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Exploration of different parameter optimization algorithms within the context of ACTS software framework

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The particle track reconstruction is one of the most important part of the full event reconstruction chain and has a profound impact on the detector and physics performance. The underlying tracking software is also very complex and consists of a number of mathematically intense algorithms, each dealing with a particular tracking sub-process. These algorithms have many input parameters, to be supplied beforehand. However, it is very difficult to know the best configuration of these parameters that can yield in a highly efficient outcome. Currently, the input value of these parameters is decided mainly on the basis of prior experience and some brute force techniques. A parameter optimization approach that is able to automatically tune these parameters for high efficiency and low fake and duplicate rate is highly desirable. In this current study, we are exploring various machine learning based optimization methods to devise a suitable technique that can be used to optimize parameters in complex tracking environment. These methods are evaluated on the basis of a metric that targets high efficiency while keeping the duplicate and fake rates small. We are mainly focusing on the derivative free optimization approaches that can be applied to the problems involving non-differentiable loss functions. For our studies, we are considering the tracking algorithms defined within A Common Tracking Software (ACTS) framework. We are testing our methods using simulated data from ACTS software corresponding to the Generic detector and the ATLAS Inner Tracker (ITk) detector geometries.

Consider for young scientist forum (Student or postdoc speaker)

Yes

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