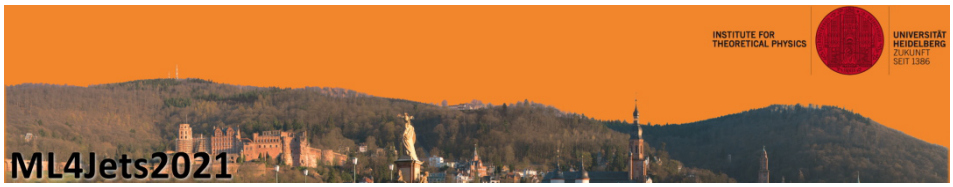

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Particle Convolution for Jets

Tuesday 6 July 2021 10:00 (20 minutes)

We introduce the Particle Convolution Network (PCN), a new type of equivariant neural network layer suitable for many tasks in jet physics. The particle convolution layer can be viewed as an extension of Deep Sets and Energy Flow network architectures, in which the permutation-invariant operator is promoted to a group convolution. While the PCN can be implemented for various kinds of symmetries, we consider the specific case of rotation in the $\eta - \phi$ plane. In two standard benchmark tasks, q/g tagging and top tagging, we show that the rotational PCN (rPCN) achieves performance comparable to graph networks such as ParticleNet. Moreover, we show that it is possible to implement an IRC-safe rPCN, which significantly outperforms existing IRC-safe tagging methods on both tasks. We speculate that by generalizing the PCN to include additional convolutional symmetries relevant to jet physics, it may outperform the current state-of-the-art set by graph networks, while allowing some control over physically-motivated inductive biases.

Affiliation

Yale University

Academic Rank

Postdoc

Author: SHIMMIN, Chase Owen (Yale University (US))

Presenter: SHIMMIN, Chase Owen (Yale University (US))

Session Classification: New architectures