

# Machine Learning Tutorial Overview

Emmanuel Olaiya

Rutherford Appleton Laboratory

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# Agenda

Today, Monday  
13<sup>th</sup> June, this  
afternoon

- Tutorial walkthrough
- 1400 - 1540
- We will have breaks
- 1600 - 1730

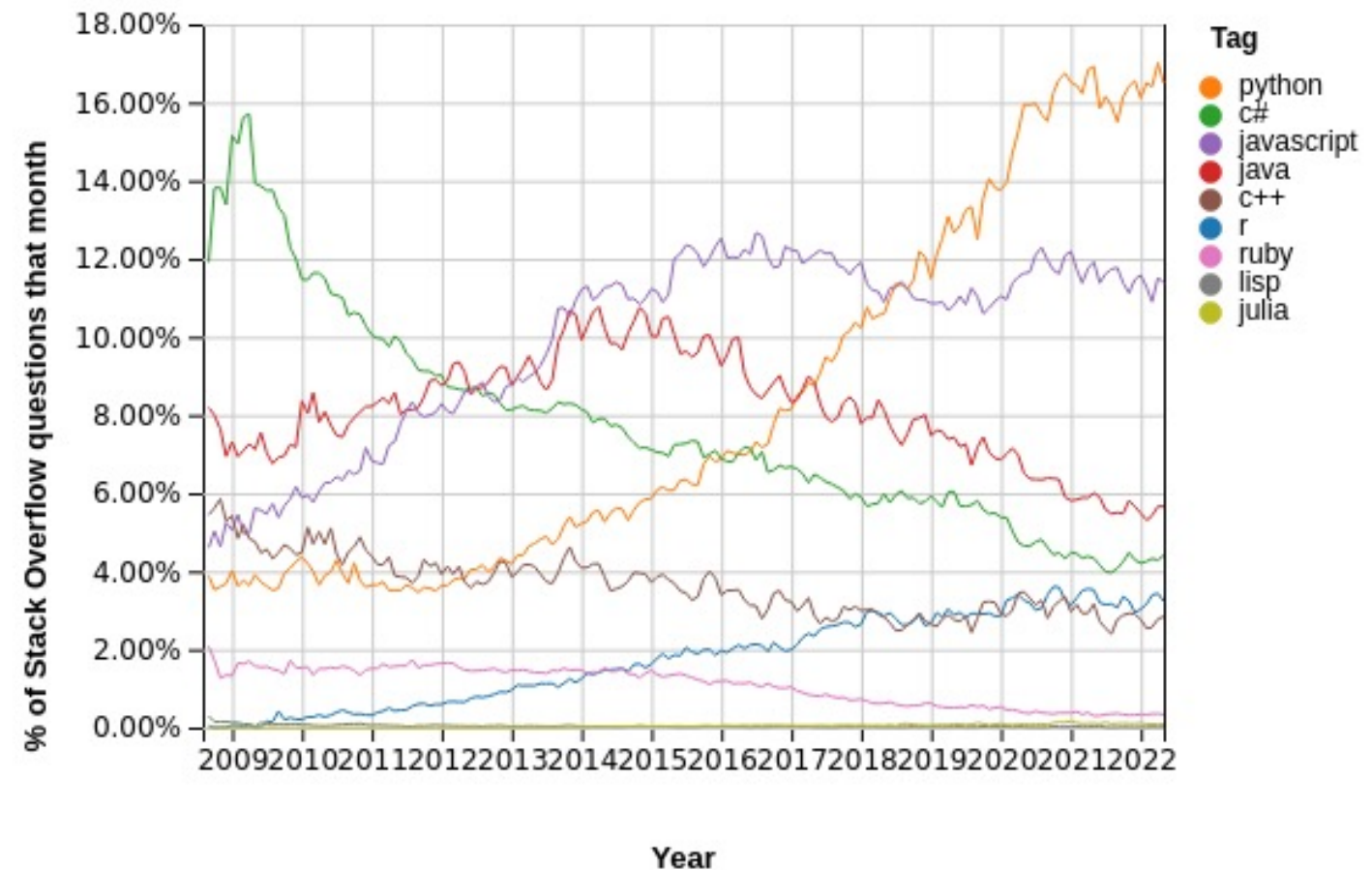
12:00	Machine Learning lectures and tutorial (emmanuel.olaiya@stfc.ac.uk)	Emmanuel Olaiya
		11:30 - 12:25
13:00	Lunch	
		12:30 - 14:00
14:00	Machine Learning lectures and tutorial (emmanuel.olaiya@stfc.ac.uk)	Emmanuel Olaiya
15:00		14:00 - 15:40
	coffee/tea	15:40 - 16:00
16:00	Machine Learning lectures and tutorial (emmanuel.olaiya@stfc.ac.uk)	Emmanuel Olaiya
17:00		16:00 - 17:30

# Content

- What is the goal of the tutorial
  - Continue the learning. Learn by doing!
    - Give you some hands on experience
    - Introduce you to some simple tools that have a wide application
  - Again this is an introduction. So the examples will be straightforward. Anyone who has done any machine learning before may find it easy. This workbook is for beginners!
  - The tutorial will be a walkthrough
    - It will be interactive. You will be able to execute code. Modify it if you want
    - There will be some exercises for you to practice implementing machine learning code

# Contents

- What programming languages are used for machine learning
  - Python, R, Java, Julia, LISP, C++, ..... , lots!
- Python is a language that continues to grow in popularity. Python is the language we will use



# Contents

- So what are the machine learning toolkits available
  - Again lots: Tensorflow, Pytorch, Sklearn, Amazon Machine Learning (AML), Shogun, ....
  - We will be using Tensorflow, a platform owned by Google, it is well supported, easy to use and has a wide range of features
    - GPU support is seamless (for Nvidia cards!)
      - Good at detecting if you have GPUs and then just using them without any need for configuring

# Jupyter Notebooks

- We will use Jupyter Notebooks for this tutorial
- What are they?
- They are a web-based Interactive Development Environment (IDE), from which you can program and run code

# How do we run the notebooks

- There are many ways to run the notebooks. I am going to suggest 4

If you have a preferable method then that is fine

My suggestions are:

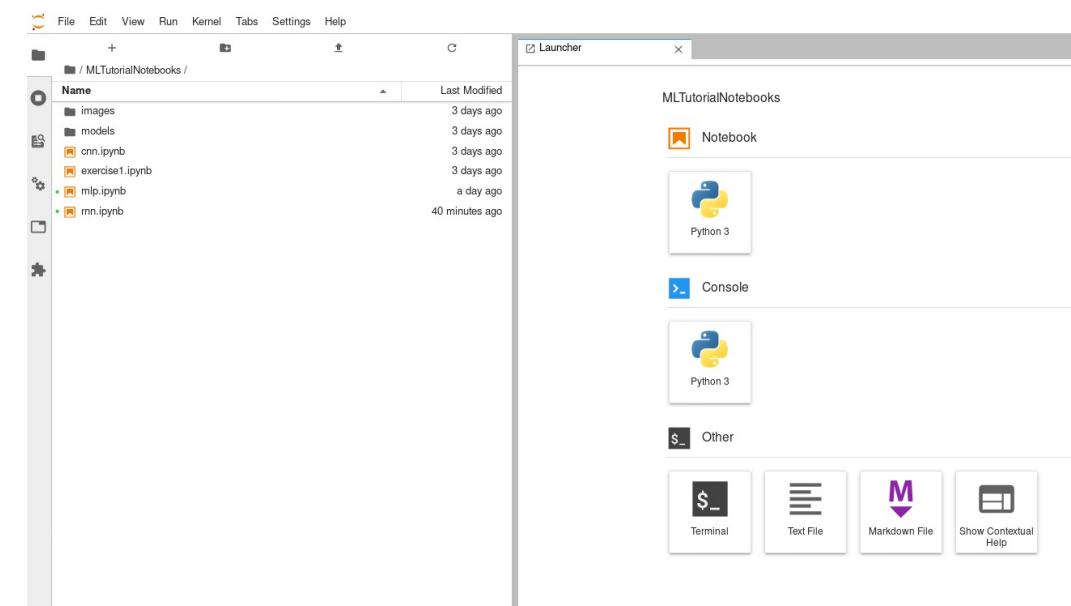
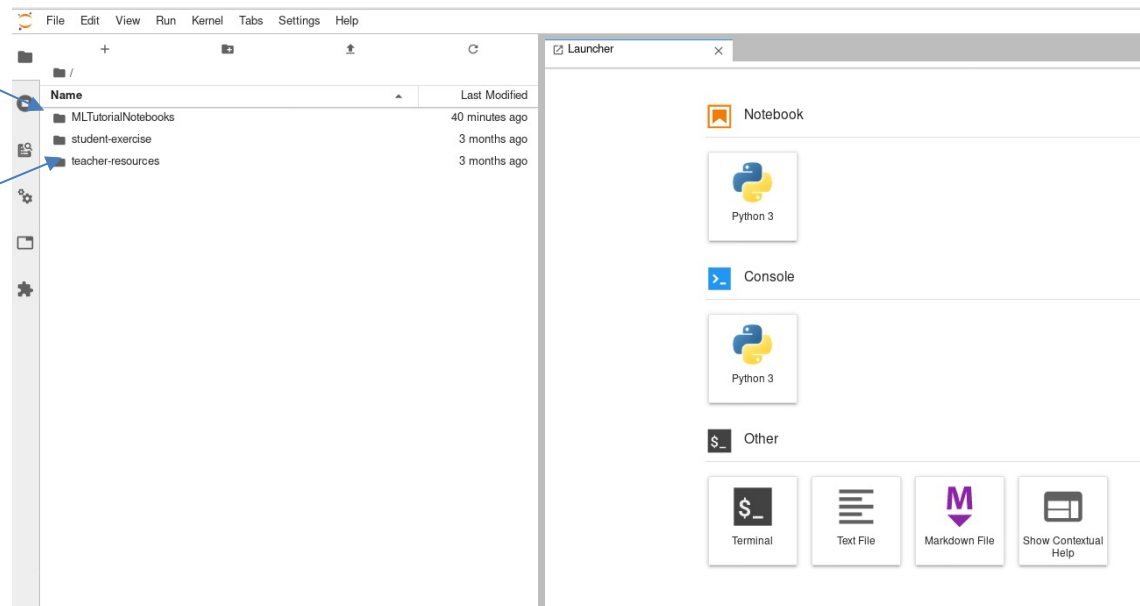
1. Using the RAL computing cluster
2. Using mybinder.org
3. Using Google Colab
4. Running on your own computer

# Using the RAL Cluster

- If you want to use the RAL cluster I will provide you with a username and a password
- Go to the page <https://monty.stfc.ac.uk> Log in with your username and password. You should see the following:

Click on  
MLTutorialN  
otebooks

The student-  
exercise and  
teacher-exercise  
tabs won't be there



Click on one of the .ipynb files to run the notebook

# Using mybinder.org

- Everyone can use this option
- Just click on this link:
  - <https://mybinder.org/v2/gh/olaiya/MLTutorialNotebooks.git/HEAD>
- After a while you should be able to see the notebook



If you are using mybinder, connect to the above link 5 mins before the start of the tutorial.  
Sometimes it can take a few minutes to fire up the container that hosts the notebook

# Using Google Colab

- People with a Google account can use this option
- Make sure you are logged into your Google account
- Go to the workbook files on github:
  - <https://github.com/olaiya/MLTutorialNotebooks>

The screenshot shows the GitHub repository page for `olaiya / MLTutorialNotebooks`. The repository is in the `master` branch, has 1 branch, and 0 tags. The commit history shows a recent commit by Emmanuel Olaiya adding a link to Google Colab. The file list includes `images`, `models`, `cnn.ipynb`, `exercise1.ipynb`, `mlp.ipynb`, `requirements.txt`, and `rnn.ipynb`. The right sidebar shows the repository's About, Releases, Packages, and Languages sections. The footer contains copyright information and links to GitHub's Terms, Privacy, Security, Status, Docs, Contact, Pricing, API, Training, Blog, and About pages.

olaiya / MLTutorialNotebooks

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 1 branch 0 tags Go to file Add file Code

Emmanuel Olaiya and Emmanuel Olaiya Added link to google colab d70be99 13 hours ago 8 commits

images	Added exercise1.ipynb and rnn.ipynb	3 days ago
models	Added models directory	3 days ago
cnn.ipynb	Added link to google colab	13 hours ago
exercise1.ipynb	Added exercise1.ipynb and rnn.ipynb	3 days ago
mlp.ipynb	Added link to google colab	13 hours ago
requirements.txt	Added requirements file	3 days ago
rnn.ipynb	Added link to google colab	13 hours ago

Help people interested in this repository understand your project by adding a README. Add a README

About No description, website, or topics provided.

Releases No releases published Create a new release

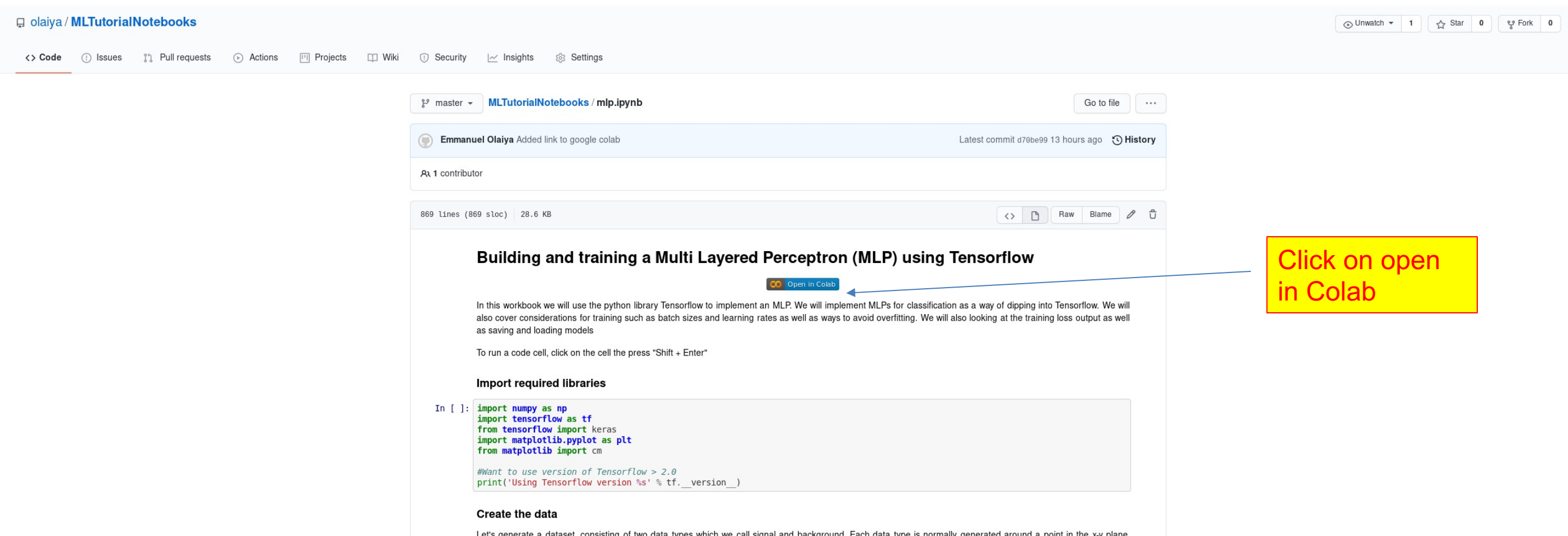
Packages No packages published Publish your first package

Languages Jupyter Notebook 100.0%

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# Using Google Colab

- When we work on a specific workbook, say mlp.ipynb, click on it



The screenshot shows a GitHub repository page for 'olaiya / MLTutorialNotebooks'. The file 'mlp.ipynb' is selected. The file content is as follows:

**Building and training a Multi Layered Perceptron (MLP) using Tensorflow**

[Open in Colab](#)

In this workbook we will use the python library Tensorflow to implement an MLP. We will implement MLPs for classification as a way of dipping into Tensorflow. We will also cover considerations for training such as batch sizes and learning rates as well as ways to avoid overfitting. We will also looking at the training loss output as well as saving and loading models

To run a code cell, click on the cell the press "Shift + Enter"

**Import required libraries**

```
In [ ]: import numpy as np
import tensorflow as tf
from tensorflow import keras
import matplotlib.pyplot as plt
from matplotlib import cm

#Want to use version of Tensorflow > 2.0
print('Using Tensorflow version %s' % tf.__version__)
```

**Create the data**

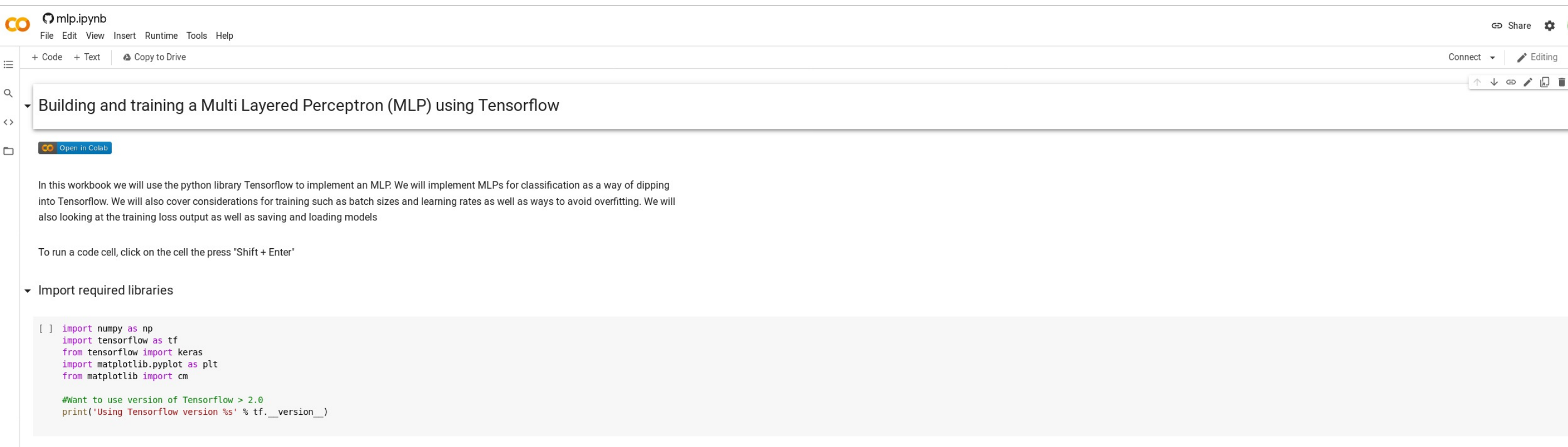
Let's generate a dataset consisting of two data types which we call signal and background. Each data type is normally generated around a point in the x-y plane

A yellow callout box with a red border points to the 'Open in Colab' button, containing the text: 'Click on open in Colab'.

- If clicking on icon doesn't work, copy and paste link in your browser

# Using Google Colab

- The workbook should load



The screenshot shows a Google Colab notebook interface. At the top, the title bar reads 'mlp.ipynb' with a menu bar containing 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help'. Below the menu bar, there are buttons for '+ Code', '+ Text', and 'Copy to Drive'. On the right side of the top bar, there are 'Share' and 'Editing' options. The notebook content is titled 'Building and training a Multi Layered Perceptron (MLP) using Tensorflow'. Below the title, there is a blue button that says 'Open in Colab'. The main text of the notebook reads: 'In this workbook we will use the python library Tensorflow to implement an MLP. We will implement MLPs for classification as a way of dipping into Tensorflow. We will also cover considerations for training such as batch sizes and learning rates as well as ways to avoid overfitting. We will also looking at the training loss output as well as saving and loading models'. Below this text, there is a note: 'To run a code cell, click on the cell the press "Shift + Enter"'. The next section is titled 'Import required libraries' and contains a code cell with the following Python code: 

```
[ ] import numpy as np
import tensorflow as tf
from tensorflow import keras
import matplotlib.pyplot as plt
from matplotlib import cm

#Want to use version of Tensorflow > 2.0
print('Using Tensorflow version %s' % tf.__version__)
```

# Using Your Own Computer

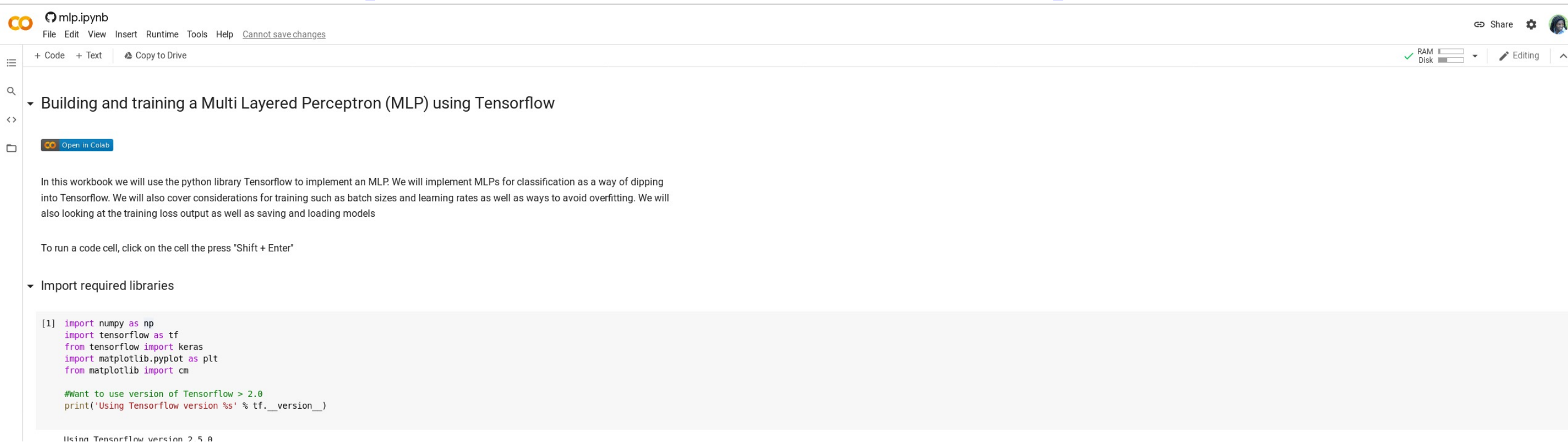
- If you want to run the workbook on your own computer that is fine
- Workbook is intentionally lightweight for this purpose
- Many setups you can use, install all the software, use a container such as Docker, use Conda .....
- What you need is git, python3 and the following libraries, tensorflow (>2.0.0), numpy, pandas, sklearn, matplotlib, jupyter
  - You don't need a GPU
- To pull the workbook onto you computer run:
  - `git clone https://github.com/olaiya/MLTutorialNotebooks.git`

Or download the workbook directly from the webpage:  
<https://github.com/olaiya/MLTutorialNotebooks>

- Run jupyter notebook

# Running A Workbook

- Workbooks are a collection of cells. The cells are either code cells or markdown cells (adding text or images )
- To run a piece of code in a cell, select the cell and press Shift+Enter



The screenshot shows the Google Colab interface for a notebook titled 'mlp.ipynb'. The top bar includes the Colab logo, the notebook name, and a menu with options like File, Edit, View, Insert, Runtime, Tools, and Help. A status bar on the right shows 'Share', 'Editing', and resource usage (RAM, Disk). The notebook content is organized into sections. The first section, 'Building and training a Multi Layered Perceptron (MLP) using Tensorflow', contains a paragraph of text. The second section, 'Import required libraries', contains a code cell with the following code:

```
[1] import numpy as np
import tensorflow as tf
from tensorflow import keras
import matplotlib.pyplot as plt
from matplotlib import cm

#Want to use version of Tensorflow > 2.0
print('Using Tensorflow version %s' % tf.__version__)
```

Below the code cell, the output shows 'Using Tensorflow version 2.5.0'.

- To add a cell click Insert->Code/Text cell
  - Some instances Insert->Cell Above/Below
    - Then select Cell->Cell type (to change between code and markdown)

# Today's Workbook Tutorial

- Today we will walk through workbooks on:
  - MLPs
  - CNNs
  - RNNs
- Hopefully we will have a bit of time for you modify the code and even create and run some code yourself
- Decide how you want to access the workbook. These slides will be available on the Indico agenda if you want to review the options again at a later date. Access to [monty.stfc.ac.uk](http://monty.stfc.ac.uk) will be available all week