12th Edition of the Large Hadron Collider Physics Conference

Contribution ID: **115** Type: **not specified**

Flavour Tagging with Graph Neural Network with the ATLAS Detector

Flavour-tagging is a critical component of the ATLAS experiment physics programme. Existing flavour tagging algorithms rely on several low-level taggers, which are a combination of physically informed algorithms and machine learning models. A novel approach presented here instead uses a single machine learning model based on reconstructed tracks, avoiding the need for low-level taggers based on secondary vertexing algorithms. This new approach reduces complexity and improves tagging performance. This model employs a transformer architecture to process information from a variable number of tracks and other objects in the jet in order to simultaneously predict the jet's flavour, the partitioning of tracks into vertices, and the physical origin of each track. The inclusion of auxiliary tasks aids the model's interpretability. The new approach significantly improves jet flavour identification performance compared to existing methods in both Monte-Carlo simulation and collision data. Notably, the versatility of the approach is demonstrated by its successful application in boosted Higgs tagging using large-R jets.

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Session Classification: Poster Session

Track Classification: Performance and Upgrade Tools