ALFA-Pc: Streaming Point Cloud Data Compression

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CENTROALGORITMI

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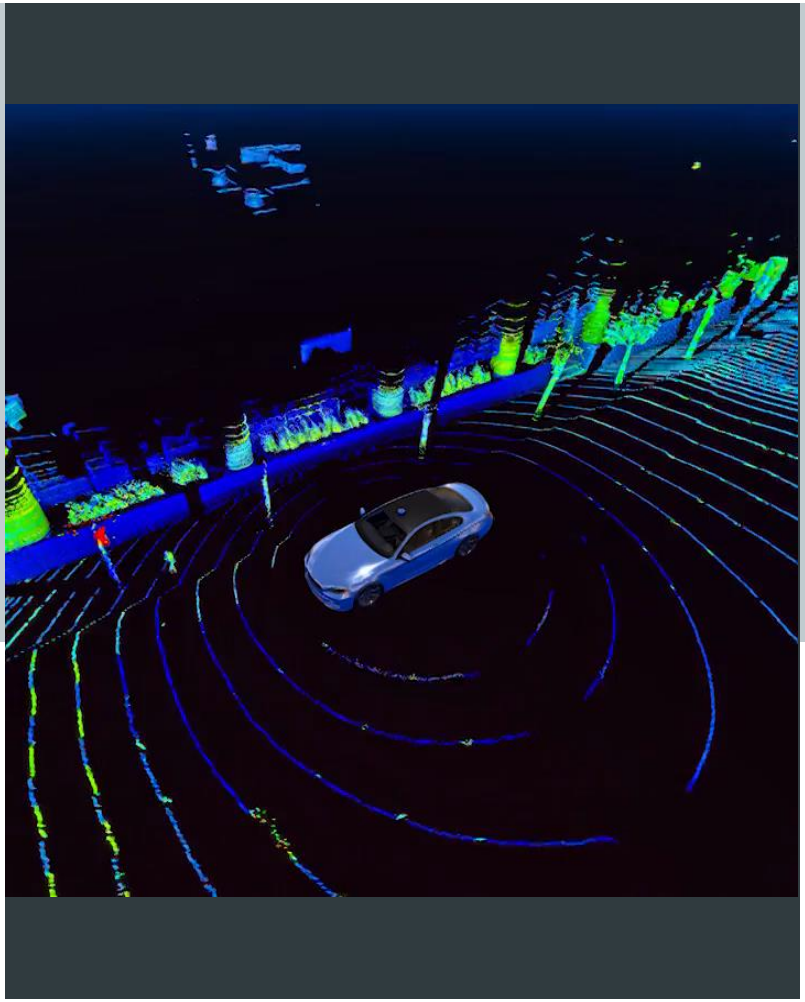
Contextualization

LiDAR, Point Cloud, Data Compression, FPGA

LiDAR

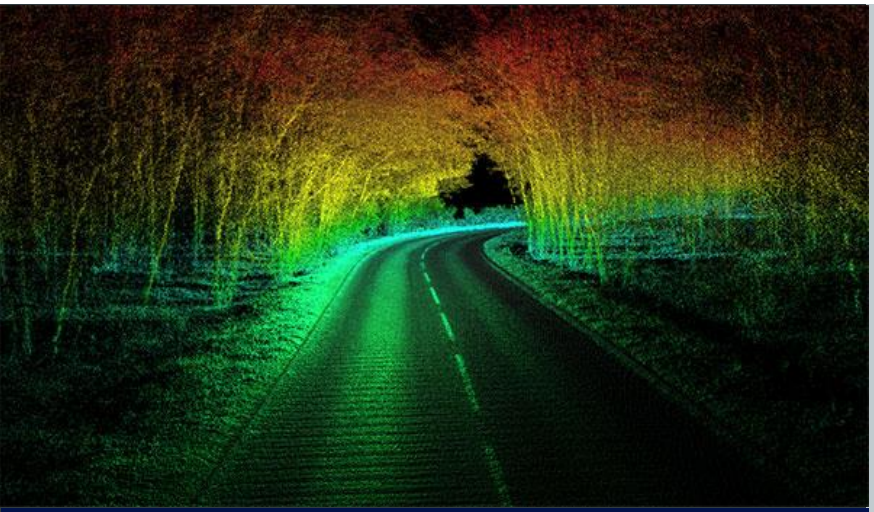


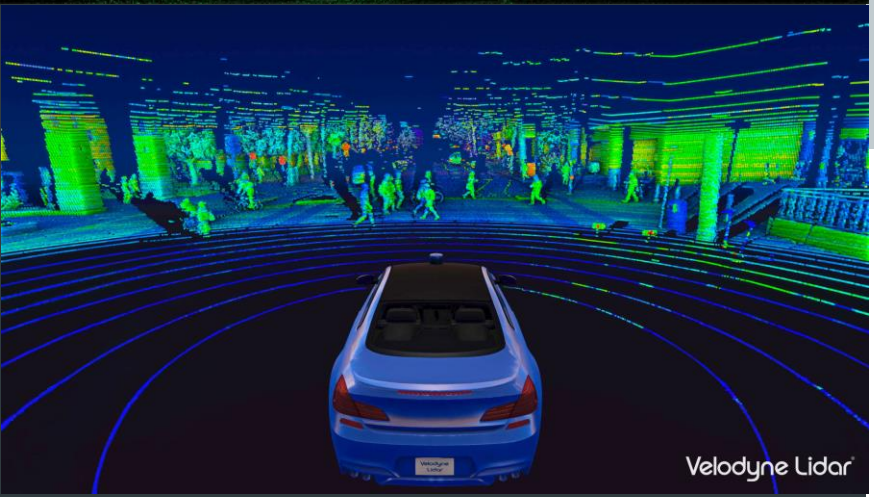
- Key sensor in autonomous driving.
- Light Detection and Ranging (LiDAR) sensors can be used to measure the distance to an object by calculating the round-trip time of a laser pulse traveled to the target and back.
- The sensor output is **a point-cloud** which consists of a 3D representation of the real environment.

Applications:

- **Autonomous vehicles:** Detection of obstacles, pedestrians and road surface
- Robotics
- Topography
- Geoscience

Point-Cloud Data Compression





Main challenge: Point-clouds with high resolution have a **high amount** of points

- Real-time point-cloud data output from LiDAR can achieve a throughput of Gbit/s.
- For example, Velodyne Alpha Puck sensor can output 9,600,000 points per second.

COMPRESSION

Performing compression tasks **may add significant processing overhead** penalizing real-time applications that rely on the sensor's output.

Solutions:

- Some solutions try to mitigate this problem during data acquisition, while others focus on **compressing data after being captured and transferred** to a computing unit.

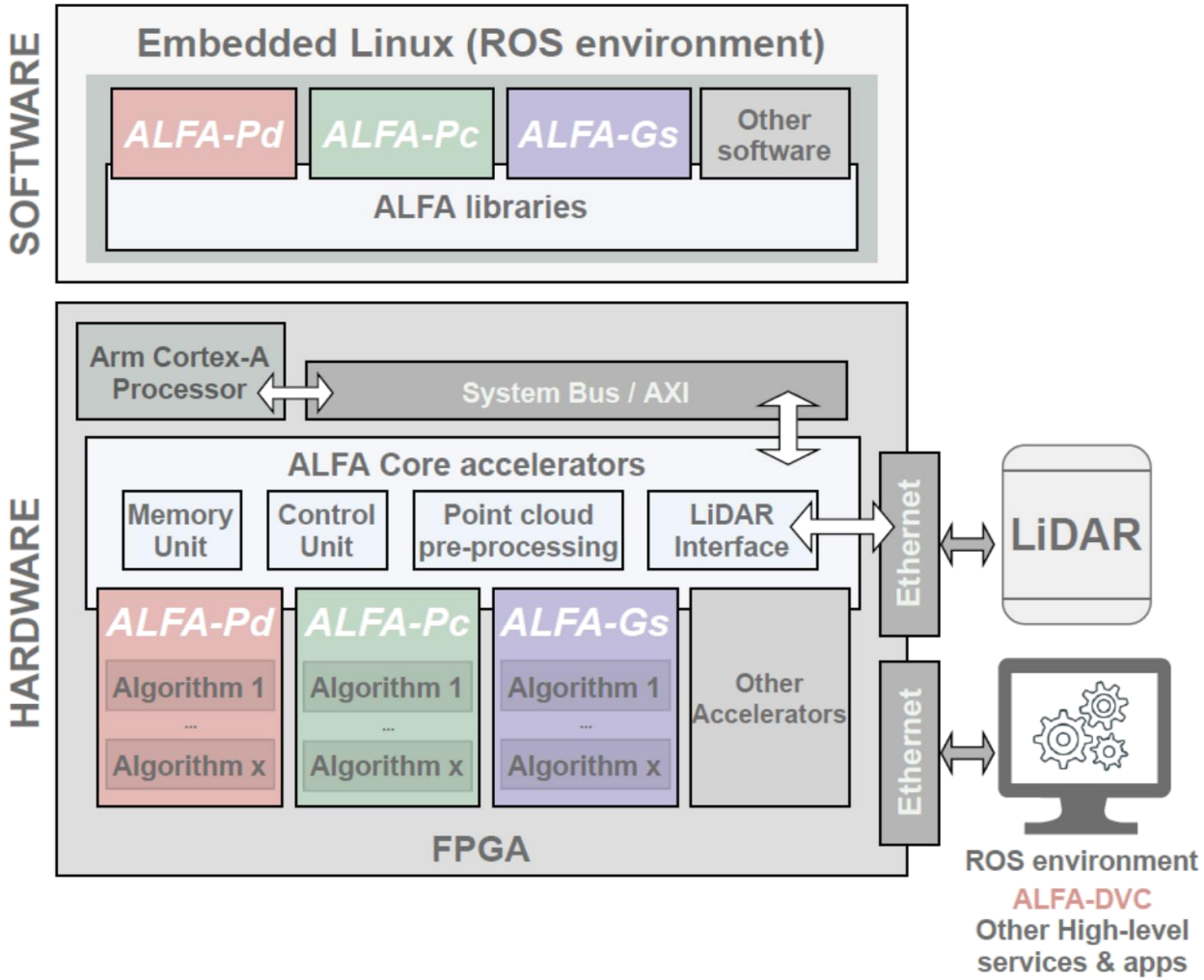
ALFA

Framework for Automotive

ALFA – Advanced LiDAR Framework for Automotive

In-house framework designed and developed at the University by Ricardo Roriz and Tiago Gomes at ESRG.

- Generic and multi-sensor interface
- Several pre-processing algorithms
- Configurable output for High-level applications
- Reconfigurable point-cloud representation architecture



Goals

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The main goal of this dissertation is to develop an FPGA based approach for streaming point cloud data compression.

- Software libraries to enable streaming point-cloud data compression in ALFA platform
- Hardware acceleration to enable streaming point-cloud data compression in ALFA platform
- ALFA integration

Relevance

Relevance – Technical & Scientific

Autonomous driving is the **new trend** in the automotive industry

- Greater Road Safety
- Reduced Congestion
- Environmental Gains

Contribute to help achieve the **levels of vehicle autonomy** according to Society of Automotive Engineers (SAE)

- Improving the behavior of this sensor has great relevance for achieving the levels of autonomous driving
- Support the systems that process LiDAR data, lowering their complexity and reducing computational resources
- Increase or reach the levels of autonomous driving as soon as possible

Motivation

Motivation

Automotive Field

LiDAR Technology

Hardware Design

Embedded Systems

THANK YOU!

ANY QUESTIONS?

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