Contribution ID: **120** Type: **not specified**

Hyperparameter Optimization for Deep Learning Models Using High-Performance Computing

Clusters counting in a drift chamber represents a highly promising breakthrough in particle identification (PID) techniques for particle physics experiments. In this paper, we trained neural network models, including a Long Short-Term Memory (LSTM) model for the peak-finding algorithm and a Convolutional Neural Network (CNN) model for the clusterization algorithm, using various hyperparameters such as loss functions, activation functions, numbers of neurons, batch sizes, and different numbers of epochs. These models were trained utilizing high-performance computing (HPC) resources provided by the ReCas computing center. The best LSTM peak-finding model was selected based on the highest area under the curve (AUC) value, while the best CNN clusterization model was chosen based on the lowest mean square error (MSE) value among all configurations. The training was conducted on momentum ranges from 0.2 to 20 GeV.
The trained models (LSTM and CNN) were subsequently tested on samples with momenta of 4 GeV/c, 6 GeV/c, 8 GeV/c, and 10 GeV/c. The simulation parameters included 10% Helium (He) and 90% Isobutane (C4H10), a cell size of 0.8 cm, a sampling rate of 2 GHz, a time window of 800 ns, 5000 events, and a 45-degree angle between the muon particle track and the z-axis (sense wire) of the drift tube chamber. The testing aimed to evaluate the performance of the LSTM model for peak finding and the CNN model for clusterization.

Giorno preferito

Primary author: ANWAR, Muhammad Numan (Istituto Nazionale di Fisica Nucleare)

Co-authors: DIACONO, Domenico; GRANCAGNOLO, Francesco; ZHAO, Guang; WU, Linghui; ABBRESCIA, Marcello; DONG, Mingyi; DE FILIPPIS, Nicola; SUN, Shengsen

Presenter: ANWAR, Muhammad Numan (Istituto Nazionale di Fisica Nucleare)