Development of LSTM and GRU Layers in TMVA

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LSTM and GRUs

- Variants of vanilla RNNs used to analyzing and processing time series data, and are able to model long term dependencies
- These layers have many important applications in the realm of data analysis for particle physics experiments
- As an example, LSTMs can be used for track reconstruction of charged particles in the Large Hadron Collider (LHC)
- They can also be used for analyzing the voltage time series from the electronic monitoring system present in superconducting LHC magnets.
Implementation Structure - LSTM and GRU

- LSTM and GRU are both implemented as classes and extend the GeneralLayer Class
- These classes have forwardPass() and backwardPass() functions as their methods
- The backwardPass() function calls within it an architecture specific ‘backward’ function
- ParseLSTMLayer(), ParseGRULayer() - parse the string description of these layers to create a new layer class
- AddLSTMLayer(), AddGRULayer() - once the layers have been created add them to a deep net
Tasks Completed

- Forward pass for LSTM layer for CPU and Ref (implementation and testing)
- Backward pass for LSTM layer for CPU and Ref (implementation and testing)
- Forward pass for GRU layer for CPU and Ref (implementation and testing)
- Backward pass for GRU layer for CPU and Ref (implementation and testing)
- Implementation for CUDA
Important Links

● Project:  https://summerofcode.withgoogle.com/projects/#5680527699345408
● Proposal:  https://docs.google.com/document/d/1eG4wPr9tp5XODVe5OMHffJIYIJIMANnXBN5_it5ShE/edit
● Pull Request:  https://github.com/root-project/root/pull/3924
● GSoC Blog:  https://surya2191997.github.io/
Thank You !