Meta-plasticity and memory in multi-level recurrent feed-forward networks

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Network systems can exhibit memory effects in which the interactions between different pairs of nodes adapt in time, leading to the emergence of preferred connections, patterns, and sub-networks. To a first approximation, this memory can be modeled through a "plastic" Hebbian or homophily mechanism, in which edges get reinforced proportionally to the amount of information flowing through them. However, recent studies on glia-neuron networks have highlighted how memory can evolve due to more complex dynamics, including multi-level network structures and "meta-plastic" effects that modulate reinforcement.

Inspired by those systems, we have developed a simple and general model for the dynamics of an adaptive network with an additional meta-plastic mechanism, that we name "meta-reinforcement", that varies the rate of Hebbian strengthening of its edge connections. Specifically, we consider a biased random walk on a cyclic feed-forward network. The random walk chooses its steps according to the weights of the network edges. The weights evolve through a Hebbian mechanism modulated by a meta-plastic reinforcement, biasing the walker to prefer edges that have been already explored. We study the dynamical emergence (memorisation) of preferred paths and their retrieval and identify three regimes: one dominated by the Hebbian term, one in which the meta-reinforcement drives memory formation, and a balanced one. Most importantly, we show that meta-reinforcement allows the retrieval of the memorized path even when all weights have been reset, erasing all standard Hebbin memory from the network.

General information:
The seminar will be held at ECT*, Villa Tambosi, Strada delle Tabarelle 286, Villazzano.
We are going to have a coffee break!

To reach Villa Tambosi: take bus number 13 from Povo or bus number 6 from the city center. The bus stops is in front of the Villa.
In order to organize the coffee break we kindly ask you to confirm your presence through the google form that you can find scanning the QR code.

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