

Set2Graph: Secondary Vertex finding in Jets with Neural Networks

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(due to slow internet connection : youtube video + recording of Q&A)

Secondary vertex finding is a crucial task for identifying jets containing heavy flavor hadron decays. Bottom jets in particular have a very distinctive topology of $b \rightarrow c \rightarrow \mu$ decay which gives rise to two secondary vertices with high invariant mass and several associated charged tracks.

Existing secondary vertex finding algorithms search for intersecting particle tracks, and group them into secondary vertices based on geometrical constraints. We propose an algorithm where the vertex finding step is performed with a graph neural network. Tracks are represented as objects in an unordered set, and our proposed model learns a function from this set to a graph that represents the vertex structure in the jet. We prove that models with this structure have maximal expressive power for all (continuous) set to graph functions.

We present performance metrics for evaluating vertex finding performance, and compare the performance of several different graph network architectures on a simulated dataset.

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Session Classification: Workshop

Track Classification: 1 ML for data reduction : Application of Machine Learning to data reduction, reconstruction, building/tagging of intermediate object