Data Mining

Integrated Analytics Lab

whoami

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Research topics

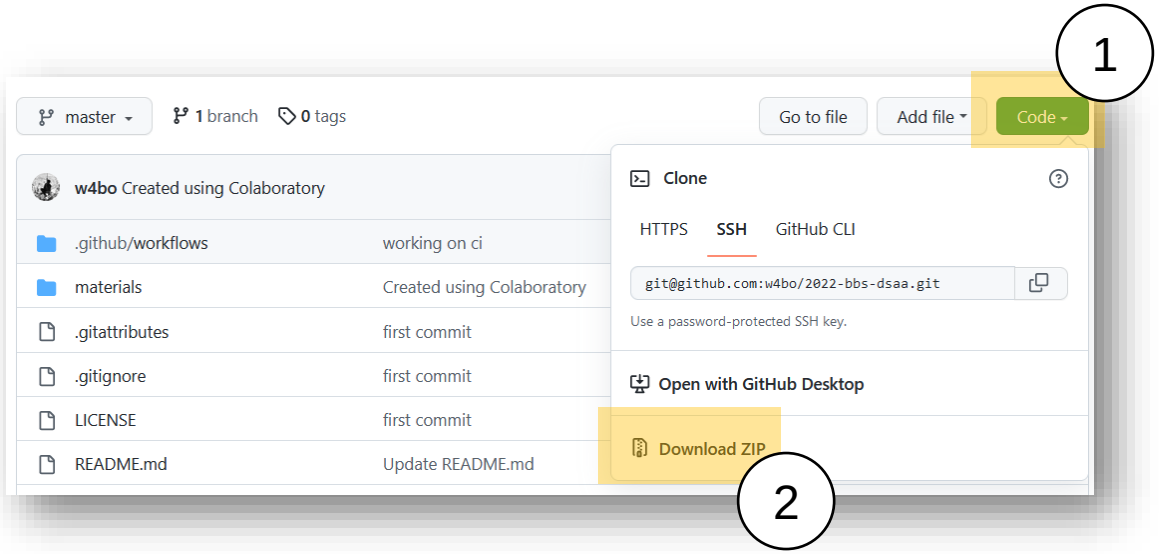
- Big data / database
- Geo-spatial analytics

https://big.csr.unibo.it/

Materials

The materials are available here:

- https://github.com/w4bo/2023-bbs-dm



Analytics

Business intelligence

- Strategies to transform raw data into decision-making insights

Analytics

- A catch-all term for a variety of different business intelligence and application-related initiatives
- The process of analyzing data from a particular domain (e.g., sales and supply chain)

Advanced Analytics

- (Semi-)Autonomous transformation of data using techniques and tools, to discover deeper insights, make predictions, or generate recommendations

Integrated Analytics (Lab)

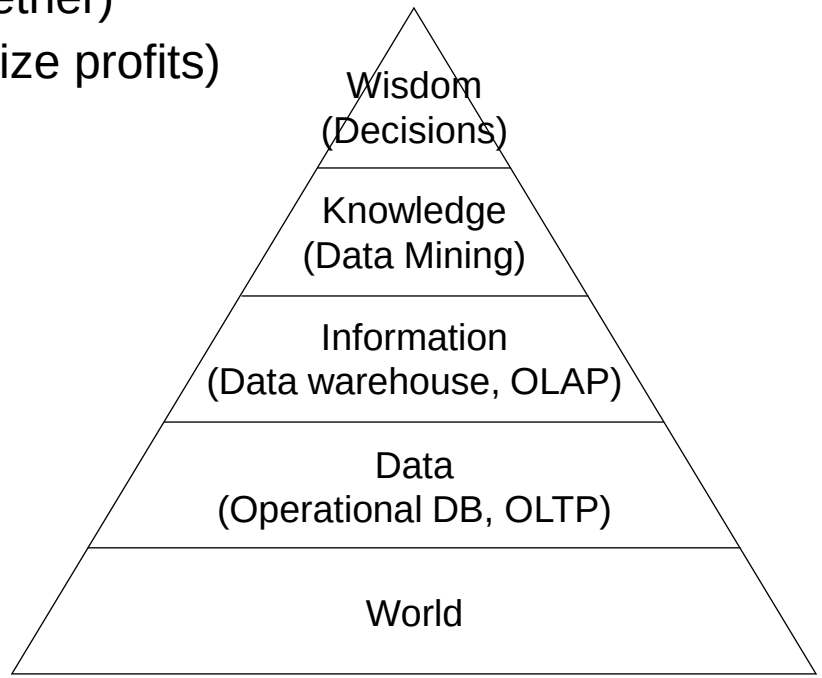
- Analytics are based on the usage of statistics, machine learning, operational research, and advanced visualization techniques

https://www.gartner.com/en/information-technology/glossary?glossarykeyword=analytics

The knowledge pyramid

Family of transformations are usually abstracted in the “knowledge pyramid”

- Data: symbols representing real-word objects (e.g., store product sales)
- Information: processed data (e.g., query the product with highest profit)
- Knowledge: understanding (e.g., mine products often sold together)
- Wisdom: knowledge in action (e.g., discount products to optimize profits)



[1] Jennifer E. Rowley: The wisdom hierarchy: representations of the DIKW hierarchy. J. Inf. Sci. 33(2): 163-180 (2007)
[2] Martin Frické: The knowledge pyramid: a critique of the DIKW hierarchy. J. Inf. Sci. 35(2): 131-142 (2009)

CRISP-DM

Data transformation requires a structured approach

- Choosing the best algorithm is only one of the success factors

Cross-industry standard process for data mining (CRISP-DM) is a model that describes common approaches for data pipelines used by data mining experts

CRISP-DM

CRISP-DM breaks the process of data mining into six major phases

- Business Understanding
- Data Understanding
- Data Preparation
- Modeling
- Evaluation
- Deployment

The sequence of phases is not strict

- Arrows indicate the most important and frequent dependencies between phases
- The outer circle in the diagram symbolizes the cyclic nature of data mining itself

CRISP-DM

Understanding the domain

- Understanding project goals from the user's point of view, translate the user's problem into a data mining problem, and define a project plan

Understanding the data

- Preliminary data collection aimed at identifying quality problems and conducting preliminary analyzes to identify the salient characteristics

Data preparation

- Includes all the tasks needed to create the final dataset: selecting attributes and records, transforming and cleaning data

CRISP-DM

Model Creation

- Several data mining techniques are applied to the dataset also with different parameters in order to identify what makes the model more accurate

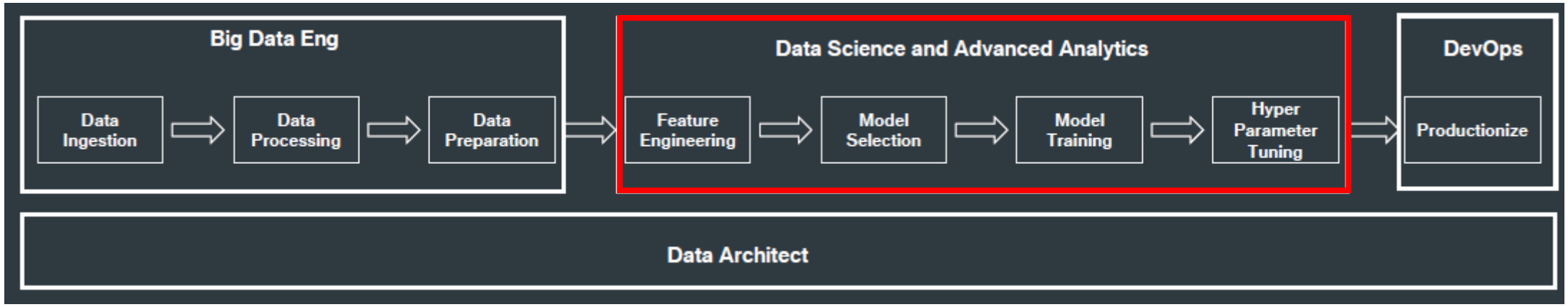
Evaluation of model and results

- The model(s) obtained from the previous phase are analyzed to verify that they are sufficiently precise and robust to respond adequately to the user's objectives

Deployment

- The built-in model and acquired knowledge must be made available to users. This phase can therefore simply lead to the creation of a report or may require implementation of a user-controlled data mining system

The full picture (data pipeline)



GOAL of this lab

Move through transformation phases

Disclaimer! (and my lesson learned)

This module covers a lot of teaching material

- Data Mining (6 CFU), Machine Learning (6 CFU)
- Business Intelligence (6 CFU), Big Data (6 CFU)
- 1 CFU = 25h, 24 CFU = 600h (almost a semester in University)

This module involves 3 abstraction levels:

- Theory: recall, understand, and discuss the main challenges
- Map theoretical issues into practice: slides
- Implementation: notebooks

Our journey is just about 3 hours + 4 hours lab

- We will discuss the integrated laboratory through the notebooks
- There is not time to focus on the programming aspect, but you have them for posterior study