Bocconi

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Bocconi University
Room 3-E4-SR03
Via Röntgen 1, Milano (3° floor)

Impact of dendritic non-linearities on the computational capabilities of neurons

Speaker

Enrico Maria Malatesta
Assistant Professor
Bocconi University

Abstract

Recent experiments in neurophysiology, in particular in pyramidal cells, have shown that dendrites have an active role in neuronal computational capabilities, contributing to non-linear synaptic input integration. In this seminar I will model the neuron as a two-layer neural network with non-overlapping synaptic weights endowed with a biologically plausible form of dendritic non-linearity. By studying the model analytically and numerically, I will highlight several key computational advantages of non-linear dendritic integration with respect to previously studied linear neuron models.

Firstly, the dendritic non-linearity enhances the number of possible learned input-output associations and learning speed.

Secondly and most importantly, I will show how synaptic weight sparsity naturally emerges as a consequence of non-linear dendritic integration, and how the model is able to reproduce the synaptic weight distribution recorded in experiments.

Non-linearly induced sparsity comes with a second central advantage for neuronal information processing, i.e. input and synaptic noise robustness and better generalization abilities.

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