The Experience of Robesafe Team in CARLA Autonomous Driving Challenge.

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1. OBJECTIVE

The future of the automotive is focused on achieving total autonomous cars in realistic urban environments. To reach it, many researching teams are working with 3D simulators such as V-REP and Gazebo, due to an easy integration with ROS platform. ROS is a middle-ware for robot code development. It allows easy communication between different systems. It is multi-language, admitting C++ and Python code programming. Those simulators provide precise motion information, but they are designed for smaller environments like robotic arms, providing unrealistic appearance and very slow performance, being unrecommended for real-time systems in rich worlds like urban cities. CARLA simulator provides high detailed environments in realistic urban situations, being able to train and test control and perception algorithms in complex traffic scenarios, very close to real situations.

CARLA Autonomous Driving Challenge was launched in Summer 2019, allowing everyone to test their own control techniques under the same traffic scenarios, scoring its performance regarding traffic rules. Robesafe researching group, from Universidad de Alcalá, submitted to this challenge, with the aim of achieving high results and compare our control and perception techniques with others provided by other teams.

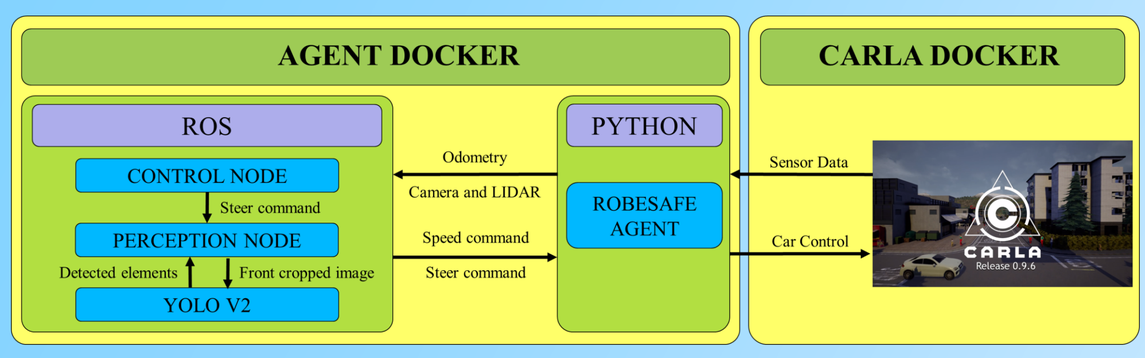
3. CONCLUSIONS

More over 200 participants around the world tried to submit their proposal for Carla Challenge, but only around 10 of them (including **Robesafe**) could success it due to docker structure was a really problem to cope with.

Robesafe reached the fourth position in Carla AD Challenge Track-3 achieving the lowest number of penalties among the 5 leaders of the final results.

Ranking	Route points	Infraction points	Total average
1st Team	79.97	13.7	66.83
2nd Team	77.48	11.87	66.05
3rd Team	81.05	20.9	60.47
4th Robesafe	**60.48**	**9.9**	**52.63**
5th Team	48.93	13.67	35.87

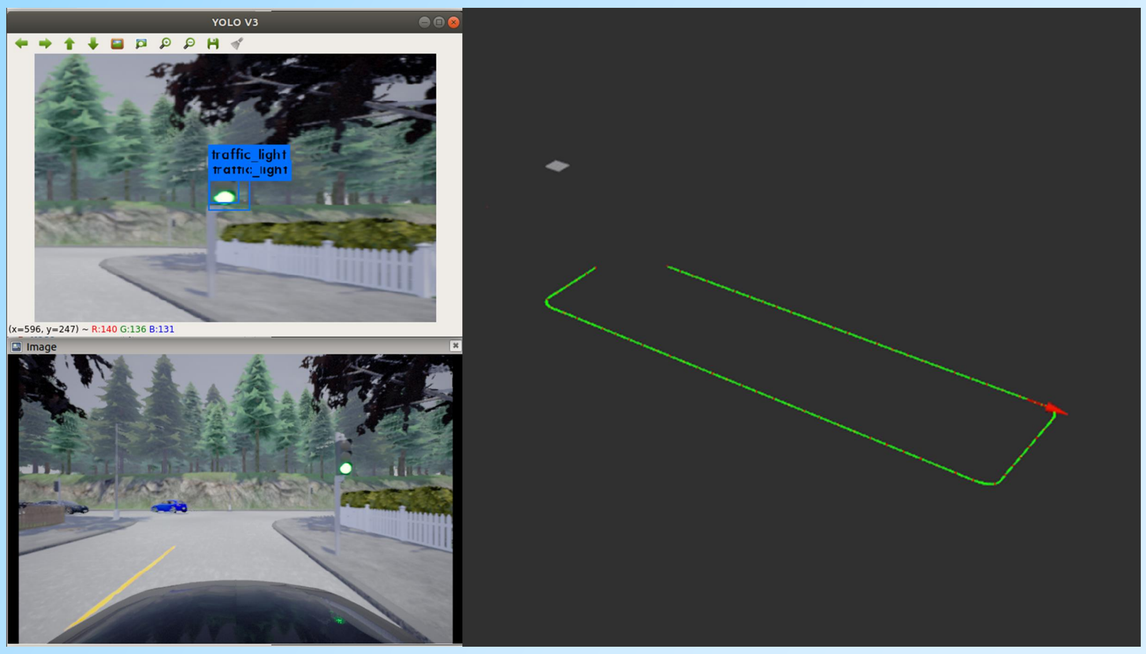
2. RESULTS



Robesafe researching group submitted to this challenge in Track3, where HD Map, waypoints and environmental sensors data (LiDAR, RGB cameras and GPS) were provided. Waypoints were followed by a PID control with GPS data, following different routes established by the challenge. RGB frontal camera was processed by YOLO CNN to recognize car surroundings and react to different agents like traffic-lights, pedestrians, STOP signals and cyclists. LiDAR information was used to keep safety distance to other vehicles, avoiding crashes when following the waypoints path.

Control and detection modules (programmed in C++) along with car agent (in Python) were included inside a Docker, which was sent to CARLA Server through EvalAI. This container communicates with CARLA Simulator, performing several traffic situations in different environments during 24 hours, returning the performance score according to traffic rules (such as hitting another vehicle or running a red light) and percentage of route completed.

CARLA 0.9.5 and ROS Kinetic were used to develop the Challenge, along with Ubuntu 16.04.



The previous picture shows YOLO image detecting a traffic light on the upper left, front image from car dashboard on the lower left and waypoints trajectory (green line) along with car position and orientation (red arrow) on the right side.

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