

Understanding Machine Learning Features for High Energy Physics

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For this project, we have decided to do something from our field of study. We are both physics majors, so we decided to contact Professor Hsu, who is working on particle physics using data from the Large Hadron Collider (LHC). Some of the data he and his team have been working on is so large, he says their work will become too costly (computing) unless they use machine learning models to aid in their analysis. So we want to look at some of the things they've been doing as it relates to some of the things we've done in class, and it is of interest to us. Professor Hsu sent us a sample his research students have been looking at, and we want to get a sense of how researchers in our field of interest are applying tools we've learned in this course.

1. Summary of research questions and results

Large Hadron Collider (LHC)

1. Count the number of jets - a group of collimated particles. One of the primary difficulties at the Large Hadron Collider (LHC) is to be able to identify and classify various groups of collimated particles. So how can we count the numbers of jets in our dataset?

[This is important because jets can be used as a proxy for a fundamental particle]

We were able to successfully count the number of jets in our dataset. A specific count (data table) is reported below.

2. Study High-Level features. We want to understand the high-level features of the data.

High-level features: `j_*` ('computed from the low-level features')

(Jet kinematics: `'j_mass_m'`)

We were able to plot the high-level features. High-level feature plots are shown in the next section.

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