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CaloGraph: Calorimeter simulation via Graph-based diffusion model

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Calorimeter response simulation is a critical but computationally consuming part of many physics analyses at the Large Hadron Collider. The simulation time and resource consumption can be effectively reduced by the usage of neural networks. Denosing diffusion models are emerging as the state-of-the-art for various generative tasks ranging from images to sets. We propose a new graph-based diffusion model tailored for fast calorimeter simulations, fitting naturally into non-regular detector geometries. We evaluate the model's performance using the ATLAS dataset from the Fast Calorimeter Simulation Challenge 2022, comparing to existing attempts.

Primary authors: KOBYLIANSKII, Dmitrii (Weizmann Institute of Science (IL)); SOYBELMAN, Nathalie (Weizmann Institute of Science (IL))

Co-authors: GROSS, Eilam (Weizmann Institute of Science (IL)); DREYER, Etienne (Weizmann Institute of Science (IL))

Presenter: KOBYLIANSKII, Dmitrii (Weizmann Institute of Science (IL))

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