

Artificial Vision for Humans

Luís A. Alexandre and Sandra Mogo*

July 2019

1 Abstract

Currently there are many advances in Computer Vision that can do things that were considered impossible for a machine, some years ago. These advances are used mainly for robotic applications.

With this project we want to integrate many Computer Vision algorithms, such as, the recognition of places or locations, people and objects [1–4], into a portable system that can be used by a blind person or a person with serious vision difficulties, and help them navigate the real world and make life easier for them as a whole.

2 Goals

The main goal of this thesis is to create a portable system that integrates semantic segmentation and object detection algorithms, that enable a person with vision difficulties to navigate indoor spaces.

The information from the world is captured by a small 3D camera and the algorithms have to be simple enough to run on an ARM architecture, in real-time (at least 5 FPS).

We will evaluate both Raspberry Pi 3 and 4 with a deep learning acceleration module and NVidia Jetson Nano platforms both in terms of usability, energy efficiency and computation capacities, for this task.

*Co-supervisor, Dep. Physics, UBI.

3 Tasks

T1: State-of-the-art in semantic segmentation and object detection.

T2: Implement the proposed method.

T3: Make extensive evaluation on real world scenarios.

T4: Write the thesis and a scientific paper.

4 Schedule

Task	Start date	Duration
T1	2019-10-01	2 months
T2	2019-12-01	4 months
T3	2020-04-01	1 month
T4	2020-05-01	2 months

References

- [1] Luís A. Alexandre. 3D descriptors for object and category recognition: a comparative evaluation. In *Workshop on Color-Depth Camera Fusion in Robotics at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vilamoura, Portugal, October 2012.
- [2] Luís A. Alexandre. 3D object recognition using convolutional neural networks with transfer learning between input channels. In *13th International Conference on Intelligent Autonomous Systems*, volume 301 of *Advances in Intelligent Systems and Computing Series*, Padova, Italy, July 2014. Springer.
- [3] Joao Maria, Joao Amaro, Gabriel Falcao, and Luís A. Alexandre. Stacked autoencoders using low-power accelerated architectures for object recognition in autonomous systems. *Neural Processing Letters*, 43(2):445–458, 2016.
- [4] Abel Zacarias and Luís A. Alexandre. Application of lifelong learning with CNNs to visual robotic classification tasks. In *24th Portuguese Conference on Pattern Recognition, RECPAD 2018*, Coimbra, Portugal, October 2018.