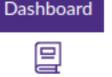
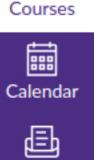


(b)







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Due May 11 by 5:59pm

Question 5 (1 point)

Suppose we define a convolutional network as shown below.

Assignment 5: ConvNets (Part 2) 🗚

Points 6

```
# python mnist-cnn.py sgd
# python mnist-cnn.py rmsprop
# python mnist-cnn.py adam
import sys
from tensorflow.keras import callbacks, datasets, layers, models, optimizers
optimizer_name = sys.argv[1]
model_name = "mnist-" + optimizer_name
(x_train, y_train), (x_test, y_test) = datasets.mnist.load_data()
x_train = x_train.reshape((x_train.shape[0], x_train.shape[1], x_train.shape[2],
                          1)).astype("float32") / 255.0
x_test = x_test.reshape((x_test.shape[0], x_test.shape[1], x_test.shape[2],
                       1)).astype("float32") / 255.0
model = models.Sequential()
model.add(layers.Conv2D(filters = 16, kernel_size = (3, 3), activation = "relu",
                        input\_shape = (28, 28, 1)))
model.add(layers.Conv2D(filters = 32, kernel_size = (3, 3), activation = "relu"))
model.add(layers.MaxPooling2D(pool_size = (2, 2)))
model.add(layers.Dropout(0.25))
model.add(layers.Flatten())
model.add(layers.Dense(units = 128, activation = "relu"))
model.add(layers.Dropout(0.50))
model.add(layers.Dense(y_train.max() + 1, activation = "softmax"))
model.compile(loss = "sparse_categorical_crossentropy", optimizer = optimizer_name,
             metrics = ["accuracy"])
model.fit(x_train, y_train, batch_size = 128, epochs = 16, validation_split = 0.1,
          callbacks = [ callbacks.EarlyStopping(monitor = "val_accuracy", patience = 8,
                                                restore_best_weights = True) ])
model.summary()
model.save(model_name)
model = models.load_model(model_name)
model.evaluate(x_test, y_test)
```

Submitting a text entry box or a file upload

a) What is the output shape of the second Conv2D() layer?

b) How many parameters are there in the second Conv2D() layer?

c) Assuming your model uses single precision (32-bit floating point numbers) for parameters, what will be the size of the second Conv2D() layer in bytes?

d) When we look at the size of mnist-optimizer/variables/variables.data-00000-of-00001, we see the following file sizes for the 3 optimizers:

```
sgd: 2,388,926
rmsprop: 4,774,349
adam: 7,159,495
```

Why would the size of a model trained with optimizer="rmsprop" be about twice the size of the model trained with optimizer="sgd"?

Hint: Check the RMSprop slide from the first night.

Model 5 (5 points)

Please navigate to the following URL and click the "I understand and agree" button to accept the invitation for this Kaggle task:

https://www.kaggle.com/c/ml530-2021-sp-imagenet/data &

Activate the conda environment on your VM:

```
conda activate py37_tensorflow
```

Download the data and create tensors for the images:

```
kaggle competitions download ml530-2021-sp-imagenet
wget https://www.cross-entropy.net/ML530/imagenet-tensors.py.txt
python imagenet-tensors.py.txt
```

Download and run the sample off-the-shelf prediction script [note the validation accuracy and compare it to the validation accuracy for the imagenet-transfer.py.txt script (which you'll run next)]:

```
wget https://www.cross-entropy.net/ML530/tiny_imagenet_names.txt
wget https://www.cross-entropy.net/ML530/imagenet-off-the-shelf.py.txt
python imagenet-off-the-shelf.py.txt
```

Download and run the sample fine-tuning script:

```
wget https://www.cross-entropy.net/ML530/imagenet-transfer.py.txt
python imagenet-transfer.py.txt
```

Note: This script will take around 120 minutes to complete. Make sure you have enough hours available on the VM to complete training. Send email to sadm_rudy514@uw.edu if you need additional hours. If you'd like, you can try changing SIZE_INDEX = 0 to SIZE_INDEX = 4 and EfficientNetB0 to EfficientNetB4.

Upload your predictions to kaggle:

```
kaggle competitions submit ml530-2021-sp-imagenet -f predictions.csv -m "imagenet submission"
kaggle competitions leaderboard ml530-2021-sp-imagenet -s
```

Submission

New Attempt

✓ Submitted!

May 11 at 1:34pm Submission Details

Download HW05.txt

Grade: 6 (6 pts possible) Graded Anonymously: no

Comments: No Comments

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