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Echo State Networks for Dynamic Aperture prediction

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The Reservoir Computing Echo State Network (ESN) are a class of recurrent neural networks that are computationally effective, since they avoid back-propagation and they require cross-validation only.
They have been proven to be universal approximant of dynamical systems.
We present the performance reached by ESN to predict the long term behavior of the extent of the phase space region in which the motion of charged particle in hadron storage rings is bounded (called dynamic aperture).
In particular, we show that ESN complemented with analytical scaling laws based on the stability-time estimate of Nekhoroshev theorem for Hamiltonian system, are able to predict effectively the time evolution of the dynamic aperture, thus providing an efficient and fast surrogate model.

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Classification de Session: Monday afternoon

Classification de thématique: 8 ML for particle accelerators (only if does not fit in Tracks above)