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Interpretable Deep Learning for Event Reconstruction in IceCube

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Event reconstruction is a critical step in the analysis of data at the IceCube Neutrino Observatory. Traditional maximum-likelihood methods, while provably optimal under certain conditions, can be computationally expensive and infeasible in practice. A reconstruction method is presented that combines the statistical rigor of maximum-likelihood estimation with the powerful representation learning capabilities of deep neural networks. By leveraging domain knowledge and exploiting inherent symmetries in the problem, a highly interpretable deep learning model is developed that improves event reconstruction accuracy and computational efficiency. The model not only achieves state-of-the-art performance but also provides robust generalization along built-in symmetries.

Type of Contribution

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