

Keras-MNIST-MLP

March 21, 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 [=====] - 5s 10ms/step - loss: 0.4360 -
 accuracy: 0.8653 - val_loss: 0.1089 - val_accuracy: 0.9661
 Epoch 2/20
 469/469 [=====] - 5s 10ms/step - loss: 0.1075 -
 accuracy: 0.9668 - val_loss: 0.0869 - val_accuracy: 0.9744
 Epoch 3/20

469/469 [=====] - 4s 9ms/step - loss: 0.0712 -
accuracy: 0.9781 - val_loss: 0.0815 - val_accuracy: 0.9757
Epoch 4/20
469/469 [=====] - 4s 9ms/step - loss: 0.0581 -
accuracy: 0.9834 - val_loss: 0.0659 - val_accuracy: 0.9816
Epoch 5/20
469/469 [=====] - 4s 9ms/step - loss: 0.0489 -
accuracy: 0.9841 - val_loss: 0.0950 - val_accuracy: 0.9744
Epoch 6/20
469/469 [=====] - 4s 9ms/step - loss: 0.0408 -
accuracy: 0.9873 - val_loss: 0.0795 - val_accuracy: 0.9811
Epoch 7/20
469/469 [=====] - 4s 9ms/step - loss: 0.0355 -
accuracy: 0.9897 - val_loss: 0.0850 - val_accuracy: 0.9819
Epoch 8/20
469/469 [=====] - 4s 9ms/step - loss: 0.0300 -
accuracy: 0.9908 - val_loss: 0.0829 - val_accuracy: 0.9819
Epoch 9/20
469/469 [=====] - 4s 9ms/step - loss: 0.0308 -
accuracy: 0.9914 - val_loss: 0.0823 - val_accuracy: 0.9823
Epoch 10/20
469/469 [=====] - 4s 9ms/step - loss: 0.0249 -
accuracy: 0.9924 - val_loss: 0.0782 - val_accuracy: 0.9830
Epoch 11/20
469/469 [=====] - 4s 9ms/step - loss: 0.0250 -
accuracy: 0.9928 - val_loss: 0.0841 - val_accuracy: 0.9830
Epoch 12/20
469/469 [=====] - 4s 9ms/step - loss: 0.0226 -
accuracy: 0.9936 - val_loss: 0.1020 - val_accuracy: 0.9830
Epoch 13/20
469/469 [=====] - 4s 9ms/step - loss: 0.0210 -
accuracy: 0.9939 - val_loss: 0.0876 - val_accuracy: 0.9838
Epoch 14/20
469/469 [=====] - 4s 9ms/step - loss: 0.0195 -
accuracy: 0.9943 - val_loss: 0.1102 - val_accuracy: 0.9823
Epoch 15/20
469/469 [=====] - 4s 9ms/step - loss: 0.0225 -
accuracy: 0.9939 - val_loss: 0.1088 - val_accuracy: 0.9830
Epoch 16/20
469/469 [=====] - 4s 9ms/step - loss: 0.0198 -
accuracy: 0.9949 - val_loss: 0.1051 - val_accuracy: 0.9838
Epoch 17/20
469/469 [=====] - 4s 9ms/step - loss: 0.0202 -
accuracy: 0.9941 - val_loss: 0.1078 - val_accuracy: 0.9816
Epoch 18/20
469/469 [=====] - 4s 9ms/step - loss: 0.0151 -
accuracy: 0.9958 - val_loss: 0.1297 - val_accuracy: 0.9830
Epoch 19/20

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469/469 [=====] - 4s 9ms/step - loss: 0.0162 -  
accuracy: 0.9957 - val_loss: 0.1398 - val_accuracy: 0.9824  
Epoch 20/20  
469/469 [=====] - 4s 9ms/step - loss: 0.0184 -  
accuracy: 0.9949 - val_loss: 0.1136 - val_accuracy: 0.9829  
Test loss: 0.11360950767993927  
Test accuracy: 0.9829000234603882
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