2301-353-353m-453-LE5-DeepLearningIntro

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Contents

If you are compiling to pdf, for submission,

- after having run all your code
  - So that the results of each code block is visible
- Then uncomment the line above
  - that says `# eval = FALSE,`

1 LE5: Introduction to Deep Learning

Grading Rubric:

LE5a (2 points) LE5b (3 points) *LE5c (4 points)

———————PLEASE READ BEFORE DOING THE ASSIGNMENT———————

Now that we are doing deep learning[1],

- we will need to be a little more careful abouthow we utilize the HPC.

You will need to **reserve a compute node WITH A GPU**

- in order to complete this assignment.

You can test that you have a working GPU in your requested compute node

- by going into your linux Terminal
  - (right next to the R console below).
- It should have a stylized (ASCII Art) TensorFlow[2] logo.
  - We are using TensorFlow2 version 2.12 this year
- TensorFlow1 was introduced in 2015
  - And in 2020, we were using TF version 1.17

If you are working with the Keras package,

- and at any time you get an error
  - that refers to **conda/python**,
- **DO NOT download the "fix" onto your computer**.
- It will break your TensorFlow environment,
  - and it is difficult to fix.
- The fix is to go into Rstudio's Global Options
  - Find the Python choice on the left navbar
  - And confirm that it is set to point to `/usr/local/bin/python`

You can check your R package library path

- by using the `.libPaths()`
  - In your R console
- The **first R package library path**
  - **Has to be '[1] "/home/rxf131/ondemand/ubuntu2004/r4"'**

If this isn't the first path you see for .libPaths()

- Then you can reset your libPaths to the correct one
  - by running this code block

```
source('/home/rxf131/ondemand/share/config2004/r-lib-path-fix.R')
```

1.0.1 LE5a: Deep Learning Short Answer

1.0.1.1 Question 1: What is an activation function, and what does it do?

- Please provide two examples
  - and compare/contrast them.

ANSWER =>

1.0.1.2 Question 2: What is stochastic gradient descent

- in the context of machine learning?

ANSWER =>

1.0.1.3 Question 3: What happens if the learning rate

- is too high
  - or too low
- during gradient descent?

ANSWER =>

1.0.1.4 Question 4: What is the loss of a neural network model? ANSWER =>

1.0.1.5 Question 5: What is back propagation,

- and why is it important?

ANSWER =>

1.0.2 LE5b: Working with the MNIST dataset

Let's look at a concrete example of a neural network

- that uses the Keras R package [3,4]
- to learn to classify handwritten digits.

The problem we're trying to solve here is

- to classify grayscale images of handwritten digits (28×28 pixels)
  - into their 10 categories (0 through 9).

We'll use the MNIST dataset, [5]

- a classic in the machine-learning community,
  - which has been around almost as long as the field itself