



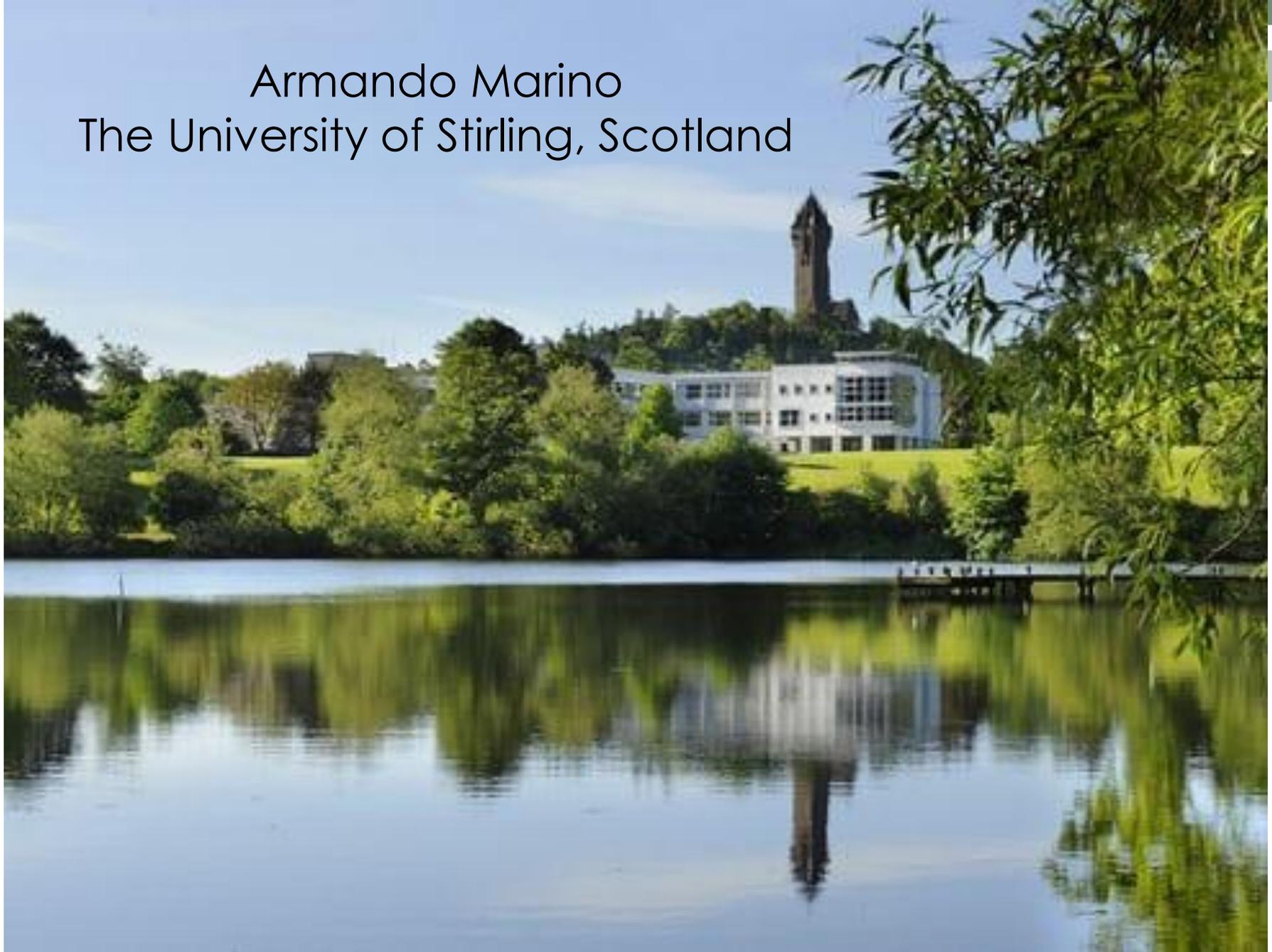
# Crop Classification with Time Series of Polarimetric SAR Data

Armando Marino

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# Introduction

Armando Marino  
The University of Stirling, Scotland



# Learning outcomes:

By the end of this practical you will learn how to:

- Run Python code for machine learning of multitemporal PolSAR data
- Pre-process PolSAR data for using machine learning
- Format the data in feature vectors
- Run random forest and K-Means classifiers
- Evaluate the accuracy of your classifiers



# Before you start:

- This practical builds on skills from a previous ARSET training: *Mapping Crops and their Biophysical Characteristics with Polarimetric SAR and Optical Remote Sensing*  
<https://appliedsciences.nasa.gov/join-mission/training/english/arset-mapping-crops-and-their-biophysical-characteristics>
- If you are not very familiar with Python, you may want to go through the materials from the previous training before you attempt this training.
- In the training folder, you will find files with and without solutions. My suggestion is to try to solve the coding exercises on your own before you listen to the training or look at the solutions.



# Python

*“Python is a programming language that lets you work quickly and integrate systems more effectively.”*

<https://www.python.org/>



You can find many tutorials or books on the web. The one I use is the following:

<https://docs.python.org/3/tutorial/>



# Downloading/Installing: Anaconda

My suggestion is to use the *Anaconda installer*, because it comes with most of the common libraries: <https://www.anaconda.com/products/individual?modal=nucleus>

If you do not want to use Anaconda, please make sure you use Python 3.x version (3.6+ will be fine), but **NOT 2.7**, since some functions have changed!

The 2.7 version will NOT run with the code I am sharing!

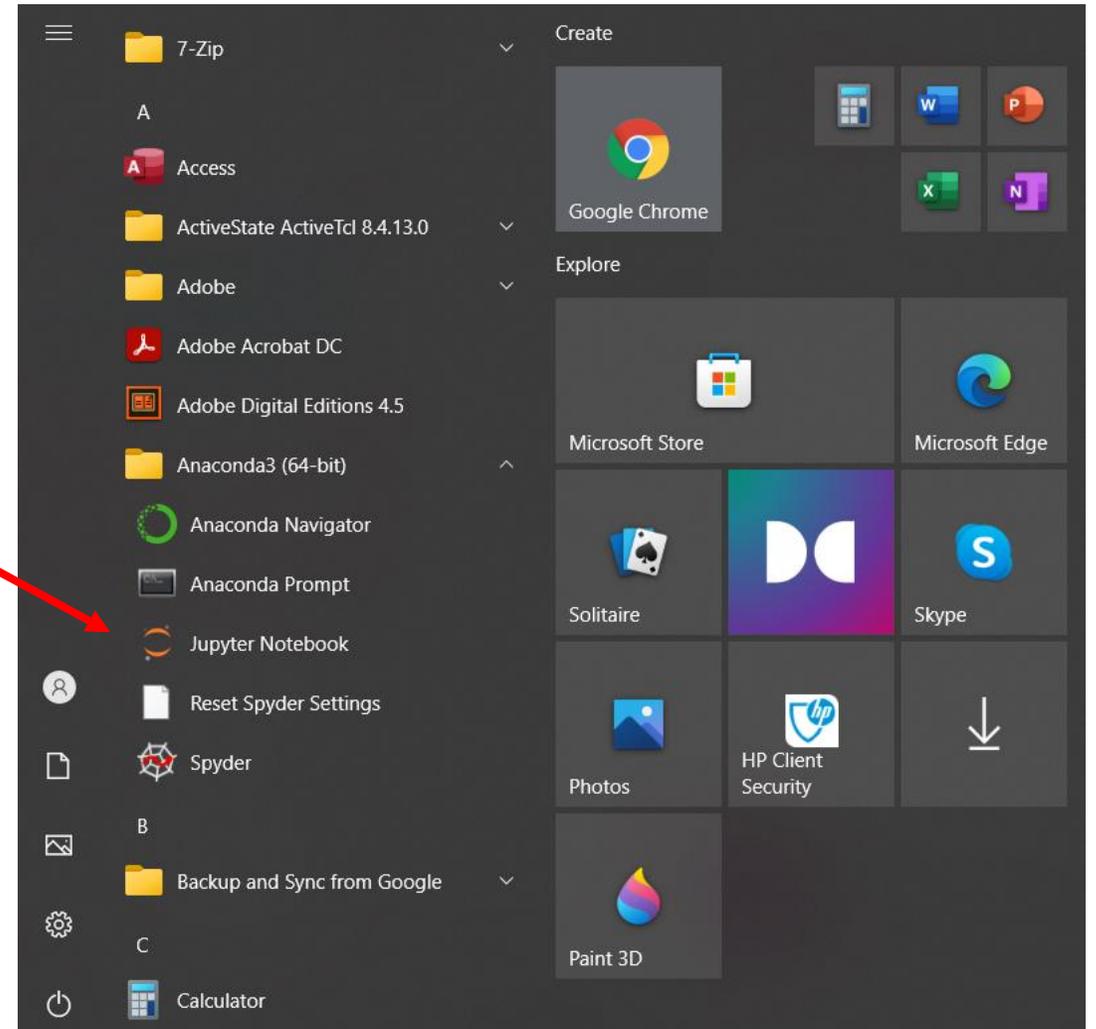
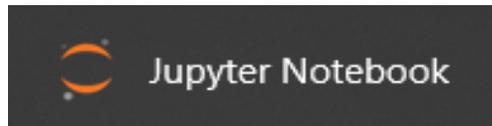
## Anaconda Installers

Windows 	MacOS 	Linux 
Python 3.9 64-Bit Graphical Installer (510 MB) 32-Bit Graphical Installer (404 MB)	Python 3.9 64-Bit Graphical Installer (515 MB) 64-Bit Command Line Installer (508 MB)	Python 3.9 64-Bit (x86) Installer (581 MB) 64-Bit (Power8 and Power9) Installer (255 MB) 64-Bit (AWS Graviton2 / ARM64) Installer (488 M) 64-bit (Linux on IBM Z & LinuxONE) Installer (242 M)

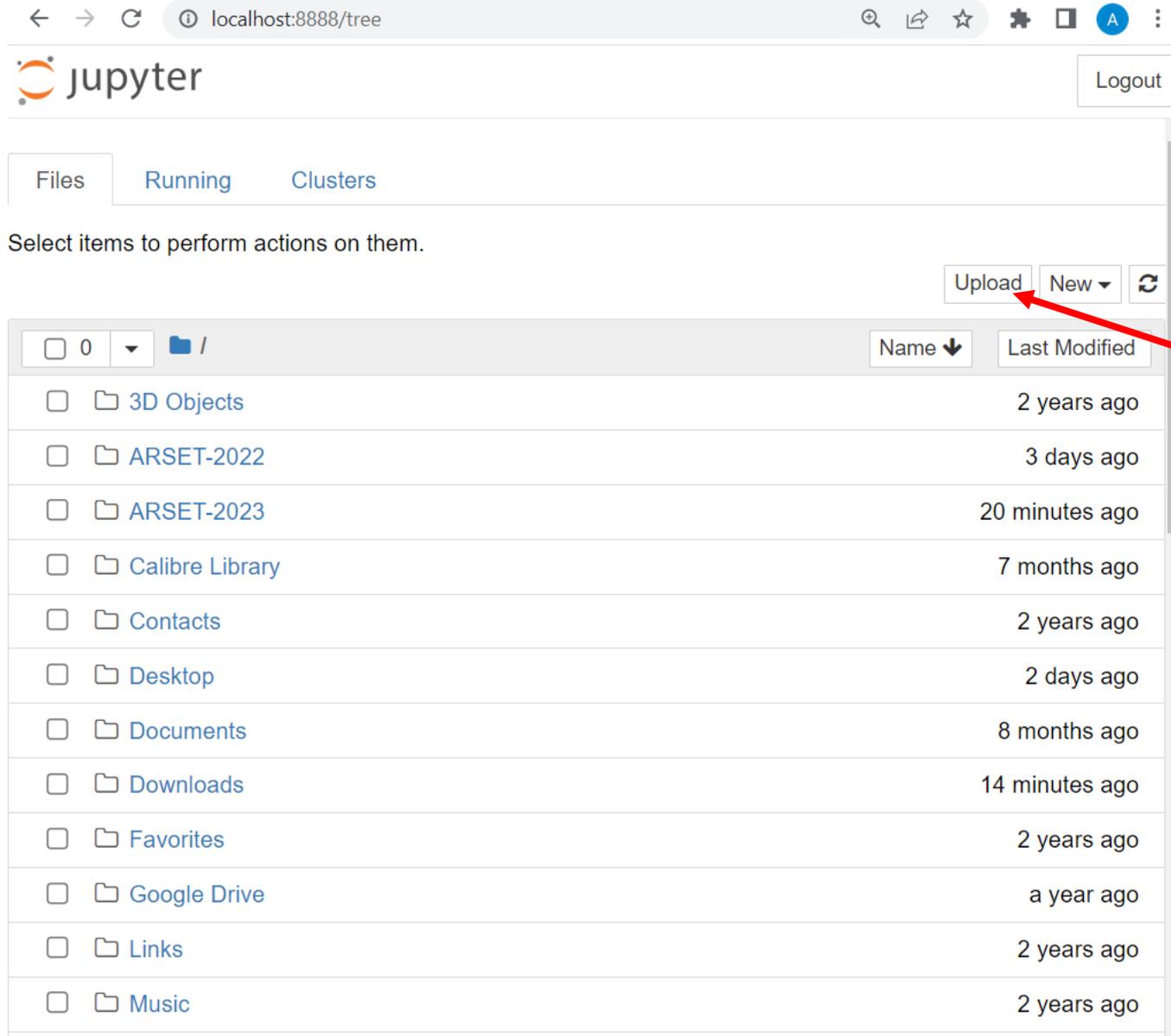


# Jupyter Notebook

Anaconda will install Jupyter Notebook and you should see its icon in the Start menu (Windows OS).



# Jupyter Notebook



The screenshot shows the Jupyter Notebook web interface in a browser. The address bar displays 'localhost:8888/tree'. The Jupyter logo is in the top left, and a 'Logout' button is in the top right. Below the logo, there are tabs for 'Files', 'Running', and 'Clusters'. A message says 'Select items to perform actions on them.' Below this, there are three buttons: 'Upload', 'New', and a refresh icon. A red arrow points from the 'Upload' button to the text on the right. The main area shows a file browser with a table of folders and their last modified times.

<input type="checkbox"/>	0	Name ↓	Last Modified
<input type="checkbox"/>	0	3D Objects	2 years ago
<input type="checkbox"/>	0	ARSET-2022	3 days ago
<input type="checkbox"/>	0	ARSET-2023	20 minutes ago
<input type="checkbox"/>	0	Calibre Library	7 months ago
<input type="checkbox"/>	0	Contacts	2 years ago
<input type="checkbox"/>	0	Desktop	2 days ago
<input type="checkbox"/>	0	Documents	8 months ago
<input type="checkbox"/>	0	Downloads	14 minutes ago
<input type="checkbox"/>	0	Favorites	2 years ago
<input type="checkbox"/>	0	Google Drive	a year ago
<input type="checkbox"/>	0	Links	2 years ago
<input type="checkbox"/>	0	Music	2 years ago

Jupyter opens in a web browser, and you can upload scripts using the **Upload** button.



# Spyder

Anaconda will install the Python editor **Spyder** and you should see the icon below.



Spyder is a handy editor, and you may want to use it when you are scripting **operational/automatic processing stacks**.

