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End to end learning with an Optical Processing Unit

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Future HEP experiments will have ever higher read-out rate. It is then essential to explore new hardware paradigms for large scale computations. In this work we consider the Optical Processing Unit (OPU) from LightOn, which is an optical device allowing to compute in a fast analog way the multiplication of an input vector of size 1 million by a 1 million x 1 million fixed random matrix, which allows efficient dimension reduction (see e.g. arXiv:2107.11814).
This new computing paradigm has so far not been explored in HEP.

We've used the dataset provided by authors of arXiv:1807.00083 who had explored the use of Convolutional Neural network to classify LHC proton proton collision events directly from the raw calorimeter information (without cluster or jet building).

We've proceeded on setting up a pipeline to map the calorimeter information to the OPU input and train on the OPU correlated output random features with a linear model. We show that the pipeline provides classifying power both directly, or as a complement to more traditional jet information.

Significance

Applying the OPU to a typical HEP problem has not been done before. Some very preliminary results were shown at the CERN IML workshop in 2020 (provided in reference), since then we've gone much deeper in the understanding of the behavior of the OPU. Also we've explored the use of the OPU to provide additional discrimimating power. And we've dropped the tracking application which was not as promising.

References

https://indico.cern.ch/event/852553/contributions/4057150/attachments/2127912/3582939/tr201022_David_Rousseau_OPU_IML.pdf

Speaker time zone

Compatible with Europe

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