Contribution ID: **51**   Type: **Regular talk**

Particle identification with machine learning in ALICE Run 3

Thursday 12 May 2022 14:25 (25 minutes)

Particle identification (PID) is an essential ingredient of many measurements performed by the ALICE Collaboration. The ALICE detectors provide PID information via complementary experimental techniques, allowing for the identification of particles over a broad momentum interval ranging from about 100 MeV/c up to 20 GeV/c. The biggest challenge lies in combining the information from the different detectors. Up to now, in ALICE, particles were identified by hand-crafted selections based on the detector signals and by the Bayesian method.

We propose to use machine learning methods to classify particle species, aiming to better exploit the detector information and to improve identification in the regions where different particle species give overlapping signals. During LHC Run 2, preliminary studies were pursued by using Random Forests [1] with the tree generation based on the Gini index. This method resulted in much higher efficiencies and purities for selected particles than standard techniques.

For the coming Run 3, a more advanced approach based on Domain Adaptation Neural Networks is under investigation (https://indico.bnl.gov/event/10699/contributions/53933/, proceedings accepted in JINST). The new approach accounts for the discrepancies between the Monte Carlo simulations and the experimental data. The algorithm consists of a feature mapping network, whose outputs –domain-invariant features –are inputs to a particle classifier and to a domain classifier. The particle classifier outputs the predicted particle species, while the domain classifier discriminates between the real and simulated data. The classifiers are trained independently. Preliminary studies show that domain adaptation improves particle classification. This solution will be integrated in the ALICE Run 3 Analysis Framework. Preliminary results for the PID of selected particle species will be discussed as well as the possible optimizations and further developments.

[1] Tomasz Trzciński, Łukasz Graczykowski, Michał Glinka, ALICE Collaboration, et al. Using Random Forest classifier for particle identification in the ALICE experiment. In Conference on Information Technology, Systems Research and Computational Physics, pages 3–17. Springer, 2018.

Authors: DEJA, Kamil Rafal (Warsaw University of Technology (PL)); GRACZYKOWSKI, Lukasz Kamil (Warsaw University of Technology (PL)); KABUS, Maja (Warsaw University of Technology (PL)); SAWICKI, Lukasz (Warsaw University of Technology (PL)); JAKUBOWSKA, Monika Joanna (Warsaw University of Technology (PL))

Presenter: KABUS, Maja (Warsaw University of Technology (PL))

Session Classification: Workshop