UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PhD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Seminar announcement

Thursday 16 January 2025, Time: 10:30 - 11:30
Room I.6, Building I, DIETI - Via Claudio, 21 - NAPOLI

Prof. Paolo Rech

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Can we Rely on AI? Reliability Issues in Artificial Neural Networks and Potential Solutions for Autonomous Vehicles

Abstract: Driverless cars are the new trend in the automotive market and, to burst deep space exploration, NASA and ESA are willing to add self-driving capabilities to their rovers. Ingenuity, landed in Mars in 2021, is the first autonomous vehicle to move outside of the Earth. To be implemented, a self-driving system needs to analyze a huge amount of images and signals in real time. This is achieved thanks to Convolutional Neural Networks (CNNs) executed on Graphics Processing Units (GPUs) or dedicated accelerators implemented in Field Programmable Gate Arrays (FPGAs) or in Application Specific Integrated Circuits (ASICs), such as the Google's Tensor Processing Unit (TPU). In the talk, after a brief description of radiation effects at physical level, we will investigate the reliability of GPUs, FPGAs, and TPUs executing neural networks, we will show if and why a neutron-induced corruption can modify the autonomous vehicles behaviors, and discuss the implications of these corruptions for the adoption of self-driving vehicles in large scale. The evaluation, to be accurate and precise, is based on the combination of beam experiments and fault injection at different levels of abstractions (RTL, microarchitectural, and software). This combination allows us to have a realistic evaluation of the error rate, distinguish between tolerable errors and critical errors, and to design efficient and effective hardening solutions for neural networks. Exploiting the potential of machine learning and taking full advantage of the computing resources in modern accelerators it is possible to significantly improve the neural network reliability with nearly-zero overhead.

Lecturer short bio: *Paolo Rech received his master and Ph.D. degrees from Padova University, Padova, Italy, in 2006 and 2009, respectively. He was then a Post Doc at LIRMM in Montpellier, France. Since 2022 Paolo is an associate professor at Università di Trento, in Italy and since 2012 he is an associate professor at UFRGS in Brazil. He is the 2019 Rosen Scholar Fellow at the Los Alamos National Laboratory, he received the 2020 impact in society award from the Rutherford Appleton Laboratory, UK. In 2020 Paolo was awarded the Marie Curie Fellowship at Politecnico di Torino, in Italy. His main research interests include the evaluation and mitigation of radiation-induced effects in autonomous vehicles for automotive applications and space exploration, in large-scale HPC centers, and quantum computers.*

For information: Dr. Edoardo Giusto (DIETI, UniNA) – edoardo.giusto@unina.it *(organizer)*