

Machine Learning

Laboratory on scikit-learn

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Set-up on Google Colab

If you prefer to run the notebook in the cloud, use the Google Colab link provided in the repository or scan the QR code below.



Figure 1: QR code to open Colab

No local installation is required; everything runs in your browser.

Preliminaries (on your PC)

1. Download the Material

Download or clone the course repository from:

<https://github.com/samuelebortolotti/machine-learning-lab>



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Preliminaries (on your PC)

2. Install Jupyter Notebook

Open your terminal and install Jupyter using pip:

```
pip install jupyter-notebook
```

Note: If you are using Anaconda, Jupyter is already included.



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Preliminaries (on your PC)

3. Navigate to the Project Folder

Use the terminal to move into the scikit directory:

```
cd path/to/scikit
```

Then launch Jupyter Notebook:

```
jupyter-notebook
```



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Preliminaries (on your PC)

4. Open Jupyter in Your Browser

Once Jupyter starts, your browser will open automatically showing the current working directory.

Locate and open the notebook file:

`scikit-learn.ipynb`

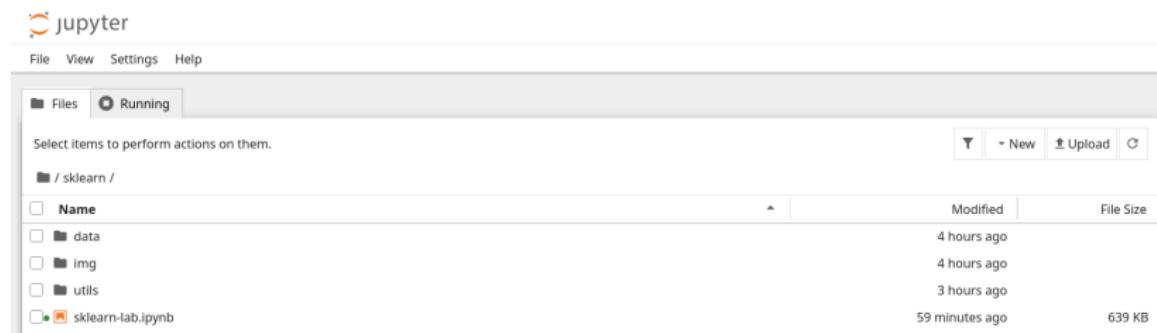
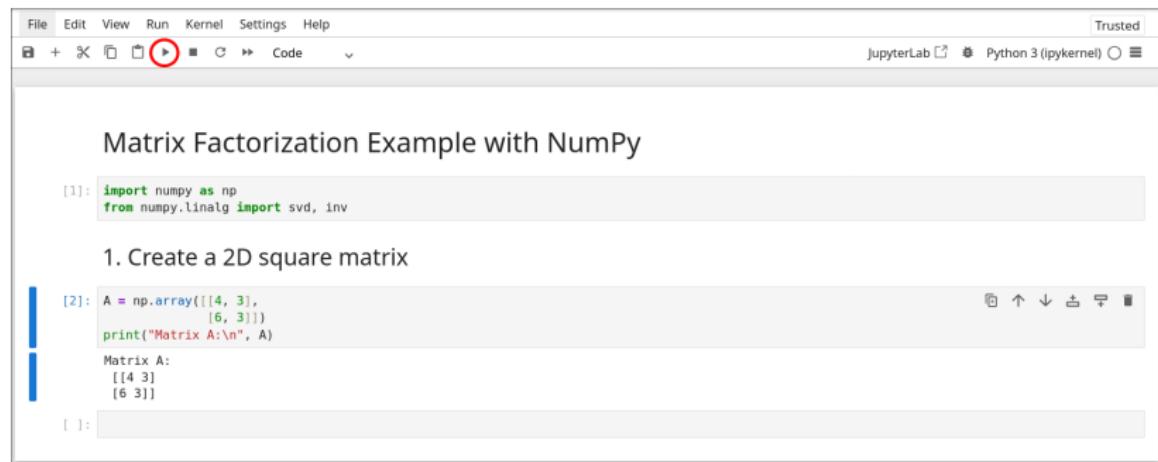


Figure 2: Jupyter file browser

Running Cells in Jupyter

To execute a cell, you can either:

- Click the **Run** button in the toolbar, or
- Press **Shift + Enter** on your keyboard.



The screenshot shows a Jupyter Notebook interface. The top menu bar includes File, Edit, View, Run, Kernel, Settings, and Help. A toolbar below the menu has several icons, with the 'Run' icon (a play button) circled in red. The main area is titled 'Matrix Factorization Example with NumPy'. Cell [1] contains the code:

```
import numpy as np
from numpy.linalg import svd, inv
```

. Cell [2] contains the code:

```
A = np.array([[4, 3],
              [6, 3]])
print("Matrix A:\n", A)
```

, which outputs:

```
Matrix A:
[[4 3]
 [6 3]]
```

. The bottom status bar indicates 'Trusted' and shows 'jupyterLab' and 'Python 3 (ipykernel)'.

Figure 3: Running a cell in Jupyter

Take-home Exercise

As a self-assessment exercise, complete a classification task using **Scikit-Learn**.

Steps:

- ① Choose a dataset.
- ② Train and tune a classifier (e.g., perform hyperparameter optimization).
- ③ Evaluate the model on the test set.
- ④ Compare performance across different classifiers.



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Suggested Datasets

You can find datasets in the UCI Machine Learning Repository:

- Spambase
- Optical Recognition of Handwritten Digits
- Abalone
- Additional datasets available at <https://archive.ics.uci.edu/>

Model Comparison

Compare the performance of multiple classifiers such as:

- Decision Tree
- Random Forest
- SVM

Perform hyperparameter tuning and report the evaluation metrics (e.g., accuracy, precision, recall, F1-score).



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