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A Lorentz-Equivariant Transformer for All of the LHC

We show that the Lorentz-Equivariant Geometric Algebra Transformer (L-GATr) yields state-of-the-art performance for a wide range of machine learning tasks at the Large Hadron Collider. L-GATr represents data in a geometric algebra over space-time and is equivariant under Lorentz transformations. The underlying architecture is a versatile and scalable transformer, which is able to break symmetries if needed. We demonstrate the power of L-GATr for amplitude regression and jet classification, and then benchmark it as the first Lorentz-equivariant generative network. For all three LHC tasks, we find significant improvements over previous architectures.

AI keywords

Transformer; geometric deep learning; generative modeling; equivariant neural networks

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Track Classification: Simulations & Generative Models