Title: Exploring jet calibration with machine learning techniques

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Abstract: Jets, collimated sprays of particles, are considered to be a perfect probe of the matter created at heavy-ion collisions. The work explores the possibility of using machine learning techniques to improve the overall calibration of jet energy scale and its resolution for ATLAS experiment calorimeters, which are used in the research of lead nucleus collisions. First, the current performance of jet reconstruction quantified by mean response and energy resolution dependence on the value of transverse momentum, pseudorapidity, and centrality of collisions is shown. It is further discussed that the current calibration does not take into account whether the jets are induced by a quark or gluon. Subsequently, four variables are selected, which might be used to distinguish between these two groups of jets. The dependence of the response on those quantities and on centrality is further studied. The last part describes the process of the preparation of a training data set, set up of the neural network, and the analysis of it using tools provided by the MultiLayerPerceptron library of the ROOT framework. The final result of the work is a neural network that improves the resolution of the response.

Keywords: ATLAS, heavy ions, jet energy calibration, neural networks