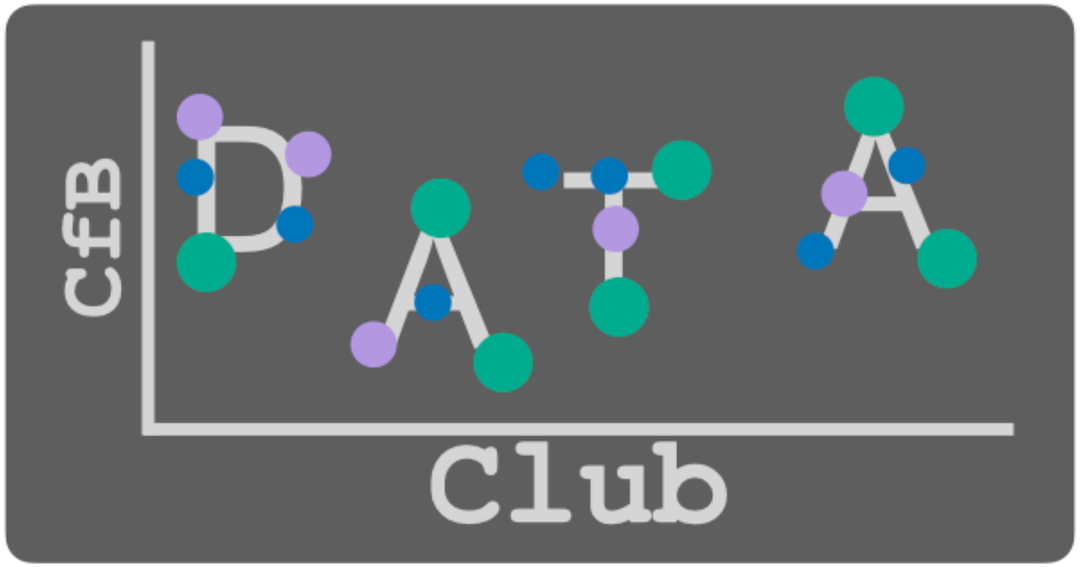
Intro & Data Literacy

Read, understand and communicate data



Alberto Santos and Teddy Groves — 8th March 2023

CfB Data Club

Building a community passionate about data

- A **forum** for **researchers of all levels** to **discuss**, **learn**, **explore** and **analyse data**
- Regular meetings **every 2 months for 1.5h**

  - A **formal part** with presentations, discussions about data-related topics, case studies, invited speakers, etc.

  - An **informal part** with sweets and coffee to approach presenters or discuss with other club members
- **Goals**

  —> Foster a **community**

  —> Create a forum for **discussion** and **solving questions**

  —> Find the **right people to help**

  —> **Learn** from each other and **share** knowledge about data

Building a Data Culture

Driven and united by data

- **Data** and **data science** as a **unifying factor** across research disciplines
- Align on **the importance of data** and t**he processes to manage and the methods to analyse them**
- Provide the **support to** acquire the skills and knowledge to **access, read, understand, and communicate data effectively**
- Focusing on **collaboration by sharing data** across teams and departments
- Use of data as a means to **improve and innovate**

Organisers

Teddy Groves

PhD in Philosophy of statistics
Data scientist, Football Radar
Co-PI QMCM kinetics, CfB

Expertise:

Kinetic models of cell metabolism
Thermodynamics of biochemical reactions
Statistics (especially custom/ Bayesian)
Programming (especially Python)

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Alberto Santos

PhD in Bioinformatics
PI Multiomics Analytics, KU
Head Data and Infrastructure, Boehringer Ingelheim Pharma
PI Multiomics Network Analytics, CfB

Expertise:

Omics
Databases
Graphs and Knowledge Graphs
Programming (especially Python)

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CfB Partnerships & Research Office (PRO)

Sünje Johanna Pamp

sjpa@biosustain.dtu.dk

Data Experts





Lea Sommer and RDM team

Shilpa Garg

Kai Blin

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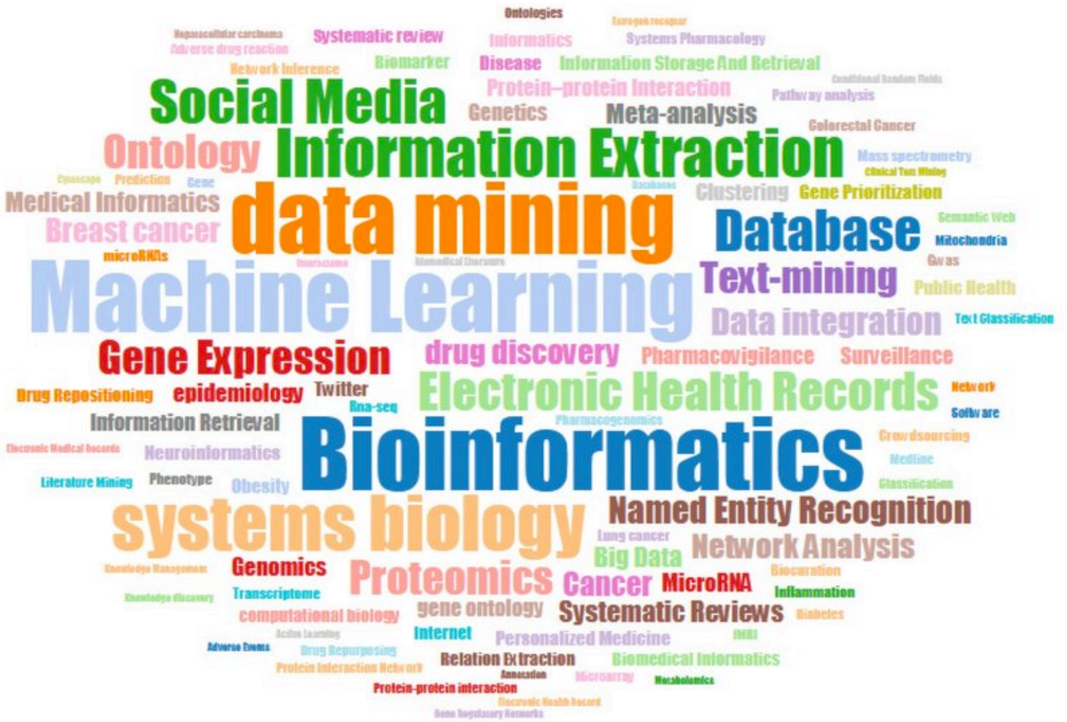


Schedule

Preliminary Schedule

- Data literacy – what is it? (Today)
- Data wrangling (May)
- Data visualization (July/August)
- Tools (September)
- Making use of publicly available data and databases (November)
- Analytics for understanding and predicting (December)

Extra

The club is flexible and adapts to your needs

- The schedule provides structure
- **But if you want to discuss, learn or work on a specific topic, let us know!**
- We can add **extra meetings** to accommodate requests that are relevant to the members of the club
- For instance:

Do you want to present **your project** and collect ideas or feedback?

Do you want to **invite someone** to give a talk?

Do you have **a specific data problem** that you need to discuss about?

Do you have an idea you want to present and **gather a team** to work on?

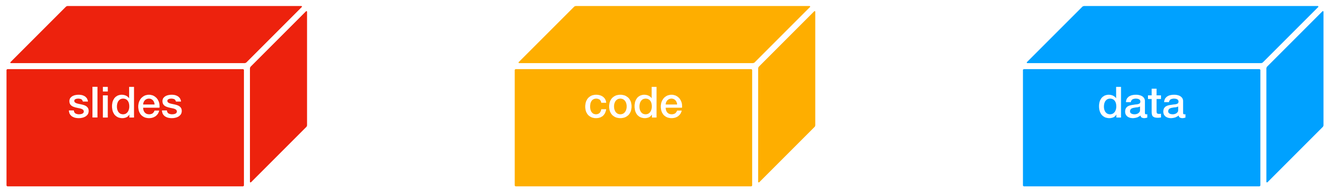
...

Tools

Data Club Website

https://github.com/Multiomics-Analytics-Group/cfb_data_club

- We use GitHub to maintain the contents of the data club
- **GitHub** is a framework generally used to maintain and version control software development projects
- **Version control** is a system that records changes to a file or a set of files over time and who made them so that you can recall specific versions later

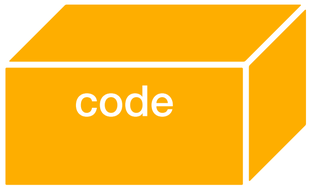


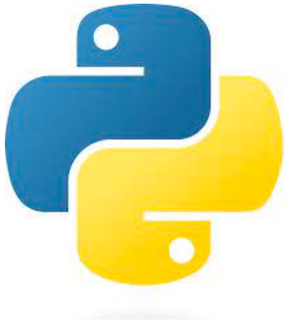
https://en.wikipedia.org/wiki/GitHub

https://git-scm.com/book/en/v2/Getting-Started-About-Version-Control

Code

Python



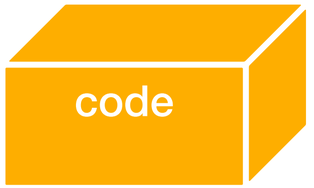


- Python is a **high-level, general-purpose programming language**
- It is a good language for both **beginners** and **advanced programmers**:
  - Its design philosophy **emphasises code readability**
  - Many **learning resources** available
  - **Large community** behind (i.e. stackoverflow for questions)
  - **Excellent Libraries** available, especially for data science

https://en.wikipedia.org/wiki/Python_(programming_language)

Code

R



- R is a programming language for **statistical computing** and **graphics**
- R is used among **data scientists**, **bioinformaticians** and **statisticians** for data analysis and development of statistical software
- Many **learning resources** available
- **Large community** behind
- **Excellent Packages** available for data and statistics

https://en.wikipedia.org/wiki/R_(programming_language)

Jupyter Notebooks

https://jupyter.org/

- **Web-based development environment** for **creating**, **running** and **sharing** **Python** (and other languages) code
- A **notebook** is an interactive document that combines **live code**, **equations**, **text or markdown**, and **visualisations** (output of your code)
- Notebooks are divided into **cells** that **run sequentially**! (Need to pay attention)
- It **requires** having **Python installed** on your local machine

Colab Notebooks

https://research.google.com/colaboratory/faq.html

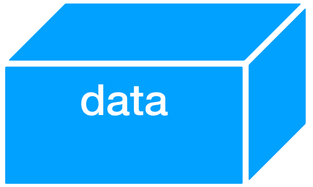
- Google Colab is based on **Jupyter Notebook** open source project **hosted on Google's servers**
- Advantages:
  - Requires **no setup** to use (no python installation)
  - Provides **free** access to **computing resources** on Google's servers including GPUs
  - **Notebooks** can be **shared** just as you would with Google Docs or Sheets.
  - You can **import** existing **Jupyter notebooks**
- **Own data and notebooks** need to be accessed through **Google Drive** — Need Google account or **accessible online**

Note: Internal Data

If we want to use **internal data (confidential)** we will work in a **secured infrastructure**

Data

We need you!



- We will use **publicly available data** to showcase topics and methods
- We will try to find **relevant biological datasets**
- But we would love to have **your help**:
  - Propose us to use **your own data or type of data**
  - Bring **your ideas** of how to best explore, analyse or visualise them
  - Ask specific **questions or issues** we should take in the scheduled meetings or extra ones

Data Literacy

Data is like garbage. You'd better know what you are going to do with it before you collect it. Mark Twain

What is it?

Data as a universal language

- The ability to **read**, **analyse** and **communicate** data effectively
- Includes also understanding **data sources** and **formats**, and the **analytical methods** to transform them into results
- Requires skills and knowledge in **data analysis**, **statistics**, **data visualisation**, and **data management**.
- It does not mean that we all need to be **Data Scientist …**
- **but** we all need certain skills to extract value from data:
  - **Non-technical**: interpretation, critical thinking, communication, evaluation
  - **Technical**: analysis, visualisation, programming, management

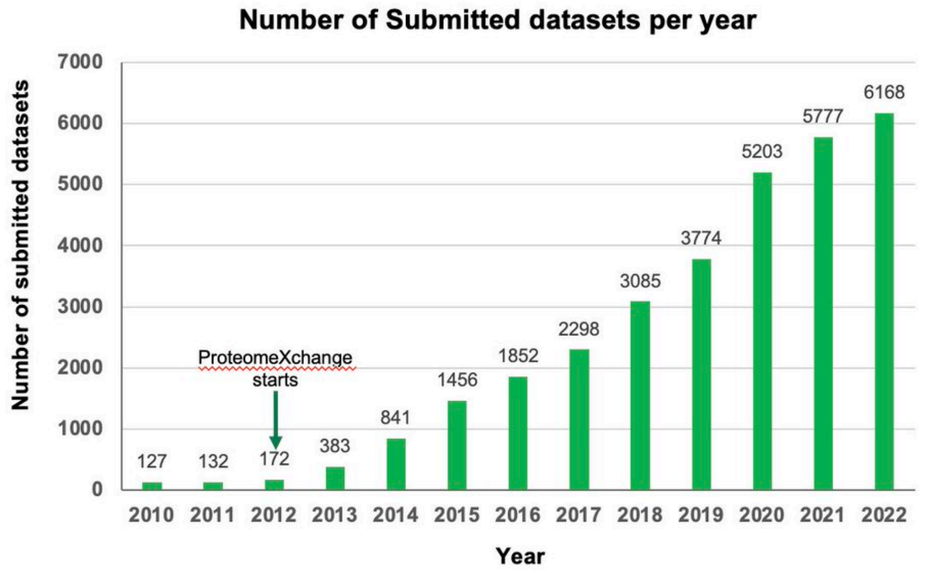
https://www.tableau.com/data-insights/data-literacy/what-is
https://en.wikipedia.org/wiki/Data_literacy

Why?

Data! Data! Data! Evidence to support our research

- We **generate data** everyday: metadata, raw, processed, clean, derived results
- **Growing number** of **resources** and **datasets** available
- The data can have **multiple purposes** — reusability (FAIR)
- Benefits:
  - Better **understanding** of data
  - Extract **data-driven** insights
  - **Freedom** to create, format and analyse
  - **Meaningful** communication with data
  - Manage your data **sustainably**

PRIDE
PRoteomics IDEntifications Database

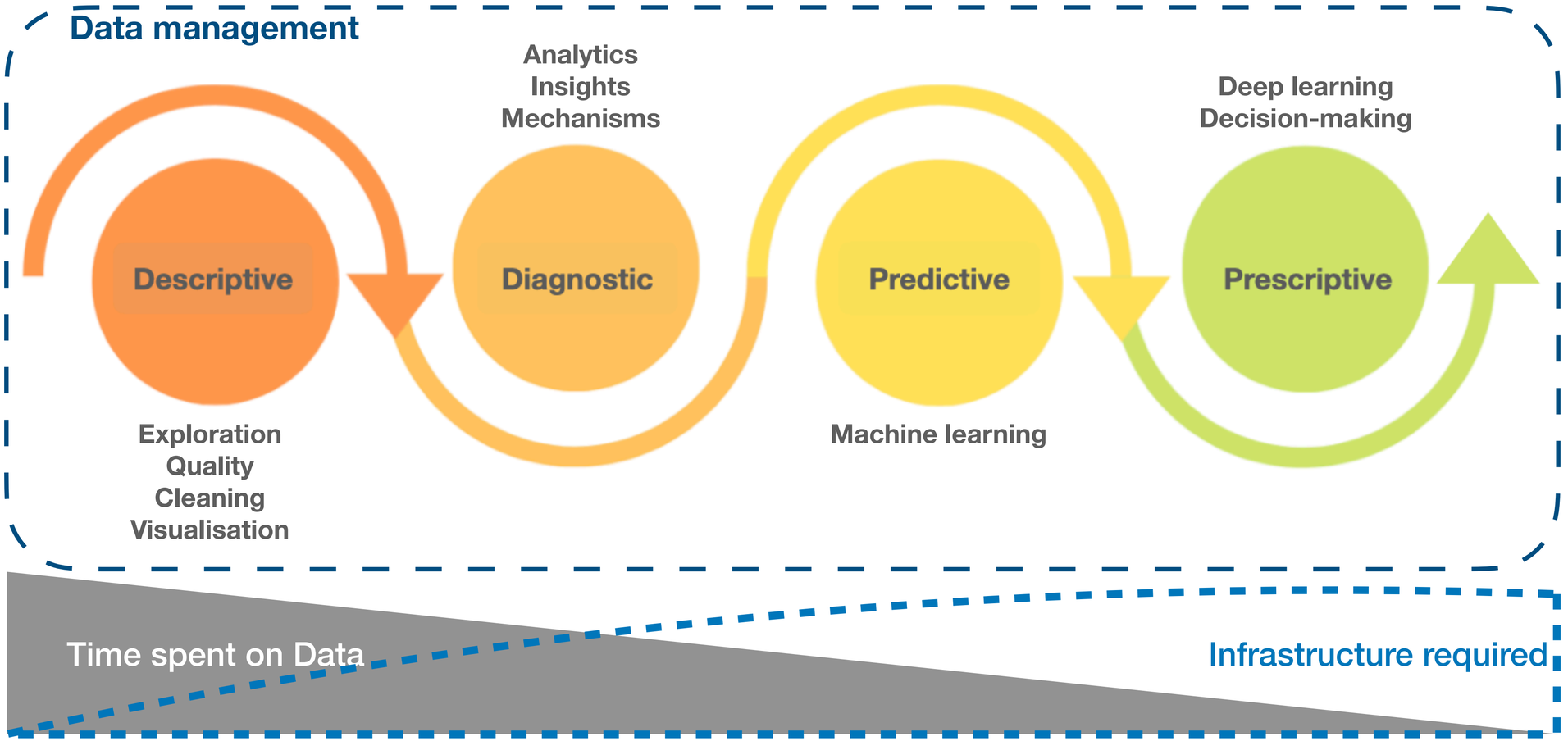


https://www.ebi.ac.uk/pride/

Our Data Journey

Be Data Literate: The Data Literacy Skills Everyone Needs To Succeed. *Jordan Morrow*

4 Levels of Data Literacy



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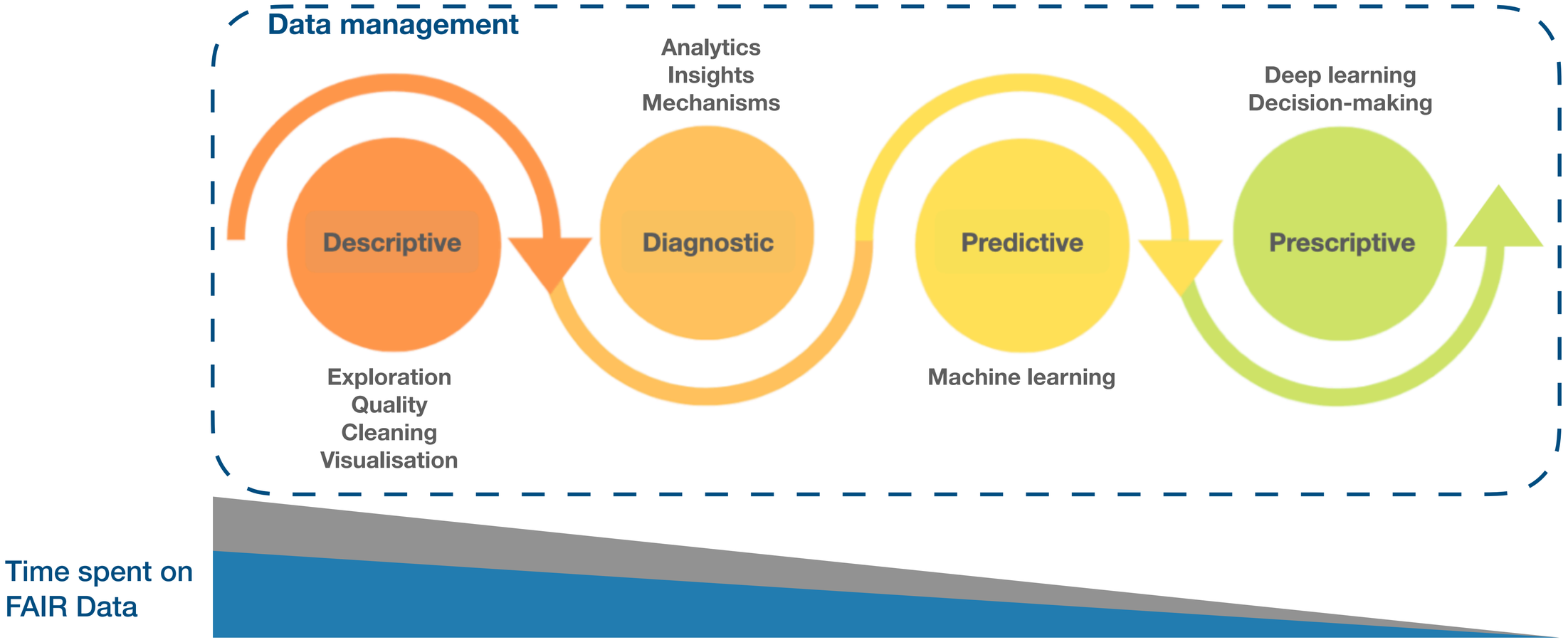

2023

Our Data Journey

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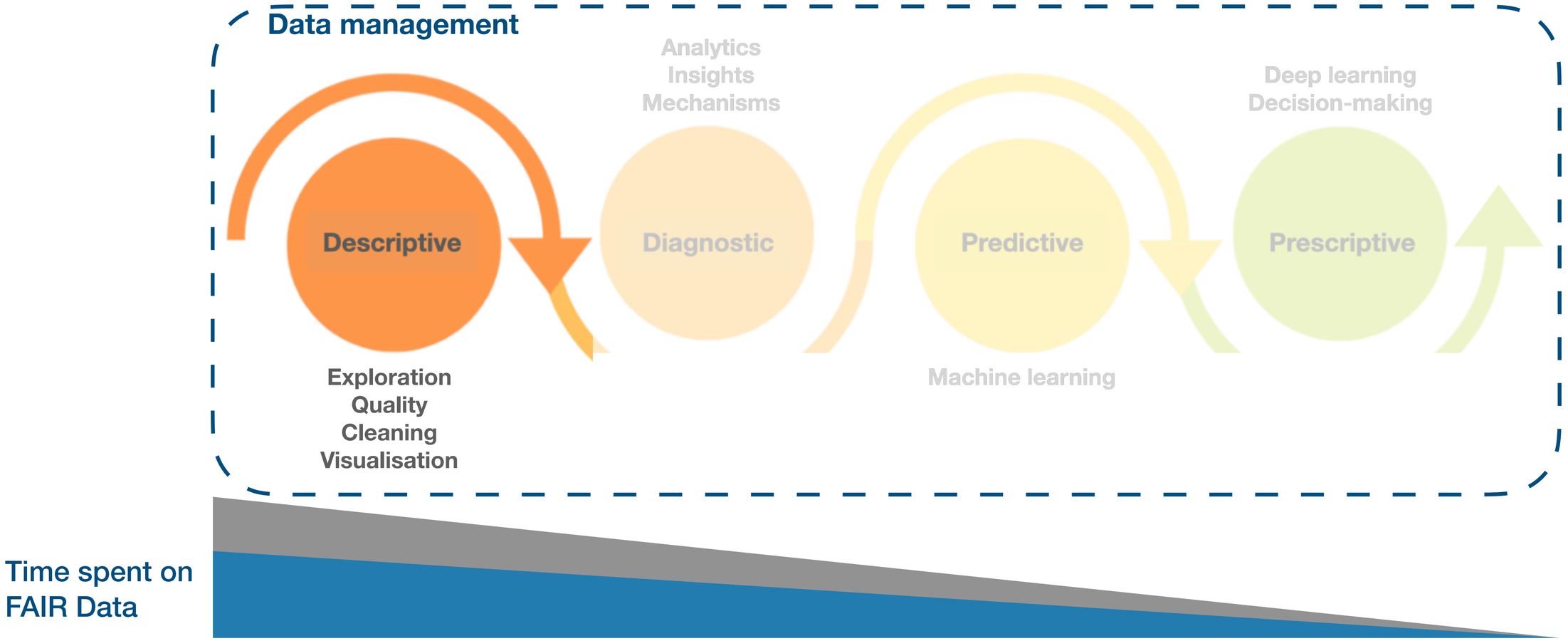
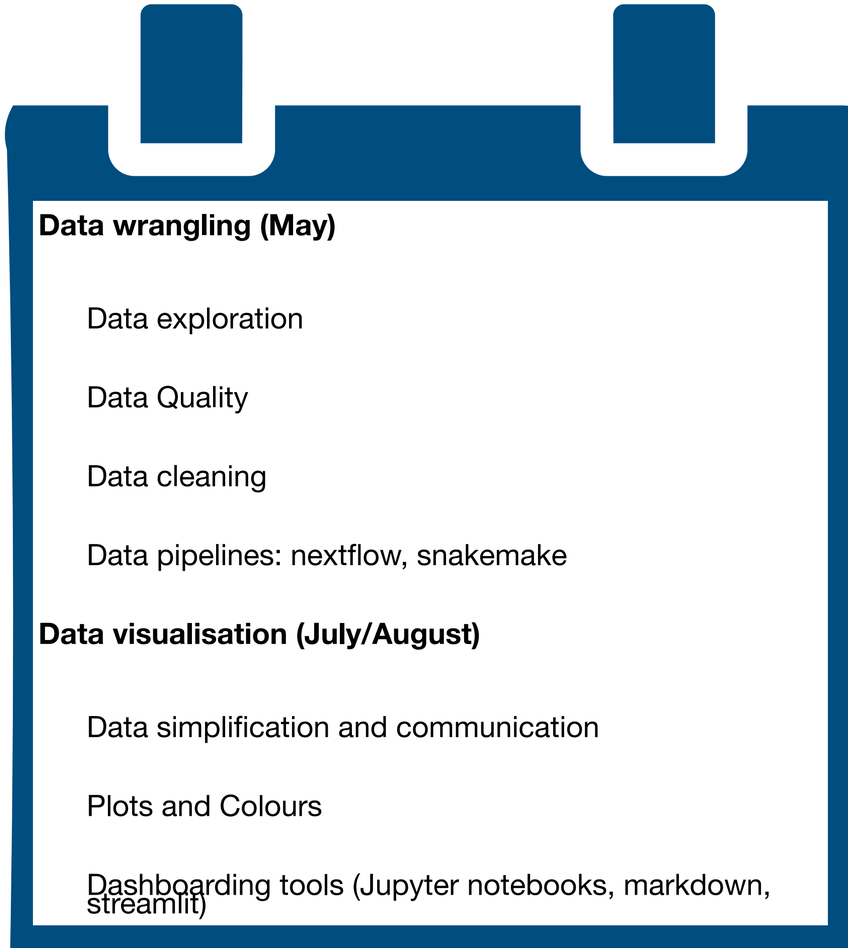


Descriptive level

- Focus on **reading**, and **visualising** data
- Output is generally a **graph**, a **dashboard** or a **report**
- Requires:
  - **Exploring** the data
  - **Shaping** and **standardising** the data
  - **Evaluating the quality** of the data
  - Extracting some **metrics**
  - **Visualising** these metrics



You are not alone

- **Support:**
  - RDM team (Lea Sommer)
  - Data Science Platform (Alberto Santos)
- **Data and Data Science collaborations and discussions:**
  - Quantitative Modeling of Cell Metabolism (Teddy Groves)
  - Genomics Sustainable Solutions (Shilpa Garg)
  - Natural Products Genome Mining (Kai Blin)
  - Multiomics Network Analytics (Alberto Santos)
- **Data Club!**

Any Questions, Ideas, Suggestions?

Time for cake!