

ALFA: Advanced LiDAR Framework for Automotive

PhD Student (2nd year)

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FCT Fundação
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The new automotive trend: Autonomous driving



Trends

- Stronger
- Faster
- Cheaper
- Environmentally Friendly

The new automotive trend: Autonomous driving



Trends

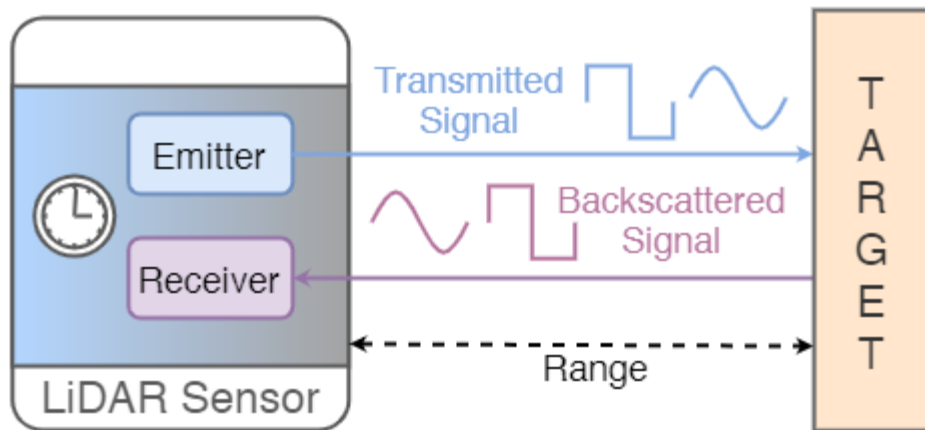
- Stronger
- Faster
- Cheaper
- Environmentally Friendly
- Smarter

The key sensors in autonomous driving

RADAR

LiDAR

Cameras



The technology behind LiDAR works by illuminating a target with an optical pulse and measuring the characteristics of the return signal, being the distance to the target obtained by calculating the round-trip delay of the reflected light.

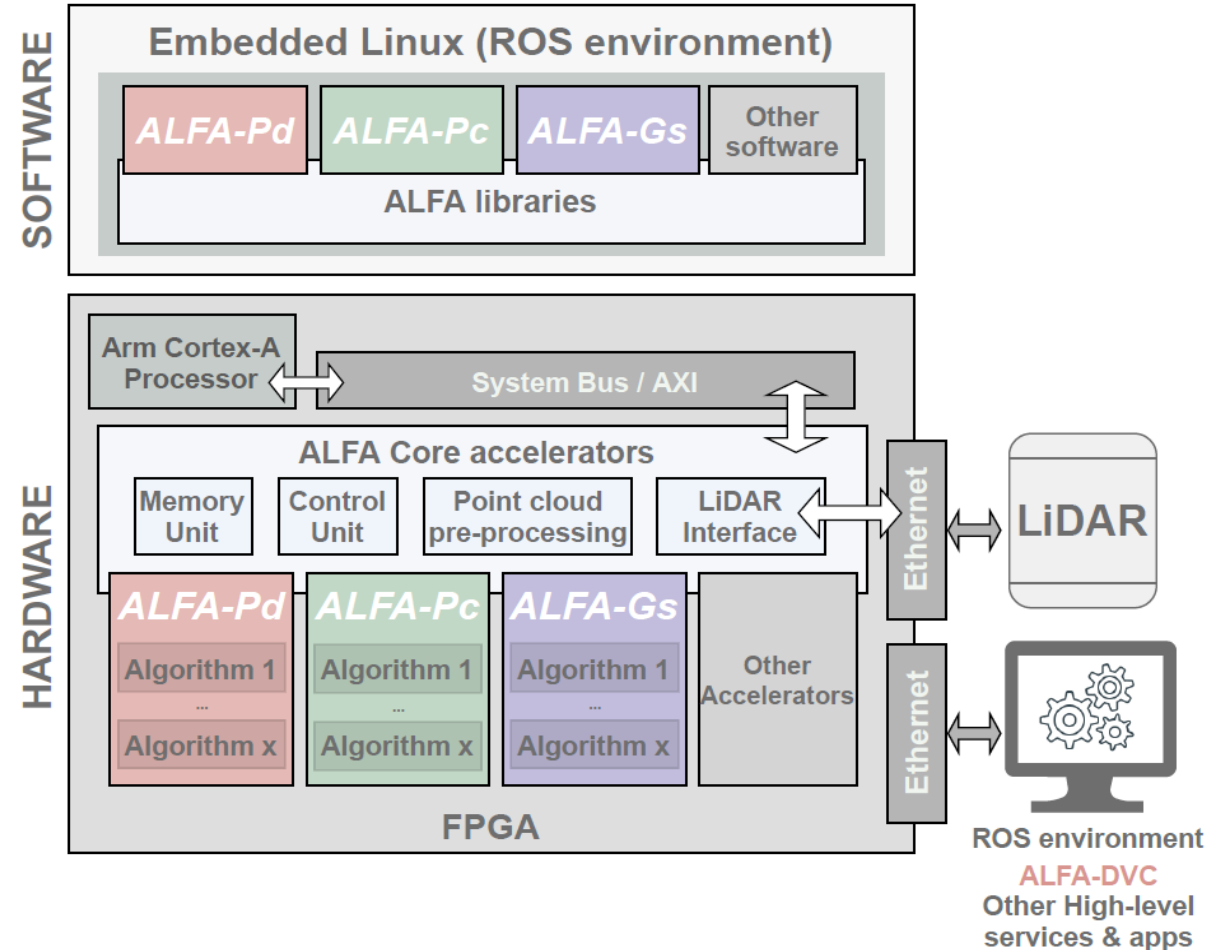
Challenges:

- **Mutual Interference;**
- **Compression;**
- **Noise;**
- **3D Object Detection & Classification.**



ALFA Framework

Advanced LiDAR Framework for automotive (ALFA)

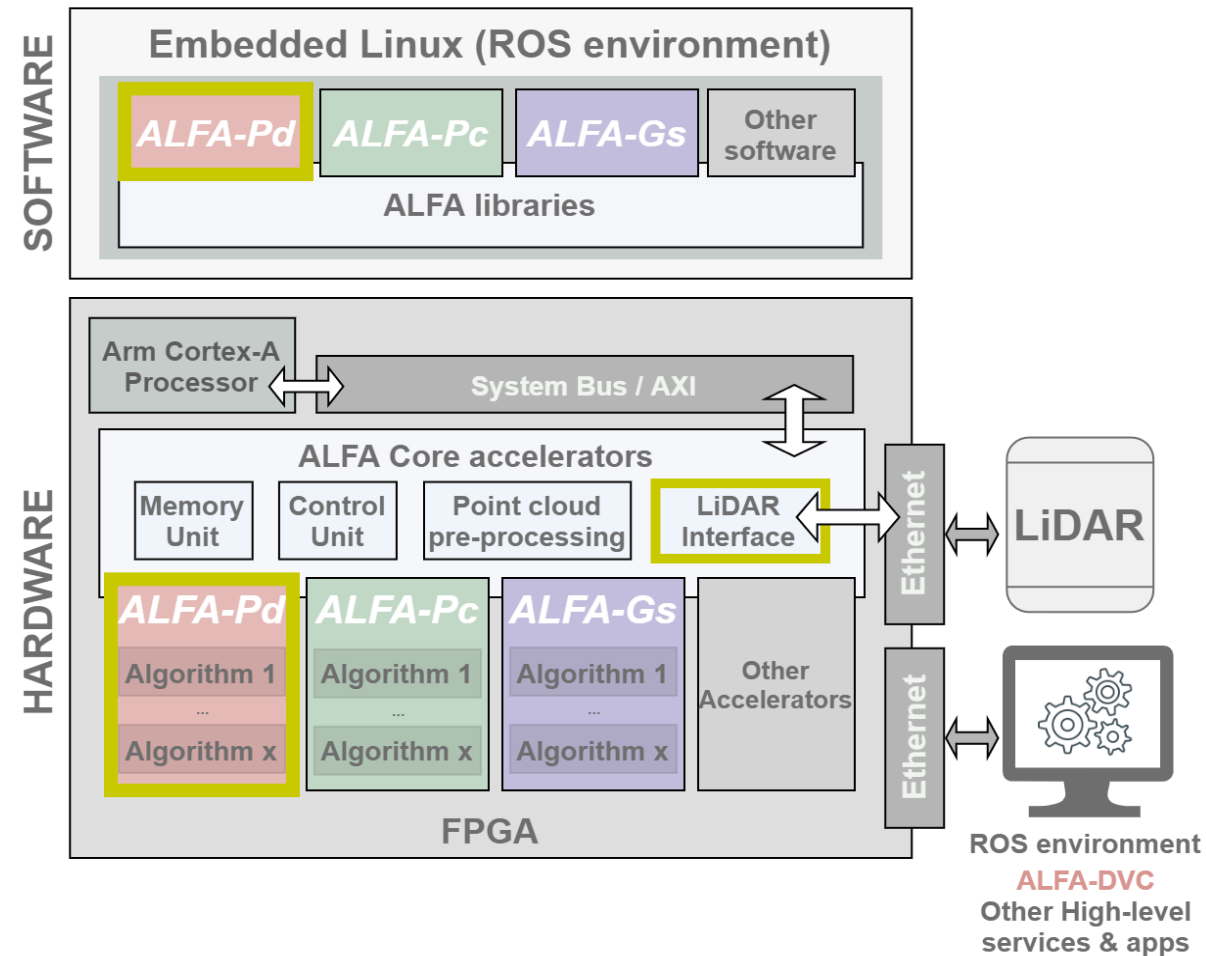


An open-source Framework for Automotive with:

- Generic and multi-sensor interface;
- Several pre-processing algorithms: data compression, noise filtering, ground segmentation, etc;
- Configurable output for High-level applications;
- Reconfigurable point-cloud representation architecture;

ALFA State

Advanced LiDAR Framework for automotive (ALFA)



State:

- ALFA core components (software/hardware) implemented and currently under test;
- Currently writing ALFA primary publication;

On-going Master's thesis (2020/2021):

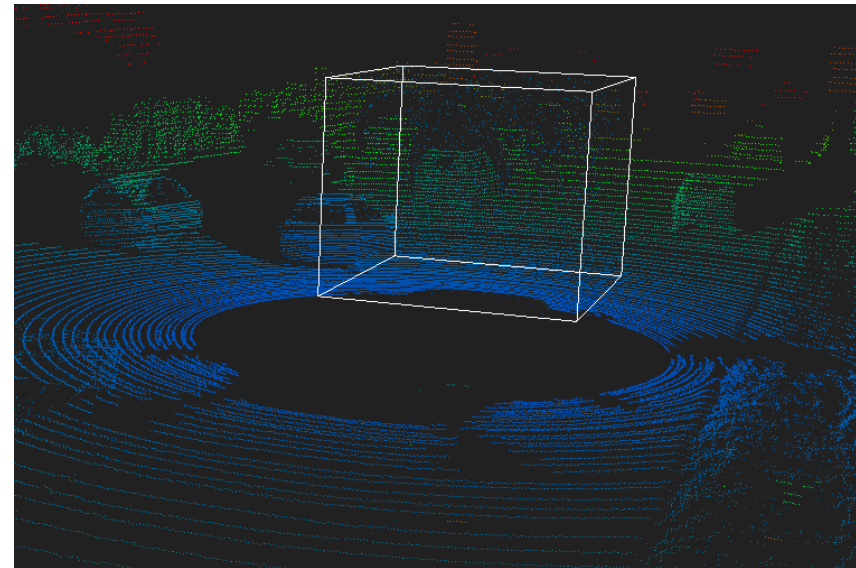
- **ALFA-Pd** - André Campos – expected output: 1 publication (aiming at T-ITS Q1 Journal)
- **ALFA-Pi** - Luís Cunha - expected output: major contrinution in ALFA primary publication (aiming at T-ITS Q1 Journal)

MSC Dissertations

1

ALFA-Pc: ALFA Point Cloud Compression (Hybrid FPGA/Embedded Linux development)

- **Goal 1 – Software library to enable point cloud compression in ALFA platform.**
- **Goal 2 – Hardware extension to enable point cloud compression in ALFA platform.**
- **Goal 3 – ALFA integration**
- **Pre-requisites:**
 - **Embedded Systems Design;**
 - **FPGA/Verilog (hardware co-processors)**
 - **Embedded Linux**

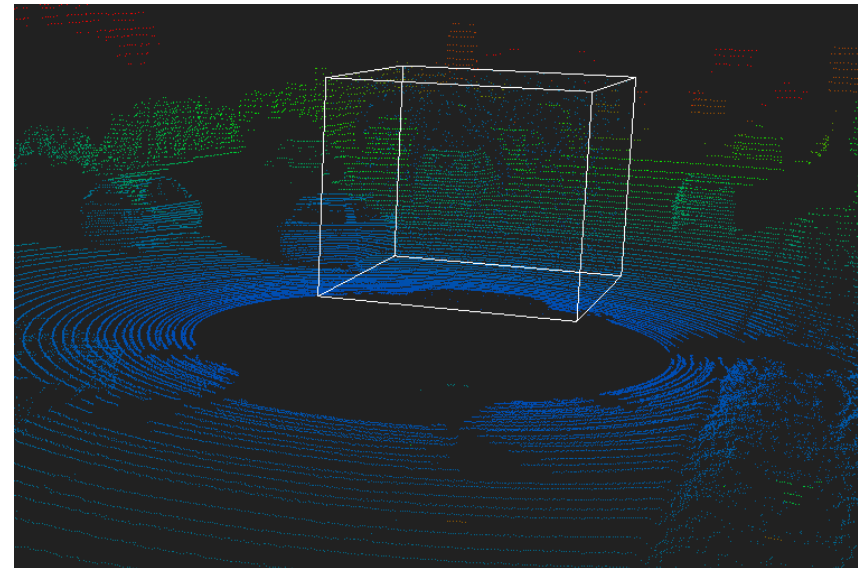


MSC Dissertations

2

ALFA-Gs: ALFA Ground Segmentation (Hybrid FPGA/Embedded Linux development)

- **Goal 1** – Software library to enable ground segmentation (noise/ground removal) in ALFA platform.
- **Goal 2** – Hardware extension to enable ground segmentation in ALFA platform.
- **Goal 3** – ALFA integration
- **Pre-requisites:**
 - Embedded Systems Design;
 - FPGA/Verilog (hardware co-processors)
 - Embedded Linux

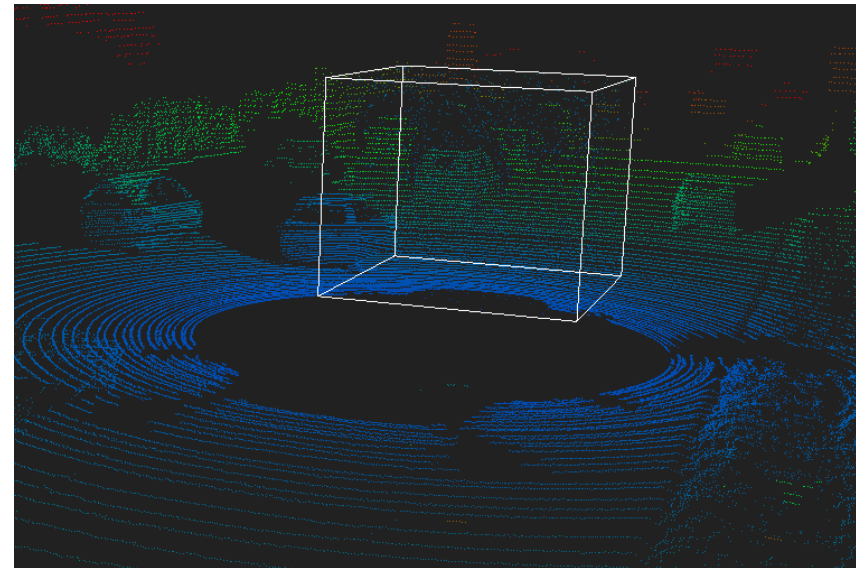


MSC Dissertations

3

LiDAR Mutual Interference / Side-channels

- **Goal 1 – Explore Mutual Interference in LiDAR systems for automotive**
- **Goal 2 – Explore side-channel sources in LiDAR systems for automotive**
- **Goal 3 – ALFA Integration**
- **Pre-requisites:**
 - Embedded Systems Design;
 - FPGA/Verilog (hardware co-processors)
 - Embedded Linux



THANK YOU!

ANY QUESTIONS?

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