

DATA 640 Deep Learning Assignment

Introduction to Deep Learning

First watch all the video lectures and reading for the deep learning assignment part of the course. These can be found in the classroom and one of them will walk you through the example MNIST notebook.

You can watch an introduction to deep learning here:

- <https://www.youtube.com/watch?v=q8DEADeij8U>

And a walkthrough of the example script here:

- https://www.youtube.com/watch?v=gG71u5_LMKE

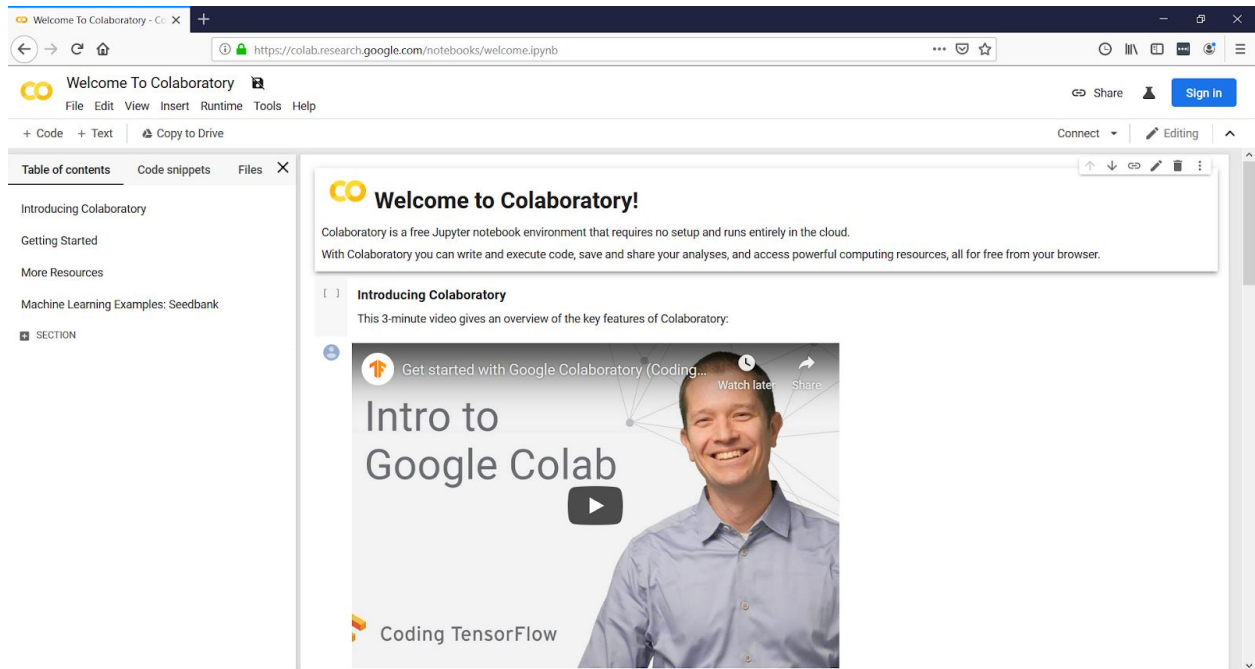
Completing the Deep Learning Assignment

For the deep learning assignment, we'll be using Google Colab, which allows you to use Python and Jupyter notebooks in the cloud, instead of having to go through the challenge of installing Python on your computer. You'll use your Google account to store the notebooks in your Google Docs.

NOTE: If you want to install Python on your computer, we have instructions for doing that, but it can be tricky to set up something fast for deep learning.

To get started, go to <https://colab.research.google.com>

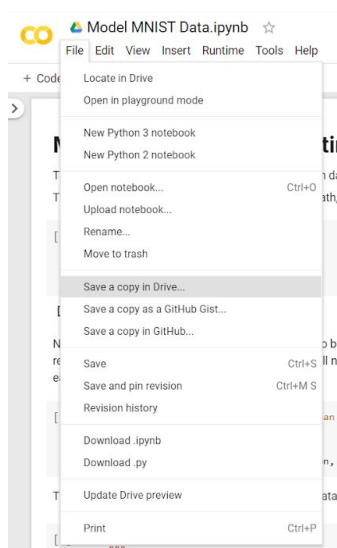
You'll see the screen below. Sign in with your Google account (in the top right).



Once you sign in, you might want to create a folder to keep your notebooks for the class on your Google drive.

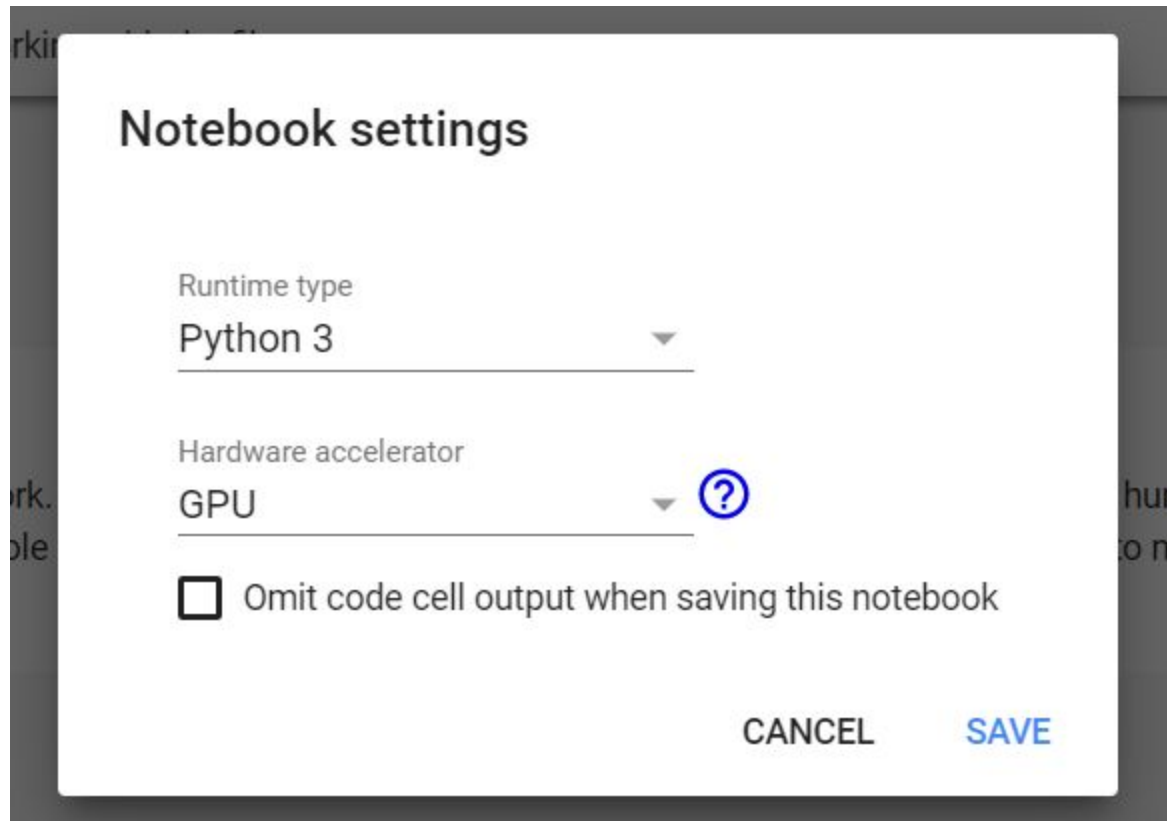
There are three notebooks for you to explore for this assignment. The first demonstrates how to create a deep learning network using the MNIST dataset. The others are options for you to use for the assignment to create your own deep learning network.

To work with these notebooks, open the links and click “Save a copy in drive.” A new copy should open saved in your drive, and you’ll be able to edit it.



One final note on Google colab - If you leave notebooks alone for long enough, the connection to the server will time out. You can reconnect, but you'll lose any variables, data or other things you have in memory and will have to run the notebook from the beginning.

To speed up training, you can have your notebook run on the GPU. To do this, click the Runtime Menu and click "Change Runtime Type." In the box that pops up, select GPU as the hardware accelerator.



On to the NOTEBOOKS!

This first notebook is an example and walks you through the basics of creating a deep learning neural network with Keras, while using the MNIST dataset with images of handwritten digits.

- MNIST Notebook:
https://colab.research.google.com/drive/1_FJhUtEoSjGEW5Uf2W_WL6964feN4E3y
and documentation: <http://yann.lecun.com/exdb/mnist/>

You can play with the networks and concepts in there, and when you feel comfortable, move on to one of the assignment datasets/notebooks below.

Chose AT LEAST ONE of the next these notebooks to use for your assignment. Note that each of these notebooks has one example network that will give you a baseline to work with:

- MNIST Fashion Data (10 Greyscale images)
https://colab.research.google.com/drive/1ITdNyCGyTW5V5bK4sfU70y6_LYMZMrMJ
documentation: <https://github.com/zalandoresearch/fashion-mnist>
- CIFAR-10 Notebook (10 Color images)
<https://colab.research.google.com/drive/1CDRK83TkAd-bdBP1b7LzNDvKUft5MzIV>
documentation: <https://www.cs.toronto.edu/~kriz/cifar.html>

Once you have chosen a notebook, the goal is to build a network that accurately predicts the data. Since all the notebooks have an example dataset, you'll need to make changes and tweak parameters to see what happens. What can you tweak?

- The number of layers
- The type of layers
- The order of the layers
- The size and shape of the layers (kernel_size)
- The way number of snapshots each layer takes (steps)
- The way the network identifies significant features (pool size, and Average vs Max Pooling)
- The number of passes through the data used to train the network (epochs)
- The size of each batch used before the network is updated (batch_size)

You'll want to note things like:

- Did the network get more or less accurate?
- Did the network quickly or slowly get more accurate?
- Did the network train at all (i.e. accuracy is always the same), or is it "guessing?"
- What happened to the training time?

Always feel free to ask questions via email or in the forums, but I STRONGLY encourage you to do a little research using the excellent Keras documentation here:

<https://keras.io/>

Good luck!