

Machine Learning with Python

Numpy / Matplotlib / Scikit-learn

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Setup

On lab machines



Download and extract the Scikit-learn lecture material from:

https://disi.unitn.it/~passerini/teaching/2021-2022/MachineLearning_AIS/index.html

Open the terminal in the folder containing the extracted files and run:

```
> ./jupyter - scikit .sh
```

Setup

On your own machine

Make sure you are using Python 3 for the following steps.

Install Numpy, Scipy, Matplotlib, Scikit-learn and Jupyter:

```
> pip install numpy scipy matplotlib sklearn pandas  
> pip install jupyter
```

Download and extract the material for the Scikit-learn lab:

https://disi.unitn.it/~passerini/teaching/2021-2022/MachineLearning_AIS/index.html

Open the terminal in the folder containing the extracted files and run:

```
> jupyter notebook
```

Setup

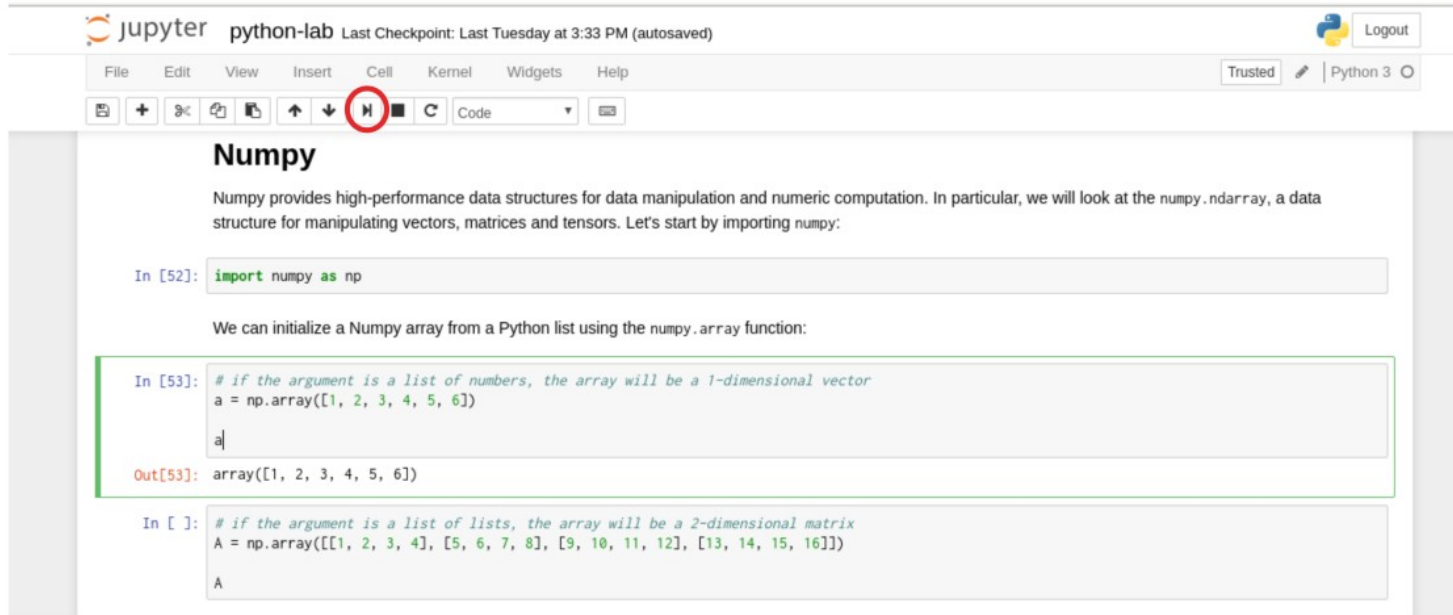
Jupyter notebook

Open the browser at the given address and you'll see something like:



Open the `sklearn-lab.ipynb` file containing the lecture notebook.

Jupyter notebook



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header: "jupyter python-lab Last Checkpoint: Last Tuesday at 3:33 PM (autosaved)" and a "Logout" button.
- Menu: "File Edit View Insert Cell Kernel Widgets Help".
- Toolbar: Includes icons for home, add, undo, redo, save, up/down arrows, a red-circled "Run" button, a stop button, and a refresh button. A dropdown menu is set to "Code".
- Section Title: "Numpy".
- Text: "Numpy provides high-performance data structures for data manipulation and numeric computation. In particular, we will look at the `numpy.ndarray`, a data structure for manipulating vectors, matrices and tensors. Let's start by importing `numpy`:"
- Code Cell 1:

```
In [52]: import numpy as np
```
- Text: "We can initialize a Numpy array from a Python list using the `numpy.array` function:"
- Code Cell 2:

```
In [53]: # if the argument is a list of numbers, the array will be a 1-dimensional vector
a = np.array([1, 2, 3, 4, 5, 6])
a
```
- Output:

```
Out[53]: array([1, 2, 3, 4, 5, 6])
```
- Code Cell 3:

```
In [ ]: # if the argument is a list of lists, the array will be a 2-dimensional matrix
A = np.array([[1, 2, 3, 4], [5, 6, 7, 8], [9, 10, 11, 12], [13, 14, 15, 16]])
A
```

Execute commands by selecting a cell and clicking the **Run button** on the header of the page or by **Shift+Enter**. You will see the output of the command just below the cell.

You can tweak and modify the code as you wish and execute it again.

Exercise

For the exercise, you will solve a classification task using **Scikit-learn** over some given dataset. Each available dataset is already split into training and test sets. Choose a dataset, train a classifier on the training set and predict the labels on the test set. Hopefully, your classifier will classify the examples in the test set with higher accuracy than the reference baseline for the chosen dataset.

Exercise

Datasets

OCR

Optical Character Recognition



Spambase

Spam email classification



Presidential campaign tweets

Classification of tweets from D. Trump and H. Clinton



Exercise

Material

Download the material:

https://disi.unitn.it/~passerini/teaching/2021-2022/MachineLearning_AIS/index.html

The material contains the three datasets, each one containing:

- ▶ The training set examples;
- ▶ The training set labels;
- ▶ The test set examples;
- ▶ The test set labels;
- ▶ A README containing info about the dataset.
this file also contains the reference baseline accuracy;
- ▶ Other info files.

Exercise

Step-by-step

1. Choose a dataset;
2. Experiment with a classification algorithm of your choosing;
3. Test your classifier using cross-validation over the training set
4. Train your classifier over the full training set;
5. Use the classifier to predict the examples in the test set;