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Título del proyecto: *Time and wavelength multiplexing in photonics neural networks*

Descripción del proyecto

Delay-based reservoir computing has emerged as an alternative scheme to perform non-conventional computation. The main idea behind the concept is that a physical network of a large number of nodes could be replaced by a single non-linear node subject to delay feedback [1]. The real nodes of the physical network are replaced by virtual nodes in the delay-based system using time-multiplexing. This scheme has been shown to be extremely efficient in several benchmark tasks and in particular very suitable for hardware implementations in photonics [2].

The objective of this work is to extend the possibilities of this already successful scheme by using multi-wavelength non-linear systems (e.g., a multi-mode semiconductor laser), aiming at gaining more processing capabilities with less virtual nodes, i.e., shorter delay feedback. This would open the possibility of using short integrated delay-based reservoir computing systems for ultra-fast machine learning applications.

- [1] "*Information processing using a single dynamical node as complex system*", L. Appeltant, M.C. Soriano, G. Van der Sande, J. Danckaert, S. Massar, J. Dambre, B. Schrauwen, C.R. Mirasso and I. Fischer, *Nature Communications*, **2**, 468 (2011).
- [2] "*Parallel photonic information processing at gigabyte per second data rates using transient states*", D. Brunner, M.C. Soriano, C.R. Mirasso and I. Fischer, *Nature Communications* **4**, 1364 (2013).