EML Task 9.3.3 - documentation

1. Comparison of accuracy

1.1. Top-1 accuracy

Data type	Batch size 32	Batch size 64	Batch size 256
BF16	0.76418	0.76464	0.76464
FP16	0.76484	0.76498	0.76498
TF32	0.76484	0.76484	0.76484

Oberservations:

Between batch size 64 and 256 there were no differences, no matter the data type. As for BF16 and FP16, a batch size of 32 had lower accuracy than 64 and 256. For TF32, the batch size had no effect. I would like to mention that the differences, if any, are only marginal and I will therefore conclude that the batch size had no effect on the result.

Comparing the data types, BF16 had the lowest accuracy, then TF32 and FP16 had the highest.

1.2. Top-5 accuracy

Data type	Batch size 32	Batch size 64	Batch size 256
BF16	0.92142	0.92140	0.92140
FP16	0.92116	0.92112	0.92112
TF32	0.92124	0.92124	0.92124

Oberservations:

Between batch size 64 and 256 there were no differences, no matter the data type. As for BF16 and FP16, a batch size of 32 had a higher accuracy than 64 and 256. For TF32, the batch size had no effect. I would like to mention that the differences, if any, are only marginal and I will therefore conclude that the batch size had no effect on the result.

Comparing the data types, BF16 had the highest accuracy, then TF32 and FP16 had the lowest.

1.3. Conclusion

Judging by the results, I conclude that the batch size did not impact the accuracy in a meaningful way. The differences were too small for me to be able to make a statement on any correlation. I assume one should conduct the experiment with a larger number of samples (with much larger batch sizes) and analyze the differences further.

2. Comparison of batch time

2.1. Batch size 32

Data type	Time of first batch
BF16	0.017332792282104492
FP16	0.017462968826293945
TF32	0.03482961654663086

Oberservations:

While BF16 and FP16 had similar times, TF32 performance was roughly 2 times slower.

2.2. Batch size 64

Data type	Time of first batch
BF16	0.03745436668395996
FP16	0.0376279354095459
TF32	0.069854736328125

Oberservations:

While BF16 and FP16 had similar times, TF32 performance was about 1.86 times slower (than BF16).

2.3. Batch size 256

Data type	Time of first batch
BF16	0.1478135585784912
FP16	0.14426541328430176
TF32	0.3342461585998535

While BF16 and FP16 had similar times, TF32 performance was about 2.26 times slower (than BF16).

2.4. Conclusion

One could argue that base GPU usage lead to distorted results, since multiple users may conduct runs on the machine at the same time. However it seems reasonable to get double the performance of 32-bit precision (TF32) when using only 16 bits (BF16 and FP16).