4. LUMIN: Lumin Unifies Many Improvements for Networks

LUMIN aims to become a deep-learning and data-analysis ecosystem for High-Energy Physics, and perhaps other scientific domains in the future. Similar to Keras and fastai it is a wrapper framework for a graph computation library (PyTorch), but includes many useful functions to handle domain-specific requirements and problems. It also intends to provide easy access to to state-of-the-art methods, but still be flexible enough for users to inherit from base classes and override methods to meet their own demands.

TMVA contained in CERN's ROOT system, has been the default choice for BDT training for analysis and reconstruction algorithms due to never having to leave ROOT format. With the gradual move to DNN approaches, more scientists are looking to move their data out of ROOT to use the wider selection of tools which are available. Keras appears to be the first stop due to its ease of use, however implementing recent methods in Keras can be difficult, and sometimes requires dropping back to the tensor library that it aims to abstract. Indeed, the prequel to LUMIN was a similar wrapper for Keras (HEPML_Tools) which involved some pretty ugly hacks. The fastai framework provides access to these recent methods, however doesn't yet support sample weights to the extent that HEP requires. LUMIN aims to provides the best of both, Keras-style sample weighting and fastai training methods, while focussing on columnar data and providing domain-specific metrics, plotting, and statistical treatment of results and uncertainties.

Online documentation may be found at https://lumin.readthedocs.io/en/stable

For an introduction and motivation for LUMIN, checkout this talk from IML-2019 at CERN: video, slides.

This work is part of a more general effort to develop new statistical and machine learning techniques to use in High Energy Physics analyses within within the AMVA4NewPhysics project, which is supported by the European Union's Horizon 2020 research and innovation programme under Grant Agreement number 675440.

Step-by-step guide

1. Install the package according to https://lumin.readthedocs.io/en/stable/#installation
2. Several examples are present in the form of Jupyter Notebooks, that can be run also on Google Colab: https://github.com/GilesStrong/lumin#examples

Presentation made on 27 Jul 2020 : https://agenda.infn.it/event/23648/contributions/118759/attachments/74370/94573/GS_ml-infn_27-07-20.pdf

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