

PhD in Physics Scholarship Title	Photonic neural networks
Contacts.:	Lorenzo Pavesi (lorenzo.pavesi@unitn.it) Mattia Mancinelli (mattia.mancinelli@unitn.it)
Synthetic description of the activity and expected research outcome	<p>Artificial Neural Networks (ANN) are computational network's models that mimics how biological neurons elaborate data. These models have dramatically improved the performance of many learning tasks, including speech and object recognition.</p> <p>The scientific community developed specific electronic architectures that directly behaves as an ANN trying to improve the computational speed and energy efficiency. Photonics already boosted the telecom field to a new performance level by exploiting the huge data handling capabilities, speed and flexibility of optical fibres. The same paradigm is going to be applied to the ANN.</p> <p>The project is inserted in this context where optics will be exploited to find new ways to implement ANN schemes directly inspired to the biology. The brain is composed of a huge number of neurons deeply interconnected between each other; therefore, we will exploit integrated optics to pack several thousand of optical artificial neurons with specific interconnection topology in a microchip smaller than 1 euro. The packing capabilities allow scaling up the number of artificial neurons that is directly related to the network "intelligence".</p> <p>The aim of the PhD project is to use the unique advantages of optics to create an ANN able to elaborate ultrafast optical signal that can learn from the experience. The candidate will follow the whole path from the simulation of the ANN, to the design, to the test of the ANN. Several different ANN will be elaborated and tested to demonstrate the capability of photonics to compute at the speed of light.</p> <p>This PhD will be part of the ERC-funded BACKUP project (P.I. Prof. Lorenzo Pavesi, Dept. of Physics). More info at https://r1.unitn.it/back-up/</p>
Ideal candidate (skills and competencies):	We are seeking for a highly motivated and passionate student, with a strong attitude to work in a collaborative and interdisciplinary team, and with a background in photonics and, possible, in machine learning.