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Super-Resolution Surrogate Model for Accelerated Geant4 Simulations

WP6-Spoke2 of ICSC - Italian Research Center on HPC, Big Data and Quantum Computing has a use case dedicated to the integration of machine learning models to enhance Geant4. This is a well-known simulation framework in medical physics that can reproduce particle interactions down to the micrometer scale and below. However, the resources required scale linearly with the complexity of the system being simulated, limiting its effectiveness. Hadrontherapy has been identified as a crucial initial application. It provides users with a valuable tool for calculating dose and linear energy transfer distributions in water or other materials. Our work begins with the generation of a high-fidelity data set using a dense voxel-eluted water phantom to provide a reference for primary and secondary particle interactions. A generative model is then developed and trained on this dataset to reproduce the inherent spatial correlations observed. The goal is to develop a super-resolution surrogate model that can significantly improve the resolution of prediction from lower-resolution input data, with a consistent reduction in the resources required.

Giorno preferito

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