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Track Seed Filtering using Convolutional Neural Network at the CMS High Level Trigger

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Since Run II, future development projects for the Large Hadron Collider will constantly bring nominal luminosity increase, with the ultimate goal of reaching a peak luminosity of $5 \cdot 10^{34} cm^{-2} s^{-1}$ for ATLAS and CMS experiments planned for the High Luminosity LHC (HL-LHC) upgrade. This rise in luminosity will directly result in an increased number of simultaneous proton collisions (pileup), up to 200, that will pose new challenges for the CMS detector and, specifically, for track reconstruction in the Silicon Pixel Tracker.

One of the first steps of the track finding workflow is the creation of track seeds, i.e. compatible pairs of hits from different detector layers, that are subsequently fed to to higher level pattern recognition steps. However the set of compatible hit pairs is highly affected by combinatorial background resulting in the next steps of the tracking algorithm to process a significant fraction of fake doublets.

A possible way of reducing this effect is taking into account the shape of the hit pixel cluster to check the compatibility between two hits. To each doublet is attached a collection of two images built with the ADC levels of the pixels forming the hit cluster. Thus the task of fake rejection can be seen as an image classification problem for which Convolutional Neural Networks (CNNs) have been widely proven to provide reliable results.

In this work we present our studies on CNNs applications to the filtering of track pixel seeds. We will show the results obtained for simulated event reconstructed in CMS detector, focussing on the estimation of efficiency and fake rejection performances of our CNN classifier.

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