

Introduction to the LABs

Neural Networks and Deep Learning, 2021/2022

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Tentative schedule for Labs

8 lab sessions

22/10, 29/10, 05/11, 12/11, 19/11, 26/11, 10/12, 17/12

Room and time: Le/Zoom @ 14:30

Always on a Friday, always at 14:30, always in Le/Zoom

After lunch lectures be like



Even more so: we will see python code...

Heterogeneous Audience

M.Sc. ICT FOR LIFE AND HEALTH

Department of Information Engineering

M.Sc. COMPUTER ENGINEERING

Department of Information Engineering

M.Sc. AUTOMATION ENGINEERING

Department of Information Engineering

M.Sc. PHYSICS OF DATA

Department of Physics and Astronomy

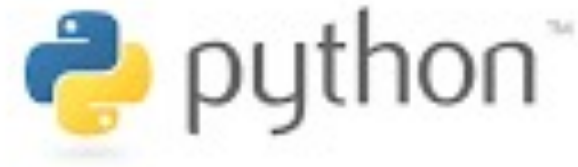
M.Sc. COGNITIVE NEUROSCIENCE AND CLINICAL NEUROPSYCHOLOGY

Department of General Psychology

→ We will start from the basics

Overview

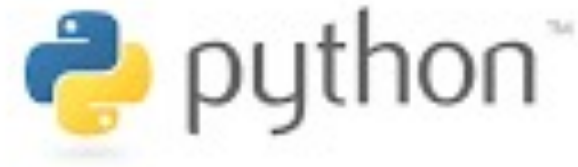
- Python and its ecosystem
- Where to run Python code
 - Locally
 - Anaconda
 - On the cloud
 - Shared resources: Google Colab
 - Dedicated resources: Google Cloud Platform [optional]
- **Notebook 1:** Introduction to Python
- **Notebook 2:** Linear Regression in Python



Google Cloud Platform

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Python



- Open-source general-purpose language
- Object-oriented programming language
- Great interactive environment
- Current version is 3.9
 - There are **relevant** changes from Python 2.x to 3.x
 - For this course we use Python 3.x

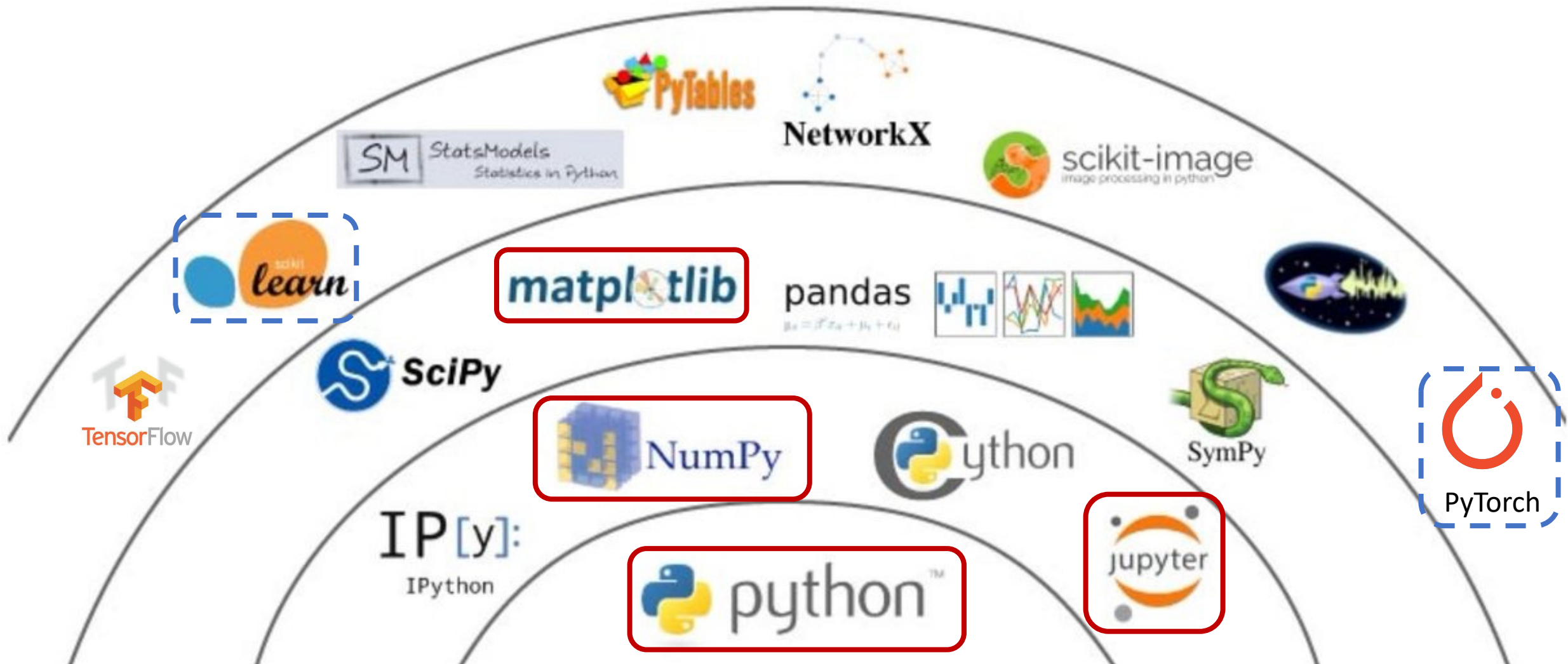
Website: <http://www.python.org>

Documentation: <http://www.python.org/doc/>

Python Ecosystem

In this lecture

In the next lectures



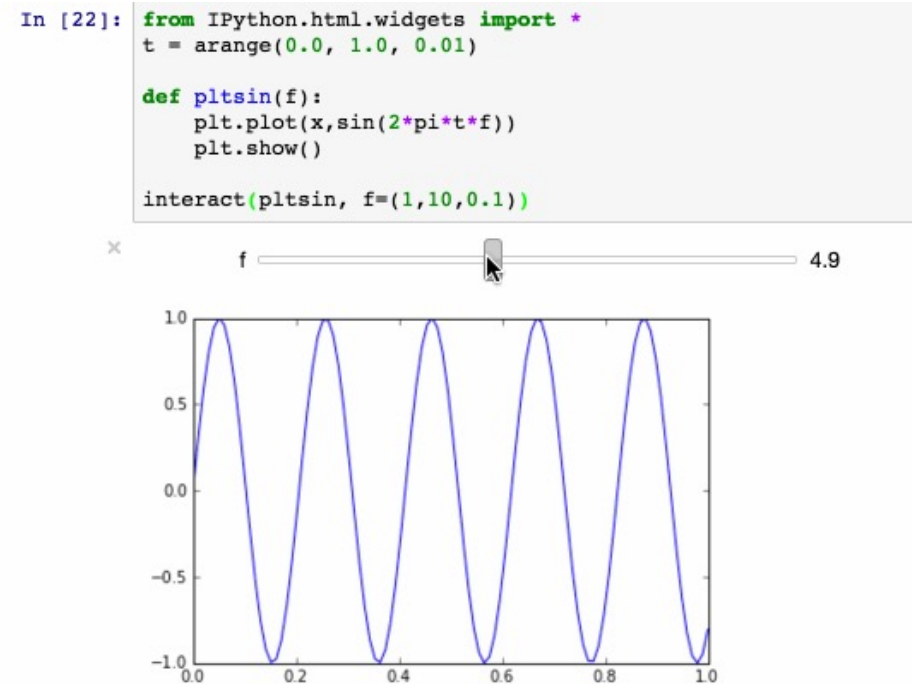
Module: Jupyter Notebooks



- It enables interactive computing
 - easier to debug and visualize data while running code
 - can combine text and code
 - can support multiple kernels
- Very useful for teaching purposes
- Start the notebook server with:
jupyter notebook (or *jupyter lab*)

Website: <https://jupyter.org/>

Documentation: <https://numpy.org/doc/>

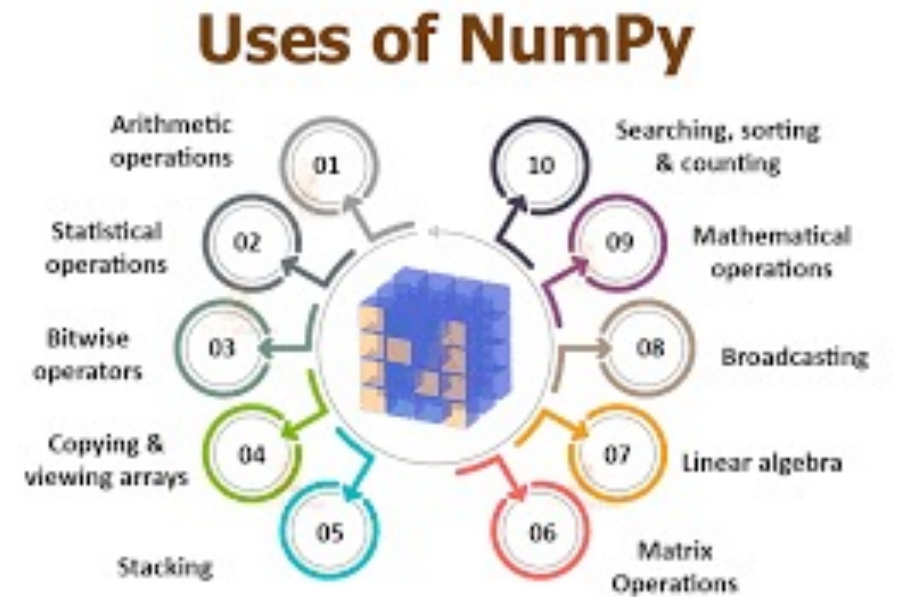
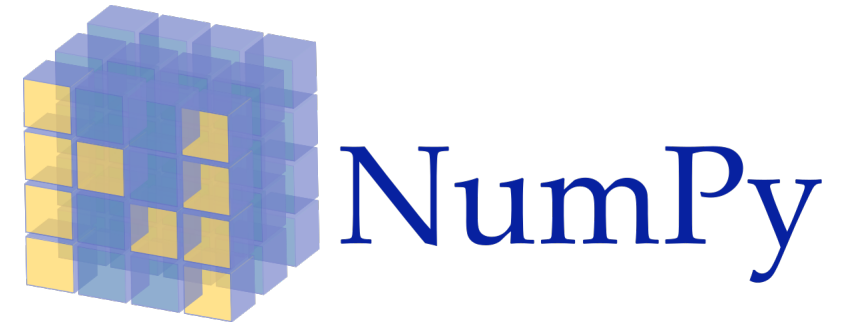


Module: NumPy

- Standard for working with numerical data in Python
→ Similar to Matlab
- **ndarray**: n-dimensional array object
- Efficient methods between arrays (linear algebra,...)

Website: <https://numpy.org/>

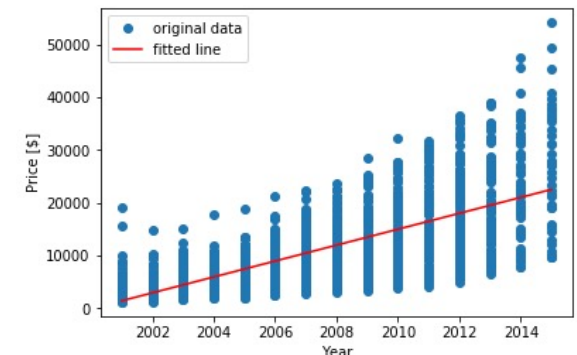
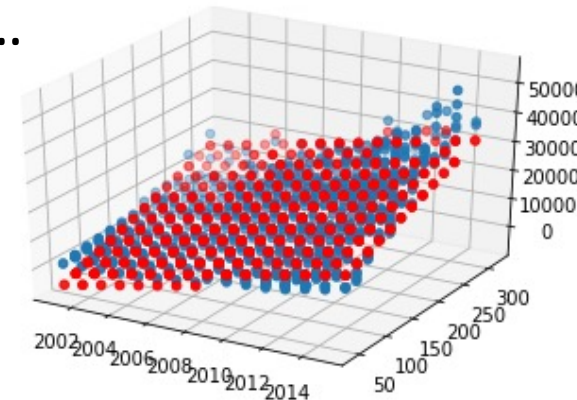
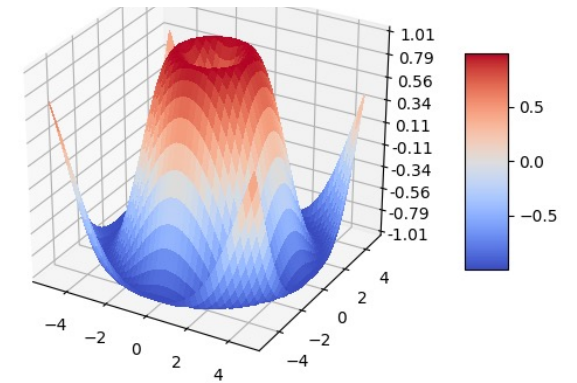
Documentation: <https://numpy.org/doc/>



Module: Matplotlib



- 2D plotting library for Python
- It can produce figures in a variety of formats and interactive environments
- It can plot: lists, numpy arrays, pandas objects,...
- It can be used from any Python snippet
 - shell, .py, .ipynb,...

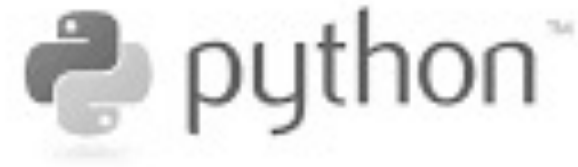


Website: <https://matplotlib.org/>

Documentation: <https://matplotlib.org/stable/contents.html>

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Running on a local machine

Recommended: (install and) use *Anaconda* (with Python 3)

Run the following commands (note: in Windows open the **Anaconda Prompt**)

- ❑ Create an environment: `conda create --name torch python=3.8`
 - ❑ Activate the environment: `conda activate torch`
 - ❑ Install packages (e.g., pytorch <https://pytorch.org/get-started/locally/>):
 - CPU version: `conda install pytorch torchvision -c pytorch`
 - GPU version [depending on the hardware!]: `conda install pytorch torchvision cudatoolkit=11.1 -c pytorch -c conda-forge`
- NOTE: Conda automatically installs all the dependencies
-
- ❑ To develop code:
 - *Jupyter Notebook* or *Spider (spider3)* [included with Anaconda]
 - PyCharm [free educational license] or Visual Studio Code [free]

<https://www.anaconda.com/products/individual>

Running on the cloud – Google Colab

Free service, with **shared** resources (also GPUs!)

Easy to setup, it should be enough for all the tasks of this course



→ We will use Jupyter Notebooks on Google Colab when we will need a GPU

→ Many modules already installed: NumPy, Matplotlib, PyTorch,...

Note: you have to ask for the GPU if you need it, from:
runtime>change runtime type



Intro: <https://colab.research.google.com/notebooks/intro.ipynb>

Running on the cloud – Google Cloud Platform (GCP)

Paid service, with **dedicated** resources (also GPUs!)

Requires a bit of setup and it is needed only for some *optional* tasks of this course

→ We will use Jupyter Notebooks on Google Colab when we will need a GPU

Intro: <https://cloud.google.com/docs/overview>



Google Cloud Platform

Running on the cloud – Google Cloud Platform (GCP)

What you need:

- a valid Google account
- access to your student email *@studenti.unipd.it* or *@dei.unipd.it*



Redeem the 50\$ Google Cloud Platform (GCP) credits:

Google Cloud Platform

As a student of this course, you can redeem 50\$ GCP credits for free.

You also have a 90-days trial of 300 GCP credits (not needed for this course).

These credits can be used for any tool available on the GCP, but be conscious of the resources that you allocate and use!

Once you run out of credits, you can still use the DEI cluster

*(<https://clusterdeiguide.readthedocs.io/en/latest/>), but **we won't be able to give you additional Google credits.***

Running on the cloud – Google Cloud Platform (GCP)



Google Cloud Platform

IMPORTANT NOTE

Be sure (triple check!) to Use an official Google account ([*@gmail.com](mailto: *@gmail.com)) to redeem the credits to avoid any issues.

If you use Google services with domains for which you don't have admin rights (e.g. [*@studenti.unipd.it](mailto: *@studenti.unipd.it) or [*@dei.unipd.it](mailto: *@dei.unipd.it)) you may experience problems when creating new projects and to associate billing accounts. If you are unsure, the safest way is to use the stealth (incognito) mode of your browser during the redeeming process.



Running on the cloud – Google Cloud Platform (GCP)

Create a new GCP project

- Go to the GCP console: <https://console.cloud.google.com/>
- Create a New Project being sure to select the billing account with the 50\$ credit.

Create a new Virtual Machine (using AI Platform)

- Go to *Navigation menu (top-left corner)* -> *AI Platform* -> *Notebooks*
- Select *New Notebook* -> *PyTorch 1.9* -> *Without GPU*
 - Don't worry! The monthly *Estimated cost* refers to an "always on" machine.
You won't be charged if you **stop** the VM, so **do not forget to shut down the VM after use.**
 - The *Standard* machine will cost about 0.15\$ per hour.
- Click *Create*.
- Wait for the VM to be created.



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It takes a while to setup the VM!

Running on the cloud – Google Cloud Platform (GCP)

Use JupyterLab

- Click *Open Jupyterlab* (be patient, the first time you have to wait a few minutes after the VM creation).
- Start looking around to be familiar with Jupyterlab and to be sure everything is working.



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SHUT DOWN THE VIRTUAL MACHINE!

Always remember to STOP the VM after use. **Even if you are not using it, you will be charged if you keep the VM on.**

- Go to *AI Platform -> Notebooks*
- Select the VM
- Click STOP

Running on the cloud – Google Cloud Platform (GCP)

(Optional) GPU support

You may want to add a GPU to your VM. You can do it easily following the previous steps, but if you get a *quota* error, you first may need to increase your quotas.



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- Go to *Navigation menu* -> *IAM & Admin* -> *Quotas*
- Search for "GPUs (all regions)"
- Click on *EDIT QUOTAS* and then fill the form that pops up on the right-hand side
- Increase the quota limit to 1 and click on *Submit request*
- The new quota may require a few days to be approved.

Running on the cloud – Google Cloud Platform (GCP)

How to redeem the 50\$ coupon

Here is the URL you will need to access in order to request a Google Cloud coupon. You will be asked to provide your **school email address** and **name**. An email will be sent to you to confirm these details before a coupon is sent to you.



Google Cloud Platform

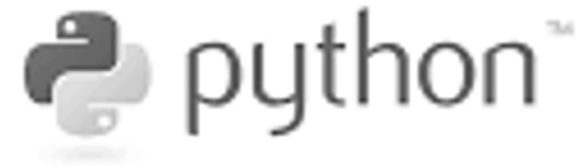
Student Coupon Retrieval Link [SENT VIA EMAIL TO REGISTERED STUDENTS]

- You will be asked for a name and email address, which needs to match your school domain. A confirmation email will be sent to you with a coupon code.
- You can request a coupon from the URL and redeem it until: 2/1/2022
- Coupon valid through: 10/1/2022
- You can only request ONE code per unique email address.

REMEMBER: after receiving the code, redeem it from your personal Google account!

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Python Tutorials

Useful resources to learn the basics of Python programming:

- ❑ See the provided script: *nndl_2021_lab_01_intro.ipynb*
- ❑ <http://cs231n.github.io/python-numpy-tutorial/>
- ❑ Jupyter notebook version of the tutorial at:
<https://github.com/kuleshov/cs228-material/blob/master/tutorials/python/cs228-python-tutorial.ipynb>