

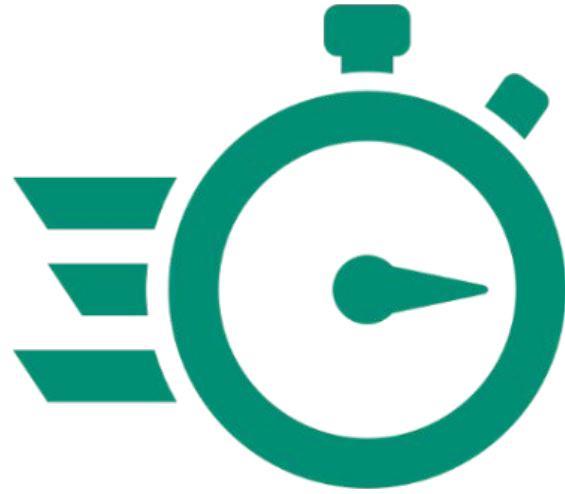
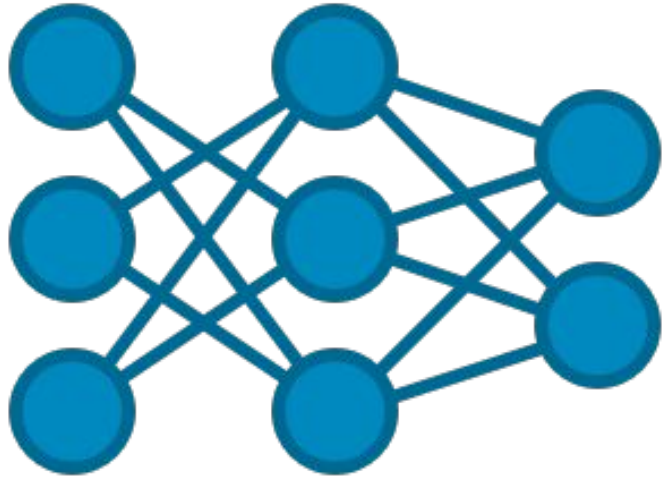


Benchmarking NNs in HEP

Sabina Manafli

Supervised by: Felice Pantaleo, Luca Atzori

Problem



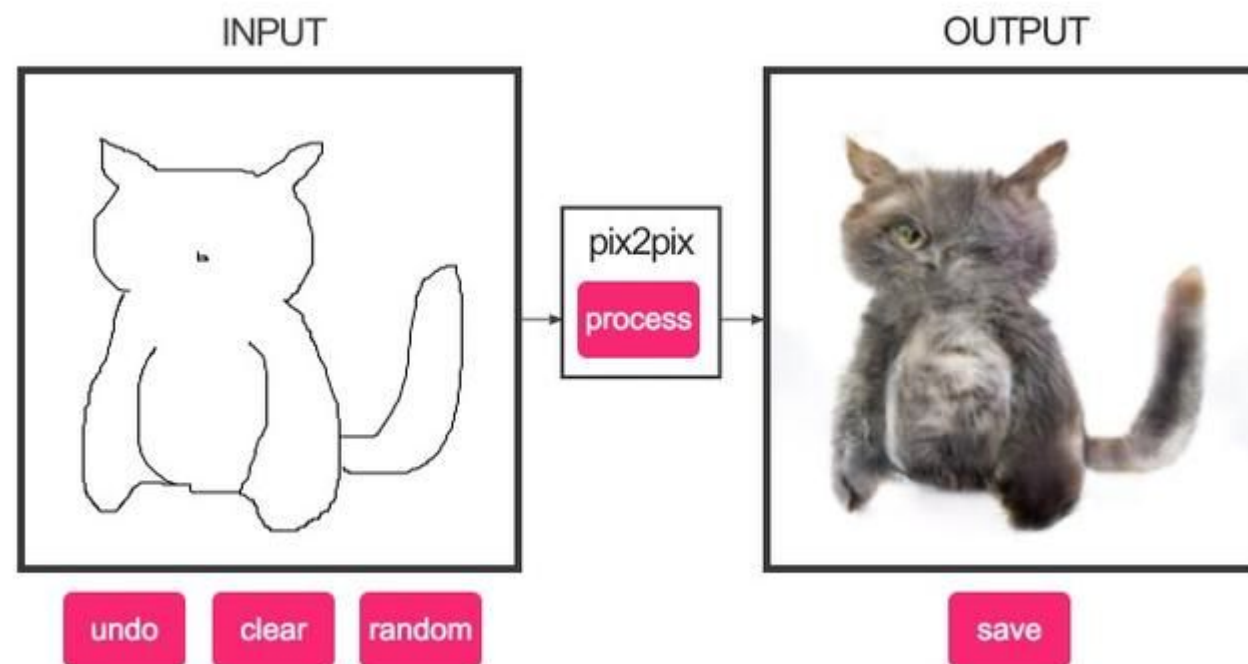
We need to benchmark



Application and Framework selection

Application: GANs

Framework: Tensorflow

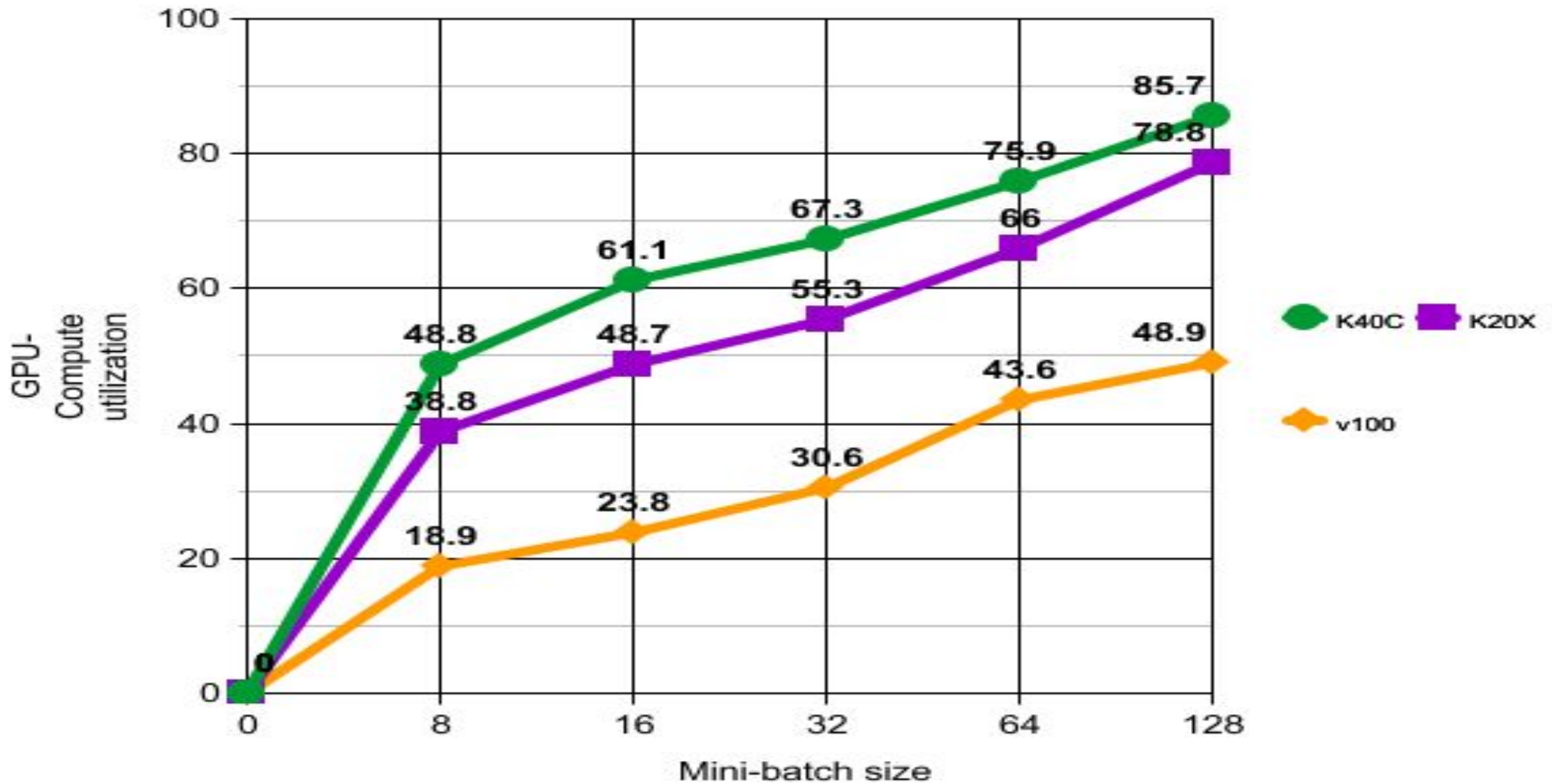


Hardware Specifications

	Tesla K20xm	Tesla K40c	Tesla V100
Architecture	Kepler	Kepler	Volta
Floating point performance	3.935 GFLOPs	4.291 GFLOPs	14.131GFLOPS
Memory Bandwidth	249 G/s	288G/s	900G/s
Memory Size	6GB	12GB	16GB
Compute Capability	3.5	3.5	7.0

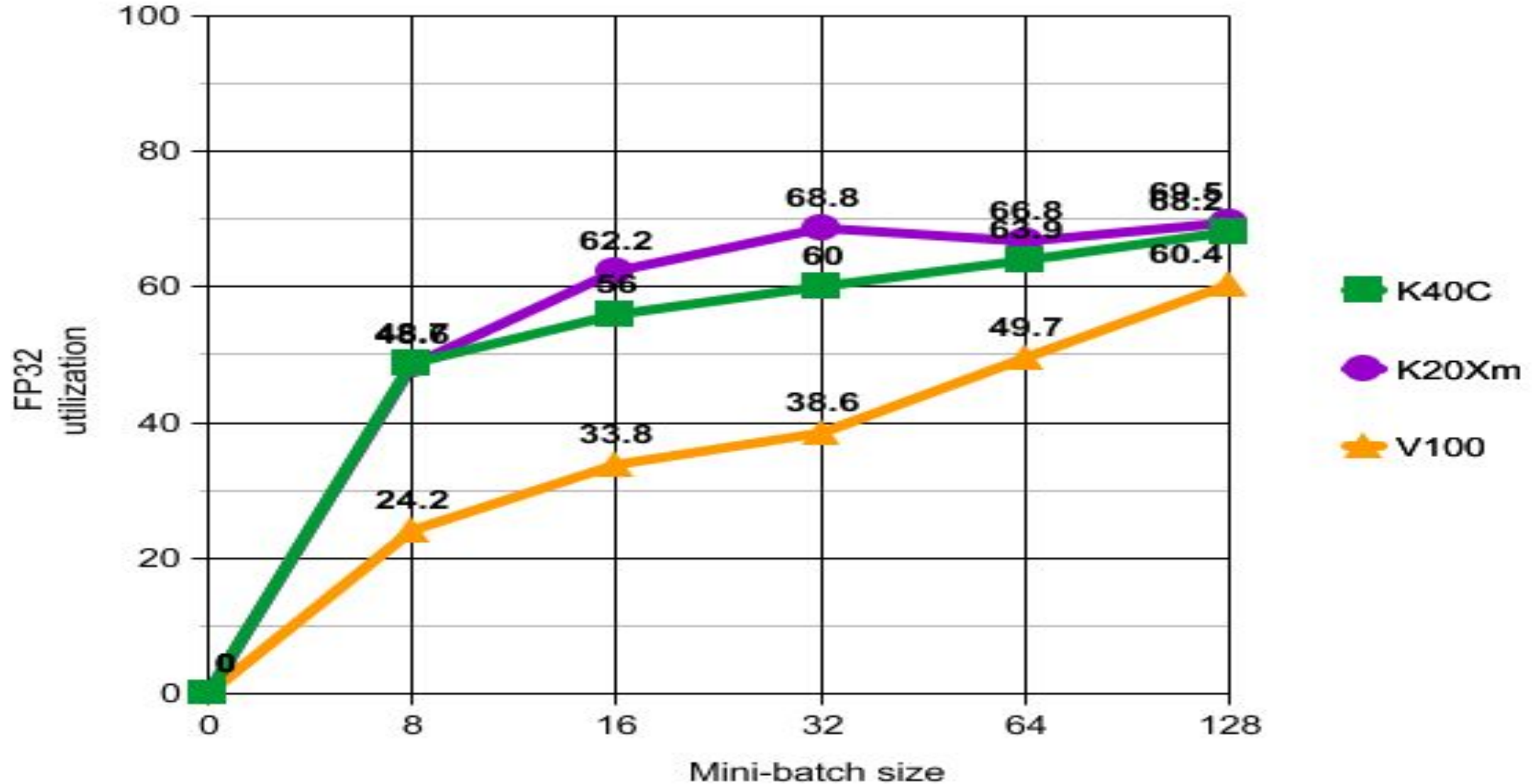
Results

GPU Compute Utilization



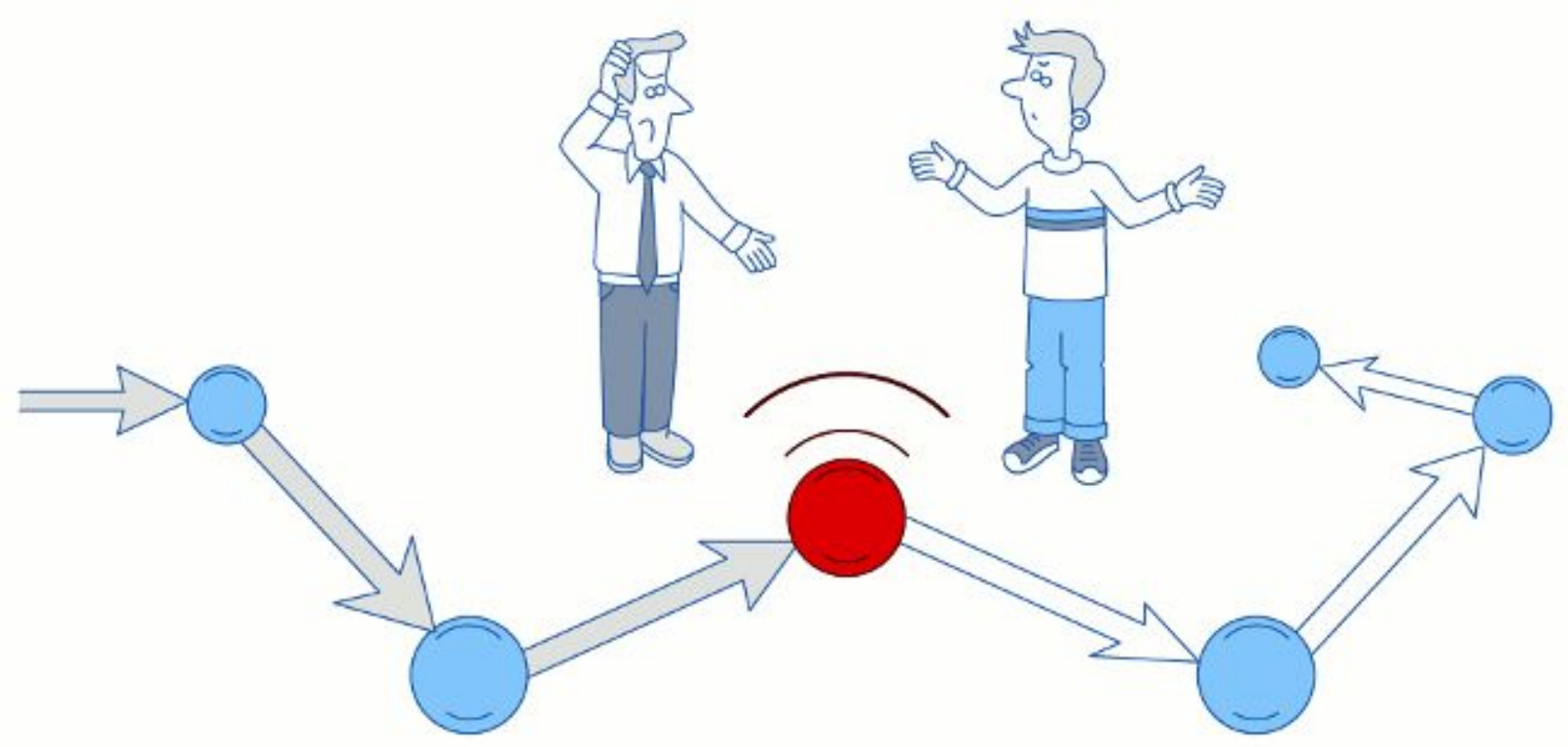
Results:FP32 Utilization

FP32 utilization



It also Helps...

Find the focus of optimization for the model



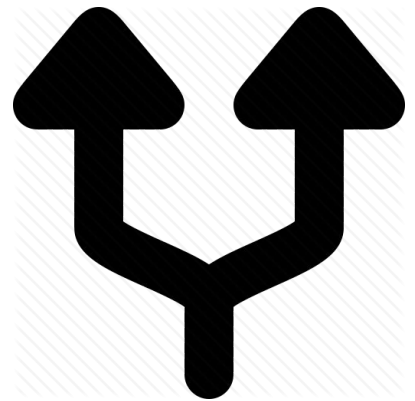
Conclusions and Future Work

Conclusion:

- Powerful GPUs need to be accompanied by better designed algorithms
- Large mini batch size keeps GPU busy

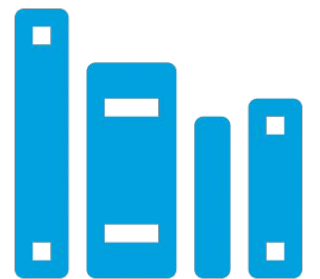
Future Work:

- Benchmark using more models and more GPUs



References

- [1] Nvidia visual profiler's user guide. <https://docs.nvidia.com/cuda/profiler-users-guide/index.html>
- [2] tbd-ai <https://github.com/tbd-ai/tbd-suite>
- [3] Machine Learning <https://github.com/David-Levinthal/machine-learning>
- [4] Deep Learning Benchmarking <https://github.com/u39kun/deep-learning-benchmark>



THANK YOU!
Questions?

Backup

Metrics Selection

1. GPU Compute Utilization
2. FP32 Utilization



How to measure these metrics

- **GPU Compute Utilization:** *nvprof -> .nvvp file*
- **FP32 Utilization :**
 - **For V100:** *nvprof --metrics single_precision_fu_utilization*
 - **For K20xm and K40c:** *nvprof --metrics inst_executed, active_cycles, maximum number of instructions can be performed*
- **Throughput :** *simple training without profiling*



Observations

1. **Mini batch size should be large enough** to keep GPUs busy
2. Although V100 is the most powerful GPU, **it is not utilized properly.**

Therefore we conclude that powerful GPU needs to be accompanied by **better designed algorithms and better low level libraries.**

