), at stage \(n\), we take into account feature value \(x\):

\[
D_i^{n+1} = D_i^n \cdot d_i(x)
\]

\[
d_i(x) = \begin{cases} 
0, & x > x_{\text{max}} \cup x < x_{\text{min}} \\
\exp \left[ -\frac{1}{2} \left( \frac{x - x_{\text{med}}}{x_{\text{desv}}} \right)^2 \right] & \text{otherwise}
\end{cases}
\]

Empirical equations inspired by Bayes rule and gaussian distribution.
OBJECT RECOGNITION

Human correction of non recognized objects
CONCLUSIONS

LitterDrone
CONCLUSIONS

- Interesting project ending at January 2019.

- Pending work:
  - Testing New Cameras.
  - Improving Object Recognition.
  - Market Research.

MEETING OF DRONE TECHNOLOGY, REMOTE SENSING AND COMPUTER VISION,
MORE PROJECTS OF THIS KIND ARE EXPECTED IN THE FUTURE
THANK YOU!

LITTERDRONE PROJECT

The LitterDrone project seeks to develop innovative tools for the control and management of marine litter through unmanned drones.

www.litterdrone.eu