Introduction to the course and final project specifications

Silvio Peroni
silvio.peroni@unibo.it – https://orcid.org/0000-0003-0530-4305 – @essepuntato

Data Science (A.Y. 2023/2024)
Second Cycle Degree in Digital Humanities and Digital Knowledge
Alma Mater Studiorum - Università di Bologna

CC BY

DIPARTIMENTO DI FILOLOGIA CLASSICA E ITALIANISTICA

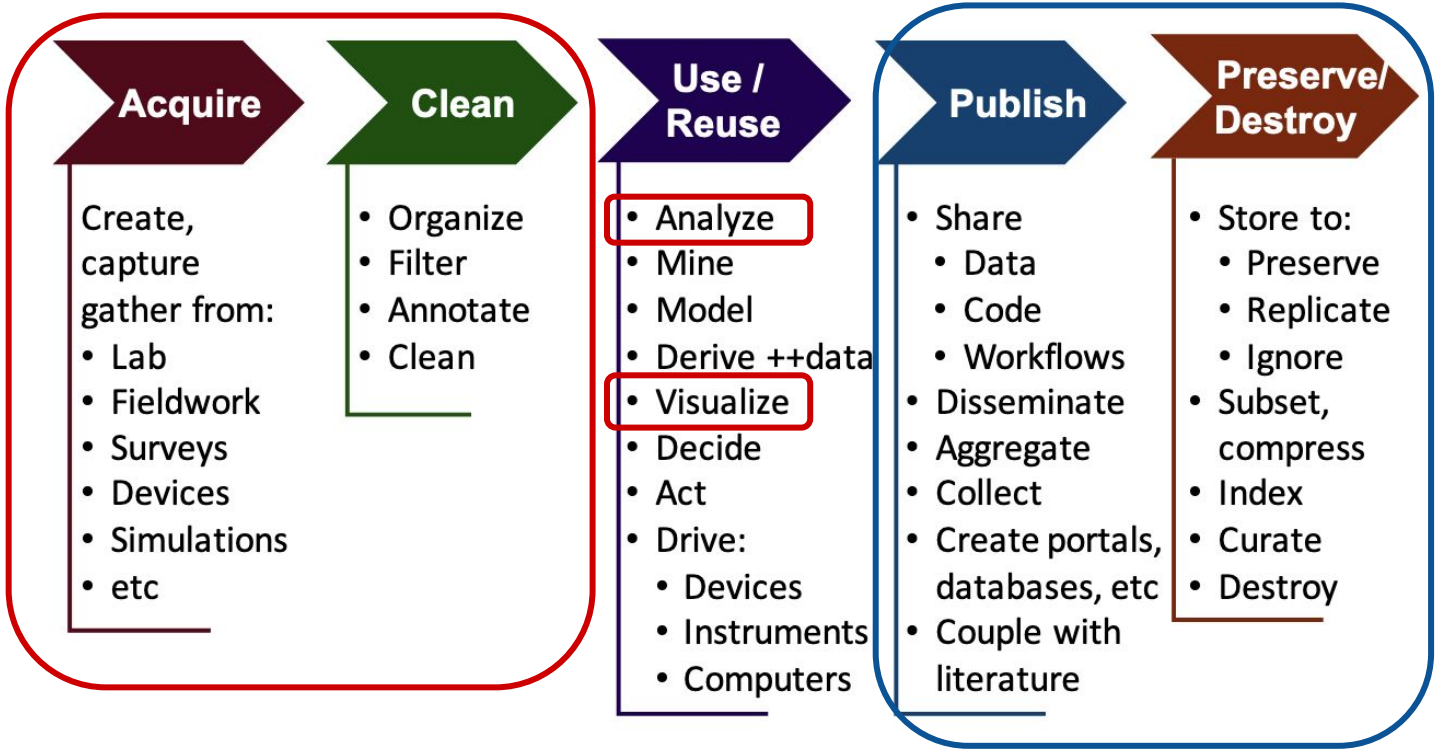
A preliminary introduction to
the basic tools that
enable you to start a

Data Science

project
(and get the final score for
the integrated course
“Computational Management of Data”)

Data Science life cycle (and what we will address)

DHDK Data Science course (this course)

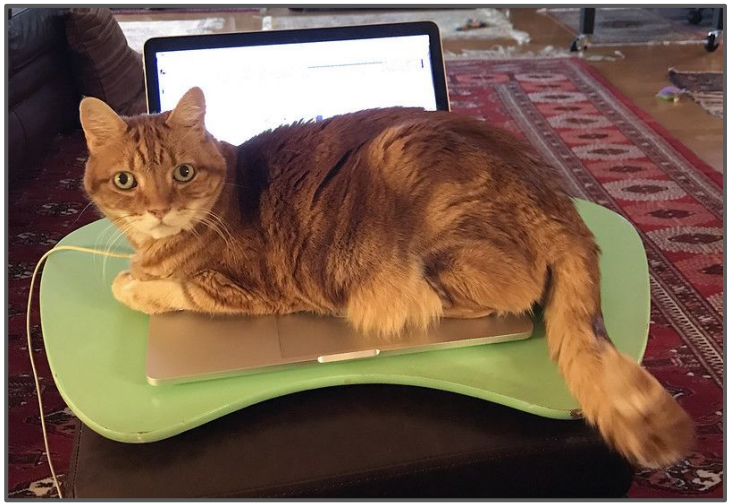


DHDK Open Science course (optional 2nd year course)

Berman, F., Rutenbar, R., Hailpern, B., Christensen, H., Davidson, S., Estrin, D., Franklin, M., Martonosi, M., Raghavan, P., Stodden, V., & Szalay, A. S. (2018). Realizing the potential of data science. Communications of the ACM, 61(4), 67–72. https://doi.org/10.1145/3188721

It is a practical course

Computer, your best friend



Gettysburg College, https://www.flickr.com/photos/gettysburgcollege/3082146647/; A.Davey, https://www.flickr.com/photos/adavey/40903187052/

Rules

Let's see the rules of this course:

- There are **no text books** provided: if you have a doubt, google it
- Material that will be introduced in the course can be found on the GitHub repository of the course
- If you cannot attend, do not attend (even if attendance is **highly recommended**: you can ask questions)
- At least six exam sessions per academic year
- Max score one can obtain is 32 (out of 30)

Course material

All the material (including slides) is available in the GitHub repository of the course at https://github.com/comp-data/2023-2024/

Have you found a mistake in the material? Please write me an email at silvio.peroni@unibo.it

Some (partial) suggested (external) material (for Python and data management with Python):

- Peroni, S. (2020). Computational Thinking and Programming book. https://comp-think.github.io
- Tagliaferri, L. (2018). How To Code in Python. ISBN: 978-0999773017. https://www.digitalocean.com/community/books/digitalocean-ebook-how-to-code-in-python
- Walsh, M. (2021). Introduction to Cultural Analytics & Python. https://melaniewalsh.github.io/Intro-Cultural-Analytics/
- The Programming Historian. ISSN: 2397-2068. https://programminghistorian.org/en/
- Dombrowski, Q. (2020). Jupyter notebooks for digital humanities. https://github.com/quinnanya/dh-jupyter

Communications

We use a Slack discussion group for communicating with each other

Slack is a communication platform offering many IRC-style features, including persistent chat rooms (channels) organized by topic, private groups, and direct messaging, and can be used in any device (it has been developed for mobile and desktop devices)

Invitation link to join the workspace:

https://join.slack.com/t/essepuntato-uni/shared_invite/zt-2bmsd7ekh-JoKR_AhyN7F128mpJSda6Q

Once you entered in the workspace following the previous link, please send a message in the channel “#general” asking for being added by me to the private channel of the course (“data-science-23-24”)

Please, do a Slack account as soon as possible (e.g. during the break) since I will close the invitation link in at the end of this week – and we will start to use it since Friday

Interacting

We will use the GitHub repository of the course for a series of activities, such as exercises and raising issues

All questions about coding to ask to either me or your fellows must be asked as new issues

Thus, please, create a new account on GitHub: https://github.com/join

Once logged into GitHub, go to the issue page of the course repository, and then feel free to add and respond to issues there

A very introductory guide to GitHub can be find online

Course organisation

This introductory lecture

Theoretical lectures (7 lectures, 14 hours), where I provide a theoretical introduction about the specific topic – computer not necessary but you can bring it with you of course

Hands-on sessions (7 lectures, 14 hours), where I run a laboratory activity session based on existing tools that enable the experimentation with the topics introduced in the theoretical lectures – computer mandatory

Tutor sessions (to be agreed with the tutor), where Arcangelo Massari recalls some of the topics introduced in the course according to your specific needs

Course calendar

All lectures 12:00 - 14:00, lectures in red, hands-on in blue

02/02/24	What is a datum and how it can be represented computationally
07/02/24	Data formats and methods for storing data in Python
09/02/24	Introduction to data modelling
12/02/24	Implementation of data models via Python classes
14/02/24	Processing and querying the data
16/02/24	Introduction to Pandas
19/02/24	Database Management Systems

21/02/24	Configuring and populating a relational database
22/02/24	SQL, a query language for relational databases
28/02/24	Configuring and populating a graph database
01/03/24	SPARQL, a query language for RDF databases
04/03/24	Interacting with databases using Pandas
06/03/24	Describing and visualising data
08/03/24	Descriptive statistics and graphs about data using Pandas

Exam

The exam consists of

1. the implementation of a project – yes, you have to write a software, and the specifications will be introduced today
2. an oral colloquium on the project implemented, for assessing the contribution of each student

It will be assigned maximum 16 points for the correctness of the project – I will run a series of tests aiming at assessing all the code developed

The points above are assigned to all the students that have worked to the project

Other 16 points (maximum) will be assigned to each individual student as result of the oral colloquium

Groups

You have to organise in groups

- 3-4 people (not less, not more)
- You have to choose a name for the group (please, be creative)

Before the next lecture, I will post a link on Slack to subscribe your group

I would strongly suggest to split the work, so as to have a reasonable amount of code to implement

Registering final grade

As you know, this course is just a module of an Integrated Course (I. C.)

- Computational Management of Data (Integrated Course)
  - Module 1: Computational Thinking and Programming (first semester course, done)
  - Module 2: Data Science (this course!)

You can register only the final grade of the Integrated Course, which is computed as the average of the final scores of the two modules (max. 30L each module)

Evaluation of the course

The last lectures of the course, you will be asked to fill-up a questionnaire on the organisation of the course and related stuff - it is anonymous, of course

Please, do it carefully and honestly, since it is one of the most important inputs I will have to understand what can be improved in the next year course

This is the third year for this course, and thus it is crucial to have your feedback in order to understand how to improve it for the next year

JupyterLab

JupyterLab is a web-based interactive development environment for notebooks, code, and data

You need to have Python installed to running Jupyter – you can find instruction for installing Python in the first laboratory lecture of the Computational Thinking and Programming course

To install JupyterLab, you can use the command `pip` as follows:

```
pip install jupyterlab
```

It will be used for all the hands-on sessions, thus be sure to have it available on your computer, and the website includes a very good documentation, while a lot of tutorials are available online

The project

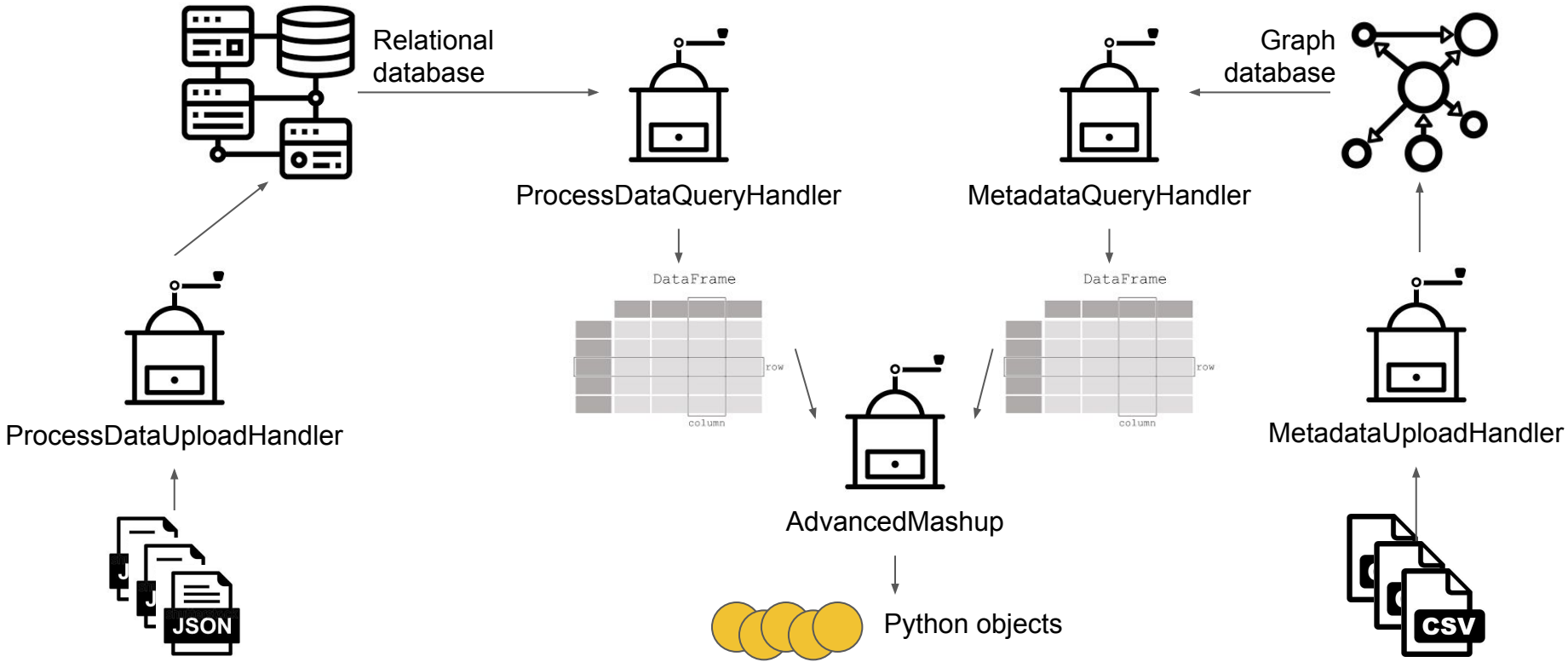
Overall goal of the project

Develop a software that enables one

1. to process data stored in different formats and to upload them into two distinct databases
2. to query these databases simultaneously according to predefined operations

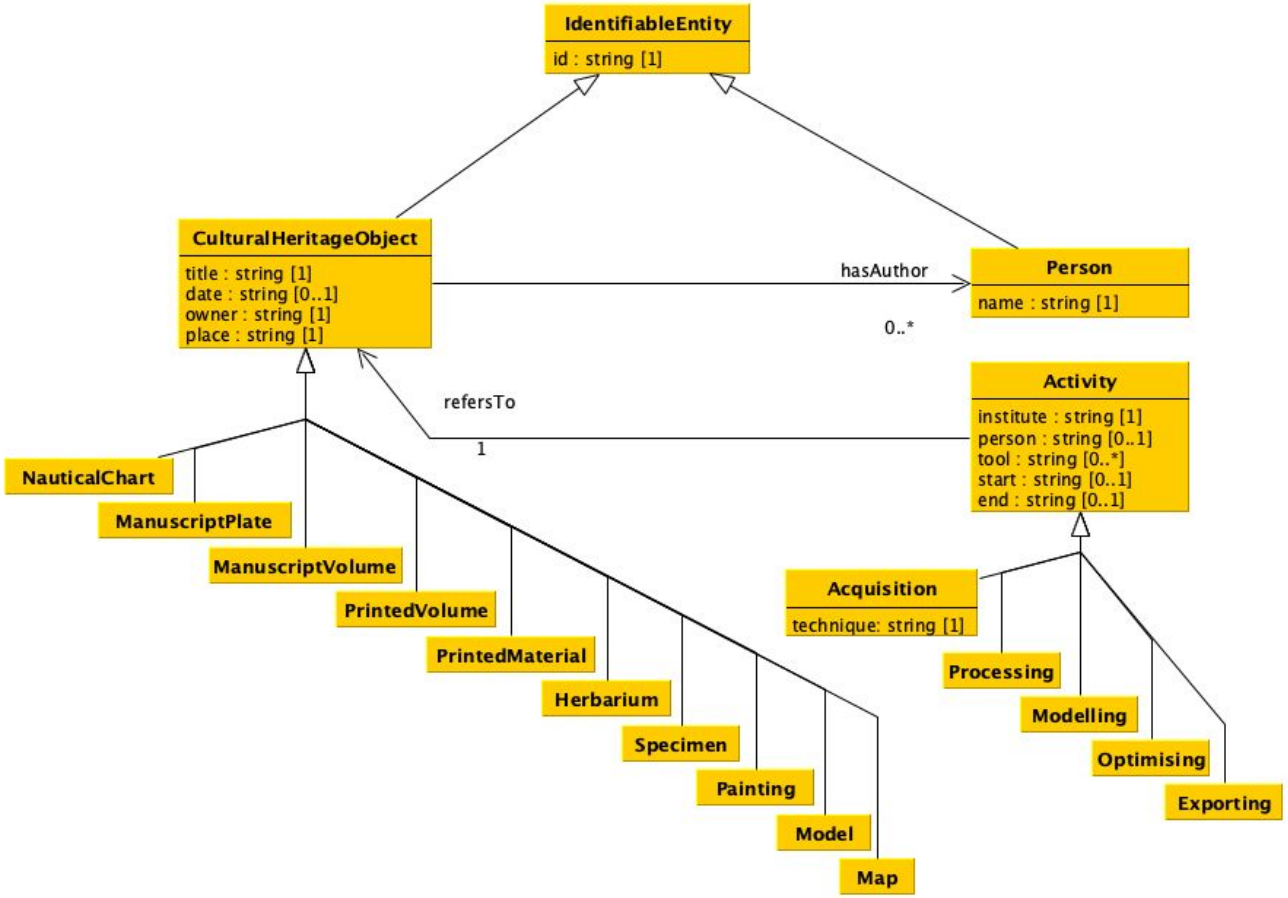
Information about the project can be found in the GitHub repository of the course (and will be updated in due course)

Workflow

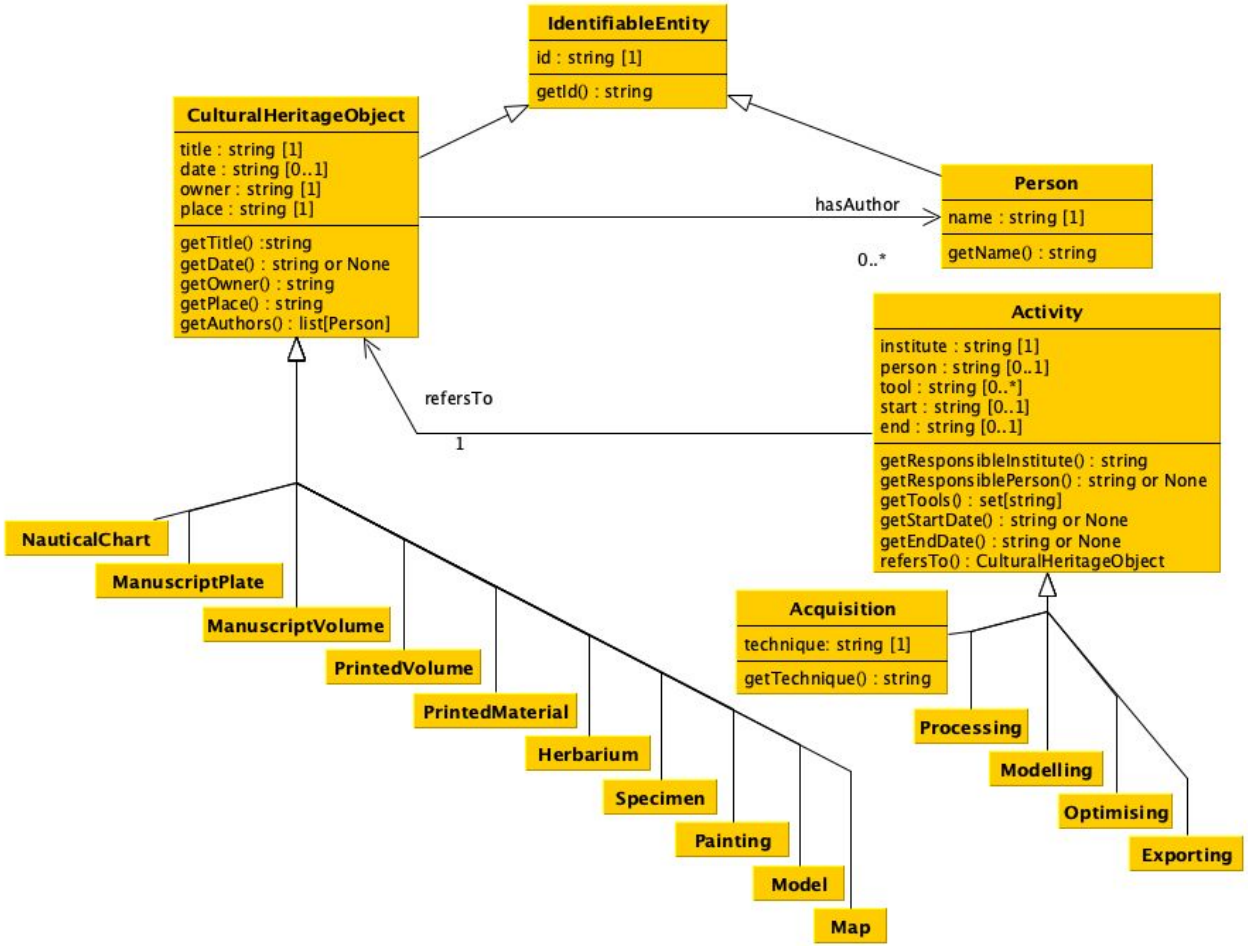

Relational database
ProcessDataQueryHandler
MetadataQueryHandler
Graph database
DataFrame
row
column
DataFrame
row
column
ProcessDataUploadHandler
AdvancedMashup
MetadataUploadHandler
JSON
Python objects
CSV

Data model

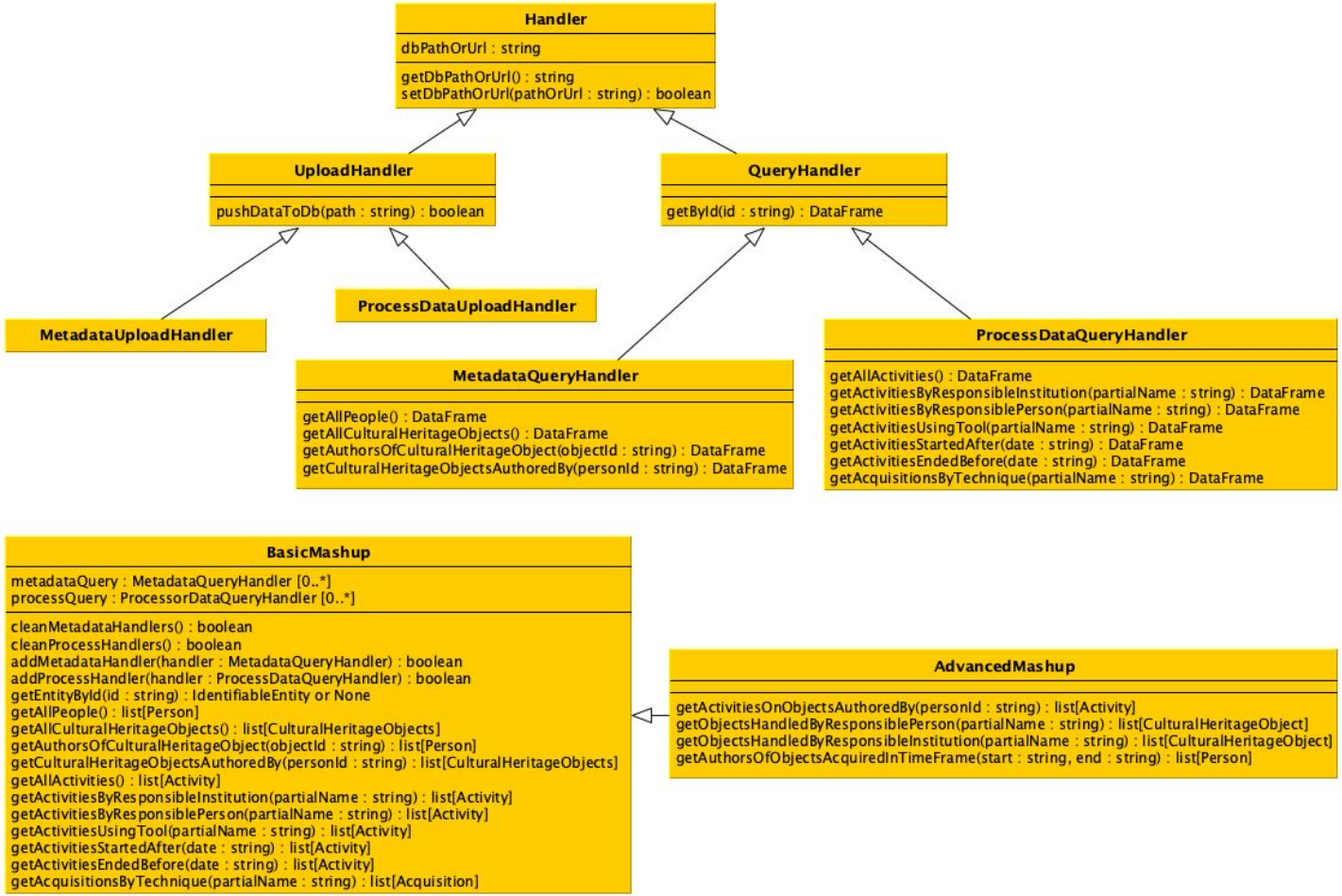
The data model of the various entities to handle is loosely based on a project we (at UNIBO) are running on museums and art collections – if you are curious, you can find more info at https://doi.org/10.1016/j.daach.2023.e00309



Software: UML diagram (1/2)



Software: UML diagram (2/2)



Submission of the project

You have to provide all Python files implementing your project, by sharing them in some way (e.g. via OneDrive)

You have to send all the files **two days before** the exam session you want to take

Before submitting the project, **you must be sure** that your code passes a particular basic test (that will be provided soon) which aims at checking if the code is runnable and compliant with the specification

The schedule of the six exam sessions:
May ‘24, June ‘24, July ‘24, September ‘24, November ‘24, January ‘25

Suggestion: use the test-driven development

You already know what is the test-driven development (TDD) – to refresh your memory, you can look at this slide (and scream…)

I strongly suggest you to systematically adopt this development technique for developing your code

In addition, there is at least a Python library available which has been entirely developed to facilitate the creation of tests, i.e. `unittest`

Online, you can find several documents describing how to create tests in Python, such as one at the Real Python website

End

Introduction to the course and final project specifications

Silvio Peroni
silvio.peroni@unibo.it – https://orcid.org/0000-0003-0530-4305 – @essepuntato

Data Science (A.Y. 2023/2024)
Second Cycle Degree in Digital Humanities and Digital Knowledge
Alma Mater Studiorum - Università di Bologna

CC BY

DIPARTIMENTO DI FILOLOGIA CLASSICA E ITALIANISTICA