

mnist_mlp_BAUER

June 12, 2021

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[1]: '''Trains a simple deep NN on the MNIST dataset.  
Gets to 98.40% test accuracy after 20 epochs  
(there is *a lot* of margin for parameter tuning).  
2 seconds per epoch on a K520 GPU.  
'''  
  
from tensorflow import keras  
from tensorflow.keras.datasets import mnist  
from tensorflow.keras.models import Sequential  
from tensorflow.keras.layers import Dense, Dropout  
from tensorflow.keras.optimizers import RMSprop  
  
batch_size = 128  
num_classes = 10  
epochs = 20  
  
# the data, split between train and test sets  
(x_train, y_train), (x_test, y_test) = mnist.load_data()  
  
x_train = x_train.reshape(60000, 784)  
x_test = x_test.reshape(10000, 784)  
x_train = x_train.astype('float32')  
x_test = x_test.astype('float32')  
x_train /= 255  
x_test /= 255  
print(x_train.shape[0], 'train samples')  
print(x_test.shape[0], 'test samples')  
  
# convert class vectors to binary class matrices  
y_train = keras.utils.to_categorical(y_train, num_classes)  
y_test = keras.utils.to_categorical(y_test, num_classes)  
  
model = Sequential()  
model.add(Dense(512, activation='relu', input_shape=(784,)))  
model.add(Dropout(0.2))  
model.add(Dense(512, activation='relu'))  
model.add(Dropout(0.2))
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model.add(Dense(num_classes, activation='softmax'))

model.summary()

model.compile(loss='categorical_crossentropy',
              optimizer=RMSprop(),
              metrics=['accuracy'])

history = model.fit(x_train, y_train,
                   batch_size=batch_size,
                   epochs=epochs,
                   verbose=1,
                   validation_data=(x_test, y_test))
score = model.evaluate(x_test, y_test, verbose=0)
print('Test loss:', score[0])
print('Test accuracy:', score[1])

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Downloading data from <https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz>
 11493376/11490434 [=====] - 1s 0us/step
 60000 train samples
 10000 test samples
 Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 512)	401920
dropout (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 512)	262656
dropout_1 (Dropout)	(None, 512)	0
dense_2 (Dense)	(None, 10)	5130

Total params: 669,706
 Trainable params: 669,706
 Non-trainable params: 0

Epoch 1/20
 469/469 [=====] - 6s 11ms/step - loss: 0.4365 - accuracy: 0.8601 - val_loss: 0.1028 - val_accuracy: 0.9678
 Epoch 2/20
 469/469 [=====] - 5s 10ms/step - loss: 0.1078 - accuracy: 0.9666 - val_loss: 0.0871 - val_accuracy: 0.9743
 Epoch 3/20

469/469 [=====] - 4s 9ms/step - loss: 0.0762 - accuracy: 0.9760 - val_loss: 0.0746 - val_accuracy: 0.9784
Epoch 4/20
469/469 [=====] - 4s 9ms/step - loss: 0.0608 - accuracy: 0.9823 - val_loss: 0.0742 - val_accuracy: 0.9802
Epoch 5/20
469/469 [=====] - 4s 9ms/step - loss: 0.0473 - accuracy: 0.9863 - val_loss: 0.0670 - val_accuracy: 0.9822
Epoch 6/20
469/469 [=====] - 4s 9ms/step - loss: 0.0385 - accuracy: 0.9882 - val_loss: 0.0831 - val_accuracy: 0.9796
Epoch 7/20
469/469 [=====] - 4s 9ms/step - loss: 0.0366 - accuracy: 0.9896 - val_loss: 0.0787 - val_accuracy: 0.9815
Epoch 8/20
469/469 [=====] - 4s 9ms/step - loss: 0.0317 - accuracy: 0.9909 - val_loss: 0.0936 - val_accuracy: 0.9801
Epoch 9/20
469/469 [=====] - 4s 9ms/step - loss: 0.0258 - accuracy: 0.9920 - val_loss: 0.0849 - val_accuracy: 0.9815
Epoch 10/20
469/469 [=====] - 4s 9ms/step - loss: 0.0256 - accuracy: 0.9926 - val_loss: 0.0822 - val_accuracy: 0.9834
Epoch 11/20
469/469 [=====] - 4s 9ms/step - loss: 0.0239 - accuracy: 0.9928 - val_loss: 0.0873 - val_accuracy: 0.9828
Epoch 12/20
469/469 [=====] - 4s 9ms/step - loss: 0.0245 - accuracy: 0.9928 - val_loss: 0.0932 - val_accuracy: 0.9832
Epoch 13/20
469/469 [=====] - 4s 9ms/step - loss: 0.0213 - accuracy: 0.9940 - val_loss: 0.0980 - val_accuracy: 0.9835
Epoch 14/20
469/469 [=====] - 4s 9ms/step - loss: 0.0176 - accuracy: 0.9945 - val_loss: 0.1166 - val_accuracy: 0.9817
Epoch 15/20
469/469 [=====] - 4s 9ms/step - loss: 0.0183 - accuracy: 0.9944 - val_loss: 0.1049 - val_accuracy: 0.9841
Epoch 16/20
469/469 [=====] - 4s 9ms/step - loss: 0.0208 - accuracy: 0.9944 - val_loss: 0.0960 - val_accuracy: 0.9827
Epoch 17/20
469/469 [=====] - 4s 9ms/step - loss: 0.0152 - accuracy: 0.9953 - val_loss: 0.1000 - val_accuracy: 0.9834
Epoch 18/20
469/469 [=====] - 4s 9ms/step - loss: 0.0155 - accuracy: 0.9956 - val_loss: 0.1314 - val_accuracy: 0.9812
Epoch 19/20

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469/469 [=====] - 4s 9ms/step - loss: 0.0181 -  
accuracy: 0.9950 - val_loss: 0.1287 - val_accuracy: 0.9826  
Epoch 20/20  
469/469 [=====] - 4s 9ms/step - loss: 0.0171 -  
accuracy: 0.9954 - val_loss: 0.1139 - val_accuracy: 0.9836  
Test loss: 0.11390794813632965  
Test accuracy: 0.9836000204086304
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