Optomechanical Oscillator Network for Neuromorphic Computation

Andrea Gaspari[*1], **Rémi Avriller**[1], **and Fabio Pistolesi**[1]

[1]*LOMA - Laboratoire des ondes et matiere d'Aquitaine - UMR5798*
351 Cours de la Libération, 33405 Talence Cedex, France
[*]contact: andrea.gaspari@u-bordeaux.fr

As neural networks develop to tackle increasingly complex tasks, we are witnessing a significant and rapid growth of the computational resources required. This trend highlights the interest for alternative approaches that can offer efficient and scalable implementations. In this context, designing physical platforms for neural networks provides a promising option [1].

In the present work, we consider a system of coupled phase oscillators, namely optomechanical oscillators [2,3], with the aim of leveraging their nonlinear behaviour to perform neuromorphic computing. In particular, we investigate the possibility of using this kind of network to execute simple tasks based on supervised learning, such as the XOR and the classification of Iris flowers. Performances and results are compared with those of ordinary artificial neural networks.

[1] D. Marković, A. Mizrahi, D. Querlioz, J. Grollier, Nature Reviews Physics 2, 499 (2020).
[2] F. Marquardt, J. G. E. Harris, S. M. Girvin, Phys. Rev. Lett. 96, 103901 (2006).
[3] G. Heinrich, M. Ludwig, J. Qian, B. Kubala, F. Marquardt, Phys. Rev. Lett. 107, 043603 (2011).