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LinacNet: a new architecture for linear accelerator surrogate model

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Accelerator physics simulations are a powerful tool for optimizing particle accelerator experiments.
They give accurate predictions of the behavior of the beam along the machine according to the values of the input parameters of the machine.
However, simulations can be lengthy, and this computation time can limit their potential application.
Machine Learning can be used to learn fast-executing surrogate models of the simulation program.
Once the model is learned, multiple experiments can be performed in parallel, allowing fast optimization of the input parameters.

This work proposes a new neural network architecture that incorporates some physical constraints of a linear accelerator.
The novelty of this architecture resides in its modularity and the representation of a beam for learning purposes.
Each module represents the propagation of a beam between two diagnostic stations and receives in input only the relevant input parameters for this section and the representation of the entering beam.

This work is a collaboration between the IJCLab and the LISN at Paris Saclay with data from the ThomX project, an accelerator currently in commissioning at Orsay.

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