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Moment Pooling: Gaining Performance and Interpretability Through Physics Inspired Product Structures

As machine learning begins to play an increasingly larger role in high energy physics, it is important to understand and interpret what precisely these models learn. In this work, we propose Moment Pooling architectures, which generalizes the summation in standard Deep Sets architectures to an arbitrary multivariate moments. This can be used to drastically decrease latent space sizes, significantly improving the model's interpretability while maintaining performance. We show that this is particularly useful in jet physics, where many existing useful jet observables can be naturally expressed in this form. We then show several examples of how the Moment Pooling architecture may be used in jet tagging, as well as how this structure can provide insight on the complexity of jet observables.

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