Object Detection for Automotive and Aerospace Applications: reliability challenges and solutions
Polo Fabio Ferrari 2, via Sommarive 9, Trento

Speaker Lecturer: Paolo Rech
Universidade Federal do Rio Grande do Sul

Seminar room: 9.30 a.m. – 12.30 a.m.

The main goal of this course is to provide students with an overview of the challenges associated with the hardware and software necessary for an application, such as object detection, that represents one of the major advances in the technology for computing devices. All the major cars builder and chip designers are targeting self-driven vehicles and the NASA’s JPL Perseverance mission launched at the end of July 2020, for instance, includes the first autonomous vehicle used for space exploration. The course proposes a revision of basic concepts of real-time systems, parallel or programmable architectures, safety-critical systems, and approximate computing. These concepts are used and applied to deeply understand the object detection frameworks based on neural networks and their application in automotive and aerospace markets. A study of the limitations in terms of reliability and of the problems that can affect the correct execution of software and hardware will be presented. The focus will be on the study of both the hardware and the software necessary to detect object in a scene in real time. The problems and the constraints related to the security and reliability that can influence a safety-critical system will be considered.

The main topics covered during the course are:
- Introduction. Safety-critical applications concepts
- Automotive and aerospace applications
- Parallel and Programmable processors
- Approximate computing and energy consumption
- Object detection: state of the art
- Convolution and Activation function
- Neural networks based object detection
- CNNs in GPUs and FPGAs
- GPUs, FPGAs, what else? Automotive vs Aerospace
- Standard ISO 26262.
- Faults in hardware, errors in software.
- Hardening techniques for object detection.
- Energy consumption, execution time, precision, fault tolerance: can we have it all?

Info
DII - Dipartimento di Ingegneria Industriale
Tel. +39 0461 282500 - 2503
dii.supportstaff@unitn.it