

Random lasers as a primary component of photonic neural networks

CSIC has developed a new photonic platform in which artificial intelligence is implemented by means of random neural networks of coupled stochastic lasers, achieving a device consisting of a network of laser resonators that function as a photonic neural network. The devices have low complexity and cost to manufacture.

Industrial partners interesting in the development of random neural networks for artificial intelligence are being sought to collaborate through a patent licence agreement.

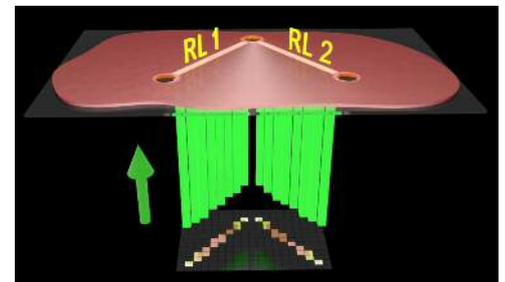
An offer for Patent Licensing

Coupled laser resonator network

The progress in artificial intelligence and its applications have been one of the main scientific advances in 2020. The CSIC team has achieved the first experimental demonstration of the potential of coupled random lasers as primary components of photonic neural networks.

The omni-directional emission of random lasers facilitates the implementation of complex networks where each laser is coupled to several and many interconnected resonators participate in a collective oscillator. The devices are fabricated by punching microscopic holes in a thin film of dye-doped biopolymer and optically pumping the segment that joins them. These holes act as mirrors and, due to their natural roughness, act as diffusion centers. As each hole can belong to several resonators, these can be coupled forming stars, chains or any imaginable configuration.

This architecture features a small footprint, low complexity and low manufacturing cost, and intrinsically incorporates the non-linearity inherent in lasers, making it a worthy candidate for embodying large-scale optical neural networks. These may be the basic elements of photonic neural networks equivalent to transistors



Schematic of the random lasers network

Main innovations and advantages

- The connection of multiple resonators (segments joining two diffuser centers) is simple and allows creating a network of any complexity.
- The random nature of these devices reduces the demands for precision in manufacturing and, therefore, the cost
- The design of the network is flexible and does not require precision in the location of the diffuser centers.
- The non-linear nature of the laser action is implicit in the operation of the components.
- The manipulation of the elements is electronic through an SLM and therefore easy to control externally

Patent Status

European patent application filed suitable for international extension

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