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Reconstructing silicon pixel hits using neural networks

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Future operation of the LHC and HL-LHC will record a higher number of proton-proton collisions and therefore yield larger data rates and sample sizes. This will further stress real-time triggering systems and offline event reconstruction. Therefore, heterogenous computing systems utilizing both CPU and GPU hardware are being developed at CMS to deal with these tasks. Specifically, the precise reconstruction of silicon pixel hits is an important aspect of tracking at the HLT and offline. However current reconstruction algorithms - the generic and template algorithms - are not optimal for a GPU implementation. In recent years, fast implementations of neural networks have been built on GPU hardware for deep learning. Additionally, neural networks have shown promising results in various ATLAS and CMS tasks over the last few years. We therefore investigate the use of hybrid convolutional neural networks and deep neural networks in local hit reconstruction. We train and test the networks on data from a detailed silicon sensor simulation, Pixelav, tuned to simulate all sensors, including heavily radiation-damaged detectors. We find that the resulting reconstruction algorithms equals, if not outperforms present reconstruction algorithms in the predicted resolutions.

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Yes

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