Lumi Hackathon

ASTERIX x FAISER

Overview

- Task 1: Scaling, tuning and training the 3D VQ-VAE prototype (ASTERIX)
- Task 2: Vlasiator restart data compression to GPUs (ASTERIX)
- Task 3: Scaling, tuning and training of the 6D VQ-VAE with temporal propagation (FAISER)
- Task 4: Vlasiator runtime hooks / online training of 6D VQ-VAE (FAISER)

Setting Up The Run Environment

- There was a significant curve in adapting our code to run again after the LUMI upgrade.
- Running pytorch using environments.
- Installing tensorboard on top of current environments for online training.

3D VQ-VAE Scaling

- Setup on LUMI
- Scale model (VQ bottleneck)
- Profiling
  - PyTorch profiler & Perfetto
- Trained on 2.4k VDFs
- Hooked tensorboard
- Ready for tuning!

- Working on a run of 3.6TB of (larger resolution) VDFs
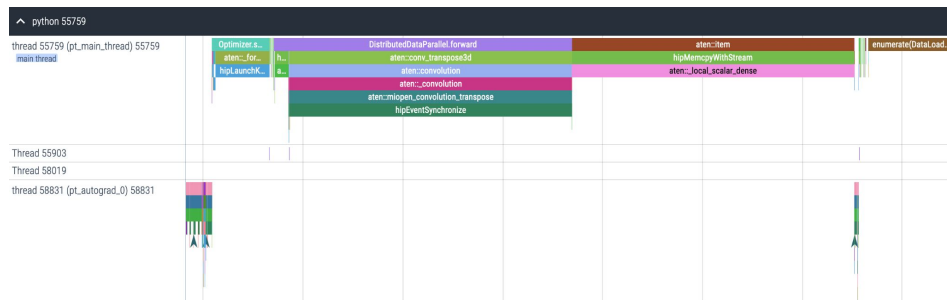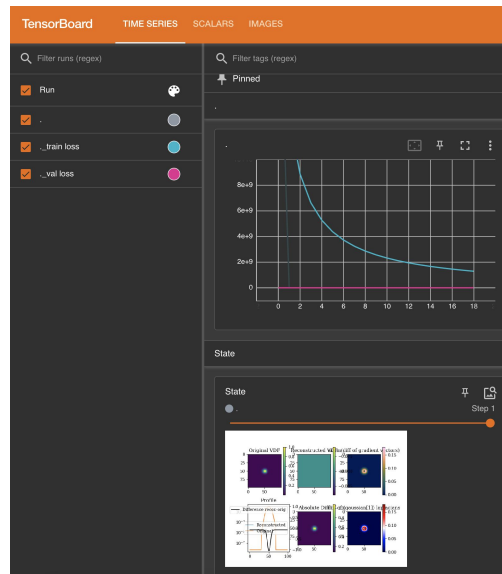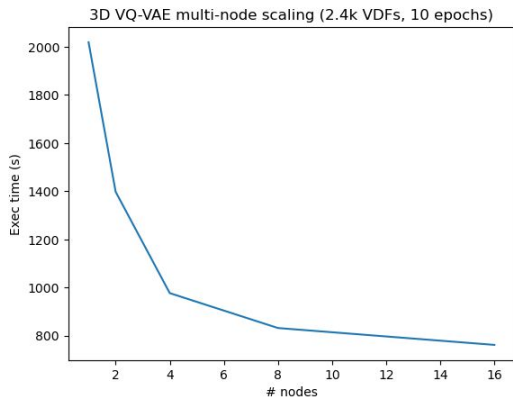
MLP on GPUs

- Used hipify to port the MLP on LUMI.
- Improved IO performance bottleneck (data shuffling).
- Improved MSE reductions during training (using warp reductions).
- Improved data loading by doing in in parallel with training.

Overall the MLP went from 20 seconds per VDF to 3 seconds!

Extending to a 6D approach

- Data scale limitations
  - A temporal instance of the 6D phase space is 23TB :)
  - Chunking into neighbourhoods, creates a trade-off between smaller-sized chunks, but large enough neighborhoods that we can compress with our model while maintaining some physical properties.
- Maintain sparsity in the input
- This calls for adapting our model design using sparse convolutions in the Encoder and Decoder modules
  - Minkowski convolutions – N-dimensional sparse convolutions
- Other issues regarding model design:
  - Learning on an AMR grid → switch to a graph representation / VQ-GCNs
  - Future work: multi-res support (?)

Runtime Hooks

- Vlasiator runtime hooks was more of a thing to discuss with people.
- We are most probably going to use the MPMD approach with MPI.
- That will require synchronization steps between the two processes.

Overview

- Which of goals did we accomplish?

- What is left to do?

- What is the most important change implemented this week?

- How did the performance improve?

Thank you all!