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Optimal Transport for Jet Physics

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Optimal Transport (OT) has been applied to jet physics in defining a notion of the distance between collider events. Here we generalize the Energy Mover's Distance to a larger space of OT distances, including both the balanced 2-Wasserstein (W2) distance and the unbalanced Hellinger-Kantorovich (HK) distances. Whereas the W2 distance only allows for mass transportation, the HK distances allow mass to be transported, created and destroyed, thereby naturally incorporating the total pT difference of the jets. Both distances possess a Riemannian structure that lends itself to efficient linearization. We develop the particle linearized unbalanced Optimal Transport (pluOT) framework for collider events based on the linearized W2 and HK distances and demonstrate their respective efficacy in boosted jet tagging. This provides a flexible and computationally efficient framework of OT coupled with simple machine learning methods ideally suited for collider physics applications.

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