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OmniLearn: A Method to Simultaneously Facilitate All Jet Physics Tasks

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Machine learning has become an essential tool in jet physics. Due to their complex, high-dimensional nature, jets can be explored holistically by neural networks in ways that are not possible manually. However, innovations in all areas of jet physics are proceeding in parallel. We show that large machine learning models trained for a jet classification task can improve the accuracy, precision, or speed of all other jet physics tasks. This is demonstrated by training a large model on a particular multiclass classification task and then using the learned representation for a different classification task, for a dataset with a different (full) detector simulation, for jets from a different collision system (*pp* versus *ep*), for generative models, for likelihood ratio estimation, and for anomaly detection. Our OmniLearn approach is thus a foundation model and is made publicly available for use in any area where state-of-the-art precision is required for analyses involving jets and their substructure.

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