

# LSTM wo Horovod

(21483, 35, 3)

(21483, 3, 1)

(1193, 35, 3)

(1193, 3, 1)

(1194, 35, 3)

(1194, 3, 1)

2021-11-18 09:17:12.716039: I tensorflow/core/platform/cpu\_feature\_guard.cc:151] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: AVX2 FMA To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.

Epoch 1/50

672/672 - 28s - loss: 0.0052 - mean\_squared\_error: 0.0052 - mean\_absolute\_error: 0.0352 - root\_mean\_squared\_error: 0.0719 - val\_loss: 2.5100e-04 - val\_mean\_squared\_error: 2.5100e-04 - val\_mean\_absolute\_error: 0.0120 - val\_root\_mean\_squared\_error: 0.0158 - 28s/epoch - 41ms/step

Epoch 2/50

672/672 - 22s - loss: 5.2044e-04 - mean\_squared\_error: 5.2044e-04 - mean\_absolute\_error: 0.0141 - root\_mean\_squared\_error: 0.0228 - val\_loss: 5.5621e-04 - val\_mean\_squared\_error: 5.5621e-04 - val\_mean\_absolute\_error: 0.0186 - val\_root\_mean\_squared\_error: 0.0236 - 22s/epoch - 32ms/step

Epoch 3/50

672/672 - 22s - loss: 4.8245e-04 - mean\_squared\_error: 4.8245e-04 - mean\_absolute\_error: 0.0135 - root\_mean\_squared\_error: 0.0220 - val\_loss: 2.8384e-04 - val\_mean\_squared\_error: 2.8384e-04 - val\_mean\_absolute\_error: 0.0137 - val\_root\_mean\_squared\_error: 0.0168 - 22s/epoch - 33ms/step

Epoch 4/50

672/672 - 20s - loss: 4.3778e-04 - mean\_squared\_error: 4.3778e-04 - mean\_absolute\_error: 0.0129 - root\_mean\_squared\_error: 0.0209 - val\_loss: 9.6503e-04 - val\_mean\_squared\_error: 9.6503e-04 - val\_mean\_absolute\_error: 0.0284 - val\_root\_mean\_squared\_error: 0.0311 - 20s/epoch - 30ms/step

Epoch 5/50

672/672 - 20s - loss: 4.1026e-04 - mean\_squared\_error: 4.1026e-04 -  
mean\_absolute\_error: 0.0122 - root\_mean\_squared\_error: 0.0203 - val\_loss: 0.0013 -  
val\_mean\_squared\_error: 0.0013 - val\_mean\_absolute\_error: 0.0343 -  
val\_root\_mean\_squared\_error: 0.0366 - 20s/epoch - 29ms/step

Epoch 6/50

672/672 - 21s - loss: 3.9063e-04 - mean\_squared\_error: 3.9063e-04 -  
mean\_absolute\_error: 0.0120 - root\_mean\_squared\_error: 0.0198 - val\_loss: 2.1444e-  
04 - val\_mean\_squared\_error: 2.1444e-04 - val\_mean\_absolute\_error: 0.0113 -  
val\_root\_mean\_squared\_error: 0.0146 - 21s/epoch - 31ms/step

Epoch 7/50

672/672 - 23s - loss: 3.7705e-04 - mean\_squared\_error: 3.7705e-04 -  
mean\_absolute\_error: 0.0118 - root\_mean\_squared\_error: 0.0194 - val\_loss: 2.5400e-  
04 - val\_mean\_squared\_error: 2.5400e-04 - val\_mean\_absolute\_error: 0.0125 -  
val\_root\_mean\_squared\_error: 0.0159 - 23s/epoch - 34ms/step

Epoch 8/50

672/672 - 22s - loss: 3.6003e-04 - mean\_squared\_error: 3.6003e-04 -  
mean\_absolute\_error: 0.0112 - root\_mean\_squared\_error: 0.0190 - val\_loss: 1.8883e-  
04 - val\_mean\_squared\_error: 1.8883e-04 - val\_mean\_absolute\_error: 0.0107 -  
val\_root\_mean\_squared\_error: 0.0137 - 22s/epoch - 33ms/step

Epoch 9/50

672/672 - 22s - loss: 3.5409e-04 - mean\_squared\_error: 3.5409e-04 -  
mean\_absolute\_error: 0.0112 - root\_mean\_squared\_error: 0.0188 - val\_loss: 0.0024 -  
val\_mean\_squared\_error: 0.0024 - val\_mean\_absolute\_error: 0.0462 -  
val\_root\_mean\_squared\_error: 0.0488 - 22s/epoch - 32ms/step

Epoch 10/50

672/672 - 22s - loss: 3.3593e-04 - mean\_squared\_error: 3.3593e-04 -  
mean\_absolute\_error: 0.0108 - root\_mean\_squared\_error: 0.0183 - val\_loss: 1.6036e-  
04 - val\_mean\_squared\_error: 1.6036e-04 - val\_mean\_absolute\_error: 0.0096 -  
val\_root\_mean\_squared\_error: 0.0127 - 22s/epoch - 32ms/step

Epoch 11/50

672/672 - 22s - loss: 3.1342e-04 - mean\_squared\_error: 3.1342e-04 -  
mean\_absolute\_error: 0.0103 - root\_mean\_squared\_error: 0.0177 - val\_loss: 2.1936e-  
04 - val\_mean\_squared\_error: 2.1936e-04 - val\_mean\_absolute\_error: 0.0112 -  
val\_root\_mean\_squared\_error: 0.0148 - 22s/epoch - 32ms/step

Epoch 12/50

672/672 - 22s - loss: 2.7871e-04 - mean\_squared\_error: 2.7871e-04 -

mean\_absolute\_error: 0.0096 - root\_mean\_squared\_error: 0.0167 - val\_loss: 1.2767e-04 - val\_mean\_squared\_error: 1.2767e-04 - val\_mean\_absolute\_error: 0.0083 - val\_root\_mean\_squared\_error: 0.0113 - 22s/epoch - 33ms/step

Epoch 13/50

672/672 - 23s - loss: 2.5038e-04 - mean\_squared\_error: 2.5038e-04 - mean\_absolute\_error: 0.0093 - root\_mean\_squared\_error: 0.0158 - val\_loss: 3.1883e-04 - val\_mean\_squared\_error: 3.1883e-04 - val\_mean\_absolute\_error: 0.0141 - val\_root\_mean\_squared\_error: 0.0179 - 23s/epoch - 34ms/step

Epoch 14/50

672/672 - 21s - loss: 2.0743e-04 - mean\_squared\_error: 2.0743e-04 - mean\_absolute\_error: 0.0087 - root\_mean\_squared\_error: 0.0144 - val\_loss: 2.8284e-04 - val\_mean\_squared\_error: 2.8284e-04 - val\_mean\_absolute\_error: 0.0142 - val\_root\_mean\_squared\_error: 0.0168 - 21s/epoch - 32ms/step

Epoch 15/50

672/672 - 22s - loss: 1.5481e-04 - mean\_squared\_error: 1.5481e-04 - mean\_absolute\_error: 0.0075 - root\_mean\_squared\_error: 0.0124 - val\_loss: 1.3767e-04 - val\_mean\_squared\_error: 1.3767e-04 - val\_mean\_absolute\_error: 0.0091 - val\_root\_mean\_squared\_error: 0.0117 - 22s/epoch - 32ms/step

Epoch 16/50

672/672 - 22s - loss: 1.2585e-04 - mean\_squared\_error: 1.2585e-04 - mean\_absolute\_error: 0.0069 - root\_mean\_squared\_error: 0.0112 - val\_loss: 1.0207e-04 - val\_mean\_squared\_error: 1.0207e-04 - val\_mean\_absolute\_error: 0.0076 - val\_root\_mean\_squared\_error: 0.0101 - 22s/epoch - 32ms/step

Epoch 17/50

672/672 - 23s - loss: 1.1652e-04 - mean\_squared\_error: 1.1652e-04 - mean\_absolute\_error: 0.0067 - root\_mean\_squared\_error: 0.0108 - val\_loss: 4.8917e-04 - val\_mean\_squared\_error: 4.8917e-04 - val\_mean\_absolute\_error: 0.0203 - val\_root\_mean\_squared\_error: 0.0221 - 23s/epoch - 34ms/step

Epoch 18/50

672/672 - 21s - loss: 1.1073e-04 - mean\_squared\_error: 1.1073e-04 - mean\_absolute\_error: 0.0066 - root\_mean\_squared\_error: 0.0105 - val\_loss: 3.0148e-04 - val\_mean\_squared\_error: 3.0148e-04 - val\_mean\_absolute\_error: 0.0156 - val\_root\_mean\_squared\_error: 0.0174 - 21s/epoch - 31ms/step

Epoch 19/50

672/672 - 23s - loss: 1.0422e-04 - mean\_squared\_error: 1.0422e-04 - mean\_absolute\_error: 0.0064 - root\_mean\_squared\_error: 0.0102 - val\_loss: 7.8829e-

05 - val\_mean\_squared\_error: 7.8829e-05 - val\_mean\_absolute\_error: 0.0065 -  
val\_root\_mean\_squared\_error: 0.0089 - 23s/epoch - 34ms/step

Epoch 20/50

672/672 - 24s - loss: 9.5996e-05 - mean\_squared\_error: 9.5996e-05 -  
mean\_absolute\_error: 0.0061 - root\_mean\_squared\_error: 0.0098 - val\_loss: 1.6867e-  
04 - val\_mean\_squared\_error: 1.6867e-04 - val\_mean\_absolute\_error: 0.0110 -  
val\_root\_mean\_squared\_error: 0.0130 - 24s/epoch - 35ms/step

Epoch 21/50

672/672 - 24s - loss: 8.9841e-05 - mean\_squared\_error: 8.9841e-05 -  
mean\_absolute\_error: 0.0059 - root\_mean\_squared\_error: 0.0095 - val\_loss: 0.0011 -  
val\_mean\_squared\_error: 0.0011 - val\_mean\_absolute\_error: 0.0323 -  
val\_root\_mean\_squared\_error: 0.0332 - 24s/epoch - 36ms/step

Epoch 22/50

672/672 - 27s - loss: 8.7758e-05 - mean\_squared\_error: 8.7758e-05 -  
mean\_absolute\_error: 0.0058 - root\_mean\_squared\_error: 0.0094 - val\_loss: 5.1334e-  
04 - val\_mean\_squared\_error: 5.1334e-04 - val\_mean\_absolute\_error: 0.0215 -  
val\_root\_mean\_squared\_error: 0.0227 - 27s/epoch - 40ms/step

Epoch 23/50

672/672 - 23s - loss: 8.3982e-05 - mean\_squared\_error: 8.3982e-05 -  
mean\_absolute\_error: 0.0056 - root\_mean\_squared\_error: 0.0092 - val\_loss: 1.7780e-  
04 - val\_mean\_squared\_error: 1.7780e-04 - val\_mean\_absolute\_error: 0.0116 -  
val\_root\_mean\_squared\_error: 0.0133 - 23s/epoch - 35ms/step

Epoch 24/50

672/672 - 23s - loss: 8.4817e-05 - mean\_squared\_error: 8.4817e-05 -  
mean\_absolute\_error: 0.0056 - root\_mean\_squared\_error: 0.0092 - val\_loss: 5.7576e-  
05 - val\_mean\_squared\_error: 5.7576e-05 - val\_mean\_absolute\_error: 0.0055 -  
val\_root\_mean\_squared\_error: 0.0076 - 23s/epoch - 35ms/step

Epoch 25/50

672/672 - 24s - loss: 8.2059e-05 - mean\_squared\_error: 8.2059e-05 -  
mean\_absolute\_error: 0.0055 - root\_mean\_squared\_error: 0.0091 - val\_loss: 5.2867e-  
04 - val\_mean\_squared\_error: 5.2867e-04 - val\_mean\_absolute\_error: 0.0218 -  
val\_root\_mean\_squared\_error: 0.0230 - 24s/epoch - 36ms/step

Epoch 26/50

672/672 - 24s - loss: 7.3843e-05 - mean\_squared\_error: 7.3843e-05 -  
mean\_absolute\_error: 0.0051 - root\_mean\_squared\_error: 0.0086 - val\_loss: 5.7777e-  
04 - val\_mean\_squared\_error: 5.7777e-04 - val\_mean\_absolute\_error: 0.0230 -

val\_root\_mean\_squared\_error: 0.0240 - 24s/epoch - 35ms/step  
Epoch 27/50  
672/672 - 30s - loss: 7.9526e-05 - mean\_squared\_error: 7.9526e-05 -  
mean\_absolute\_error: 0.0053 - root\_mean\_squared\_error: 0.0089 - val\_loss: 6.0124e-04 - val\_mean\_squared\_error: 6.0124e-04 - val\_mean\_absolute\_error: 0.0234 -  
val\_root\_mean\_squared\_error: 0.0245 - 30s/epoch - 44ms/step  
Epoch 28/50  
672/672 - 23s - loss: 7.7583e-05 - mean\_squared\_error: 7.7583e-05 -  
mean\_absolute\_error: 0.0052 - root\_mean\_squared\_error: 0.0088 - val\_loss: 6.1154e-05 - val\_mean\_squared\_error: 6.1154e-05 - val\_mean\_absolute\_error: 0.0057 -  
val\_root\_mean\_squared\_error: 0.0078 - 23s/epoch - 34ms/step  
Epoch 29/50  
672/672 - 23s - loss: 7.0976e-05 - mean\_squared\_error: 7.0976e-05 -  
mean\_absolute\_error: 0.0049 - root\_mean\_squared\_error: 0.0084 - val\_loss: 2.9416e-04 - val\_mean\_squared\_error: 2.9416e-04 - val\_mean\_absolute\_error: 0.0159 -  
val\_root\_mean\_squared\_error: 0.0172 - 23s/epoch - 35ms/step  
Epoch 30/50  
672/672 - 32s - loss: 7.1375e-05 - mean\_squared\_error: 7.1375e-05 -  
mean\_absolute\_error: 0.0050 - root\_mean\_squared\_error: 0.0084 - val\_loss: 4.2468e-04 - val\_mean\_squared\_error: 4.2468e-04 - val\_mean\_absolute\_error: 0.0194 -  
val\_root\_mean\_squared\_error: 0.0206 - 32s/epoch - 48ms/step  
Epoch 31/50  
672/672 - 27s - loss: 7.1023e-05 - mean\_squared\_error: 7.1023e-05 -  
mean\_absolute\_error: 0.0049 - root\_mean\_squared\_error: 0.0084 - val\_loss: 5.0160e-04 - val\_mean\_squared\_error: 5.0160e-04 - val\_mean\_absolute\_error: 0.0214 -  
val\_root\_mean\_squared\_error: 0.0224 - 27s/epoch - 40ms/step  
Epoch 32/50  
672/672 - 31s - loss: 7.1505e-05 - mean\_squared\_error: 7.1505e-05 -  
mean\_absolute\_error: 0.0049 - root\_mean\_squared\_error: 0.0085 - val\_loss: 5.9186e-04 - val\_mean\_squared\_error: 5.9186e-04 - val\_mean\_absolute\_error: 0.0234 -  
val\_root\_mean\_squared\_error: 0.0243 - 31s/epoch - 46ms/step  
Epoch 33/50  
672/672 - 36s - loss: 7.0617e-05 - mean\_squared\_error: 7.0617e-05 -  
mean\_absolute\_error: 0.0049 - root\_mean\_squared\_error: 0.0084 - val\_loss: 1.9933e-04 - val\_mean\_squared\_error: 1.9933e-04 - val\_mean\_absolute\_error: 0.0127 -  
val\_root\_mean\_squared\_error: 0.0141 - 36s/epoch - 53ms/step

Epoch 34/50

Restoring model weights from the end of the best epoch: 24.

672/672 - 32s - loss: 6.7747e-05 - mean\_squared\_error: 6.7747e-05 -

mean\_absolute\_error: 0.0048 - root\_mean\_squared\_error: 0.0082 - val\_loss: 1.8411e-

04 - val\_mean\_squared\_error: 1.8411e-04 - val\_mean\_absolute\_error: 0.0121 -

val\_root\_mean\_squared\_error: 0.0136 - 32s/epoch - 48ms/step

Epoch 00034: early stopping

Used training time: 822.396612

Testing set: MSE 0.000137, RMSE: 0.011701, MAE: 0.009817