## Contact

**Supervisor**  
Marco Maratea  
marco.maratea@unige.it

**Contact**  
www.dibris.unige.it

## Context of the research activity

Artificial Intelligence is now becoming ubiquitous and an asset for many industrial sectors such as the one of transportation. New generation information systems collect and store large amounts of heterogeneous data, which allow Machine Learning algorithms to induce Data Driven models of complex physical systems. They scale well with the amount of data available, but they are not as effective if exploited for deduction purposes. On the contrary, Model Based Reasoning allows to model, in an effective way, such complex systems, based on the physical knowledge about them and deduce meaningful information by solving complex planning and scheduling optimization problems. Unfortunately, it is well known that they may not scale well with the size of problem. Therefore, a synergy between Machine Learning and Model Based Reasoning is required.

This research falls in the context of the RAIDLab (Railway Artificial Intelligence and Data Analysis Laboratory): a joint lab between Hitachi Rail STS and the Department of Informatics Bioengineering, Robotics, and System Engineering (DIBRIS) of the University of Genoa (UNIGE)  
www.raidlab.unige.it

## Objectives

Rail transport is probably the most sustainable, whether in terms of carbon emissions, energy consumption, use of space, or noise levels.

In Europe the increasing volume of people and freight transported on railways is congesting the network. The only viable solution to increase capacity, in the short/medium term, is then to improve the efficiency to be able to control a larger number of running trains without requiring massive public investments in new physical assets.

Extensive research is then needed to leverage on advanced ICT solutions, Artificial Intelligence (AI)-based especially, to improve system safety and service reliability, to provide higher transit capacity, and to reduce operational costs.

In order to achieve these goals this research focuses on combining Machine Learning (Shallow and Deep models) with Model Based reasoning (planning and scheduling with knowledge representation and reasoning languages such as PDDL and ASP) taking the best of the two worlds in solving the complex prescription problem required to optimize the railway infrastructure (both in terms of maintenance and operations).
| Skills and competencies for the development of the activity | • Advance notions of Artificial Intelligence, especially in the Planning and Scheduling domain  
• Basic notions of Machine Learning, especially in the context of predictive and prescriptive analytics |