Zero-Permutation Jet Parton Assignment

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For many top quark measurements, it is essential to reconstruct the top quark from its decay products. For example, the top quark pair production process in the all-jets final state has six jets initiated from daughter partons and additional jets from initial/final state radiation. Due to the many possible permutations, it is very hard to assign jets to partons. We use a deep neural network with an attention-based architecture together with a new objective function to the jet-parton assignment problem. Our novel deep learning model and the physics-inspired objective function enable jet-parton assignment with high-dimensional data while the attention mechanism bypasses the combinatorial explosion that usually leads to intractable computational requirements. The model can also be applied as a classifier to reject the overwhelming QCD background, showing increased performance over standard classification methods.

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