Data-Driven Shadowgraph Simulation of a 3D Object

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Problem Statement:

Fast computation of electromagnetic field propagation Approximation through an object on a large 3D computational domain

Method:

Reduced order data-driven surrogate model

- Dimesionality of the original space is reduced using a convolutional autoencoder
- Solution is approximated in the reduced space using multilayer perceptron \rightarrow acceleration of computations
- Solution is approximated by given point in the domain of configurations avoiding recurrent computations

Results:

- High quality of reconstruction within the problem of interpolation
- Fast forward to any point of computational domain
- Factor of autoencoder compression is ca. 7020
- Time of reduced solution approximation: 0.28ms Decoding to the original space: 0.18s for a single point
- Acceleration for a single point of factor 4 compared to FTDT method implemented in Meep





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