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Machine learning techniques for heavy-flavour baryon production measurements at the LHC

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Quark-gluon plasma (QGP) is a state of matter predicted by quantum chromodynamics. The ALICE experiment at LHC has among its main goals the study of strongly interacting matter and the properties of QGP through collisions of ultra-relativistic heavy ions. For a comprehensive understanding of these properties, the same measurements made on smaller colliding systems (proton-proton and proton-ion collisions) are needed as a reference. Recent analyses of the data collected at ALICE have shown that our understanding of the hadronization mechanisms of heavy quarks is not complete, because the data obtained in pp and p-Pb collisions are not reproducible using models based on the results obtained in e+e- and ep collisions. For this reason, new theoretical and phenomenological models capable of reproducing experimental measurements have been proposed. The errors associated with these new experimental measurements at present do not allow definitive validation of the various proposed models. Therefore, increasing the precision of such experimental measurements will be crucial in the coming years; on the other hand, estimating the number of different particle species produced in a collision can be extremely complicated.
In this thesis, the number of baryons Λ_c^+ produced in a data sample was obtained using machine learning techniques, which can learn patterns and distinguish signal candidates from background candidates. Three different implementations of a Boosted Decision Trees (BDT) algorithm were also compared and the one with the best performance was used to reconstruct the Λ_c^+ baryon in pp collisions collected by the ALICE experiment.

Title

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