Exciton-polariton condensate neural network in disorder potential

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The implementation of technological solutions based on artificial intelligence has a significant impact on the global economy. The search for new solutions to optimize the performance of neural networks and the study of physical systems that implement neural computational models is an increasingly important aspect of modern science and technology. In this work we present reservoir neurocomputing [1,2] based on the properties of exciton-polariton condensates generated by a set of nonlinear and randomly coupled condensate modes trapped in the disorder lattices or external disorder potential [3]. To describe the complex evolution of exciton-polariton condensate we use mean-field open dissipative Gross-Pitaevskii equation. The effectiveness of the tested systems will be verified by the pattern recognition task. We detail to examine the neural networks effectiveness with different dimensionality and various types of disorder potential in their structure. We determine the efficiency of the neural network depending on the physical parameters of exciton-polariton condensate, external potential and Langevin noise term. The result of this work will be the answer to a fundamental question from the perspective of further research: how to design the effective neural network based on the nonlinear dynamics of exciton-polariton condensates in disorder potential?

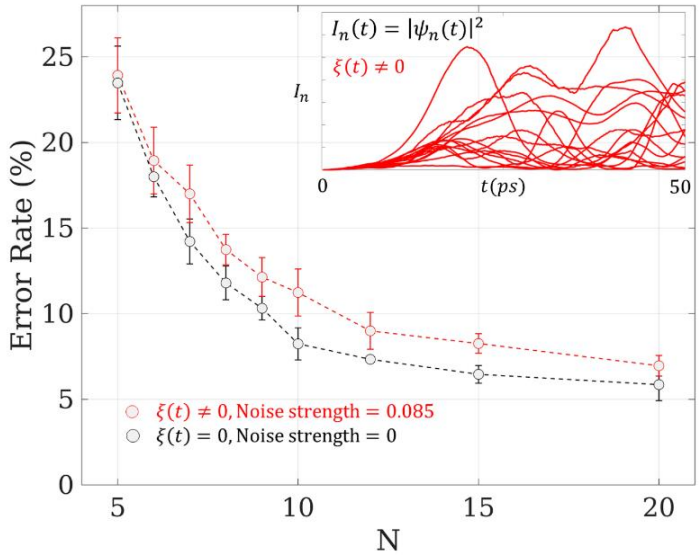

Fig.1 Dependence of the error rate on the linear size of the lattice N for the pattern recognizing task, in the cases with and without noise. The red lines are the density of condensate modes used to data classify.

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