FOUNDATIONS OF HEALTH DATA SCIENCE

An Introduction for SUND Researchers & Educators

UCPH HeaDS

PROGRAM

08:15	MORNING COFFEE
08:30	INTRODUCTION TO HDS
09:15	DATA COLLECTION
10:00	COFFEE BREAK
10:15	EXPLORATORY DATA ANALYSIS
11:30	DATA ANALYSIS PART 1
12:00	LUNCH
13:00	DATA ANALYSIS PART 2
13:30	MODEL EVALUATION PART 1
14:15	COFFEE BREAK
14:30	MODEL EVALUATION PART 2
15:00	WRAP-UP & DISCUSSION

COURSE MATERIALS:

https://github.com/Center-for-Health-Data-Science/Foundations-of-Health-Data-Science

CENTER FOR HEALTH DATA SCIENCE (HeaDS)

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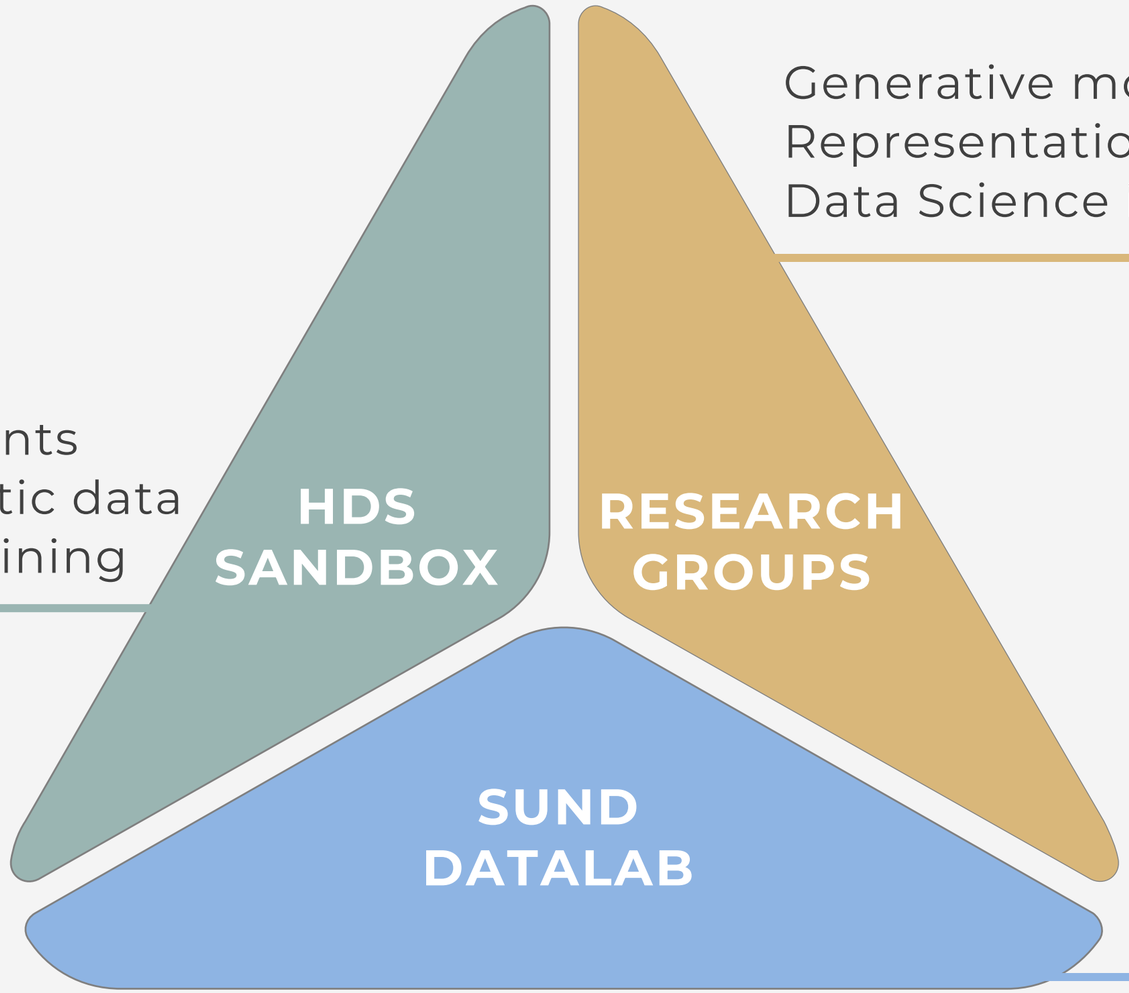

HPC environments
Public & synthetic data
Courses and training

Generative modelling
Representation learning
Data Science in Epidemiology


Henrike


Thilde

Courses, Consulting,
Commissions, Supervision

CONTACT US

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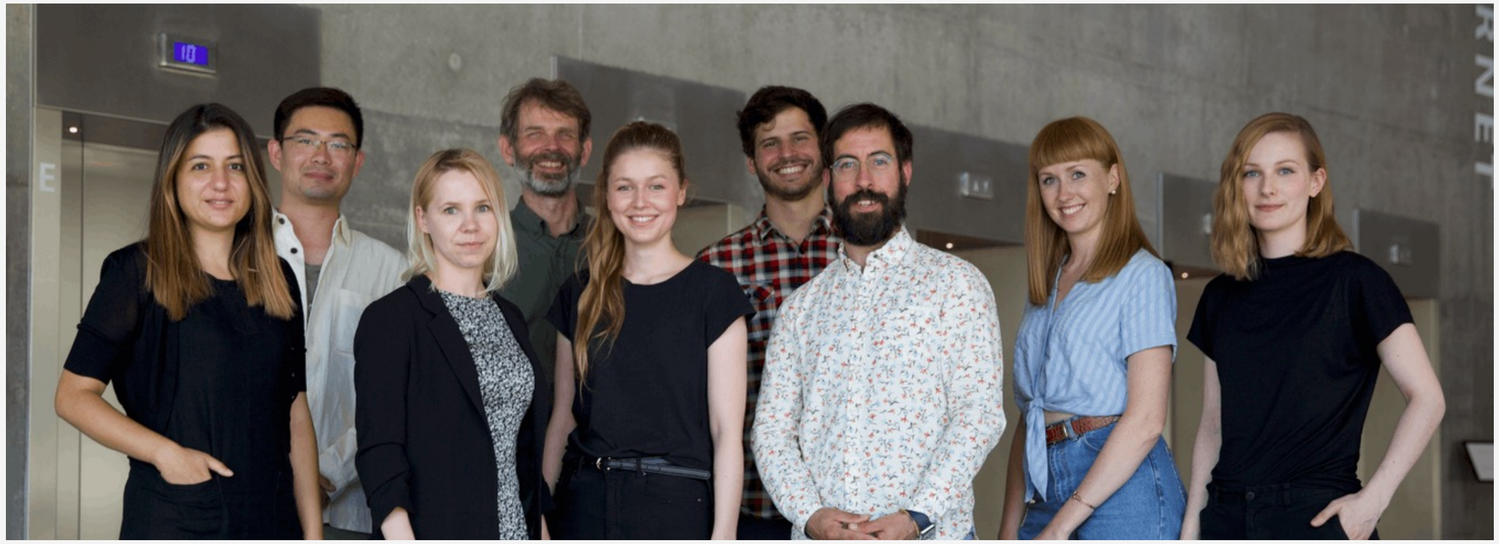
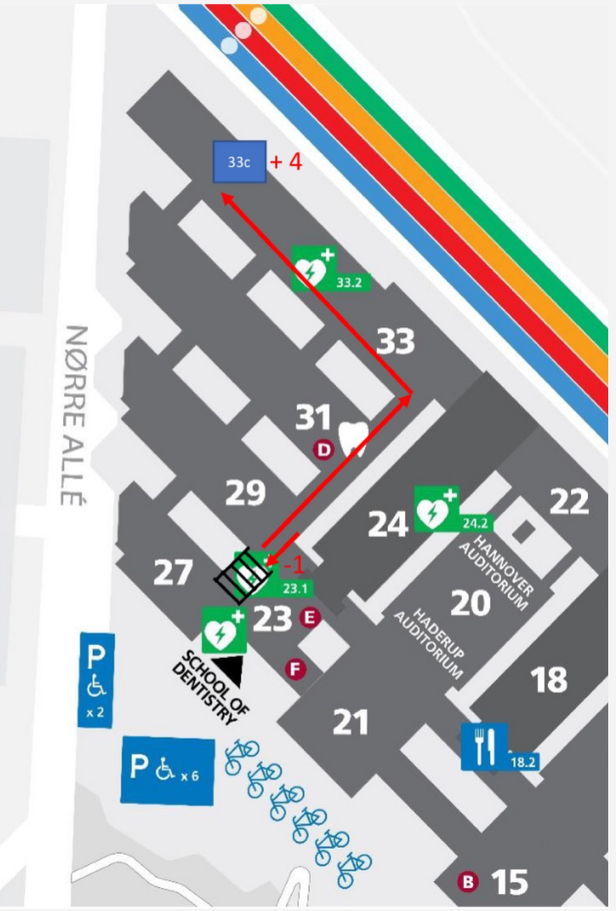
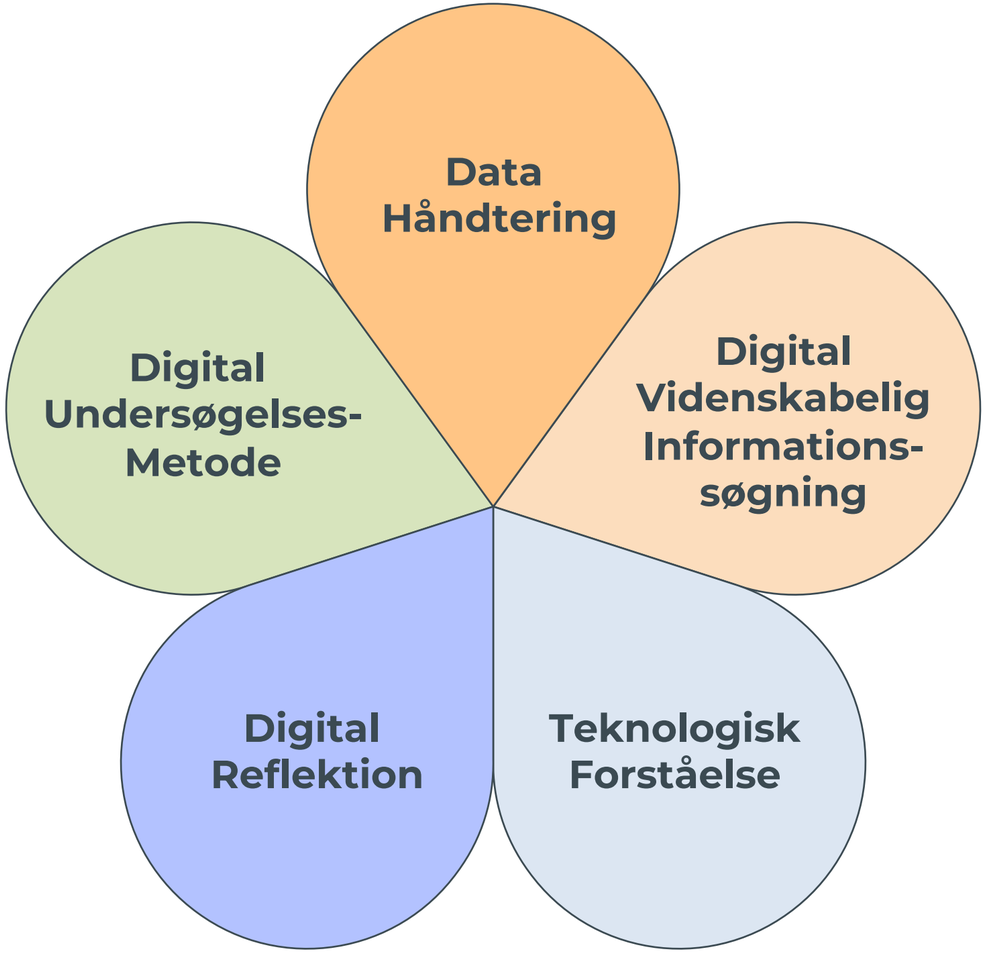




DIGITAL CORE CURRICULUM INITIATIVE

The Digital Core Curriculum (DCC) initiative

- KU-wide initiative, started at SUND
- Update KU educations to include digital literacy skills and data science competences
- Each study board does its own implementation.
- DCC working group supports and advises
- Goal: A digital core curriculum corresponding to 5 – 7,5 ECTs per study line



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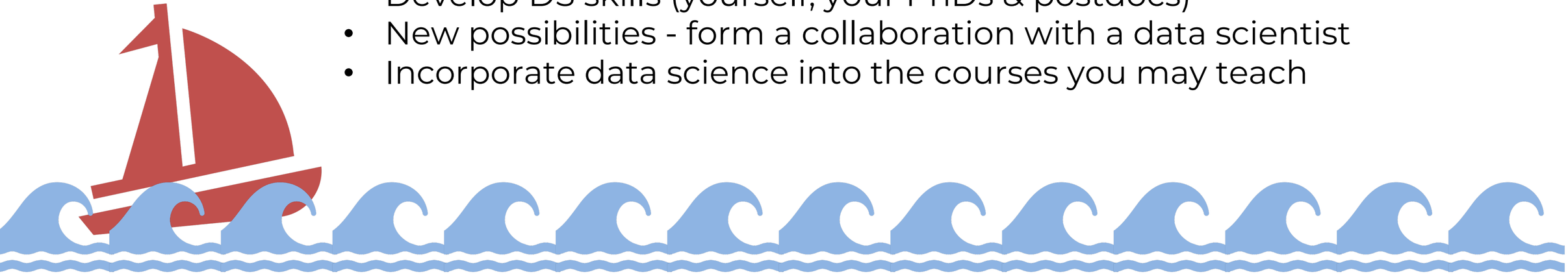
THE PURPOSE OF THIS WORKSHOP

In this workshop, we are going to begin our journey into Data Science

- **What is (Health) Data Science (DS)?** Roles, definitions, data types
- **A Data's journey**: From data collection to scientific results?
- Data science is not black box or mystical. Now you know the 'fancy words'.
- Inspiration:
  - Develop DS skills (yourself, your PhDs & postdocs)
  - New possibilities - form a collaboration with a data scientist
  - Incorporate data science into the courses you may teach



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In this workshop, we are going to begin our journey into Data Science.

On our way we shall touch upon data collection, exploration, analysis and evaluation.

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Mentimeter

During the course we will use **Mentimeter** for feedback and discussion.

Let’s try it out!

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Mentimeter

Q2 & Q3:

Now that you know about **HeaDS** and this course, we want to hear some things about **you**.

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WHAT IS DATA SCIENCE?

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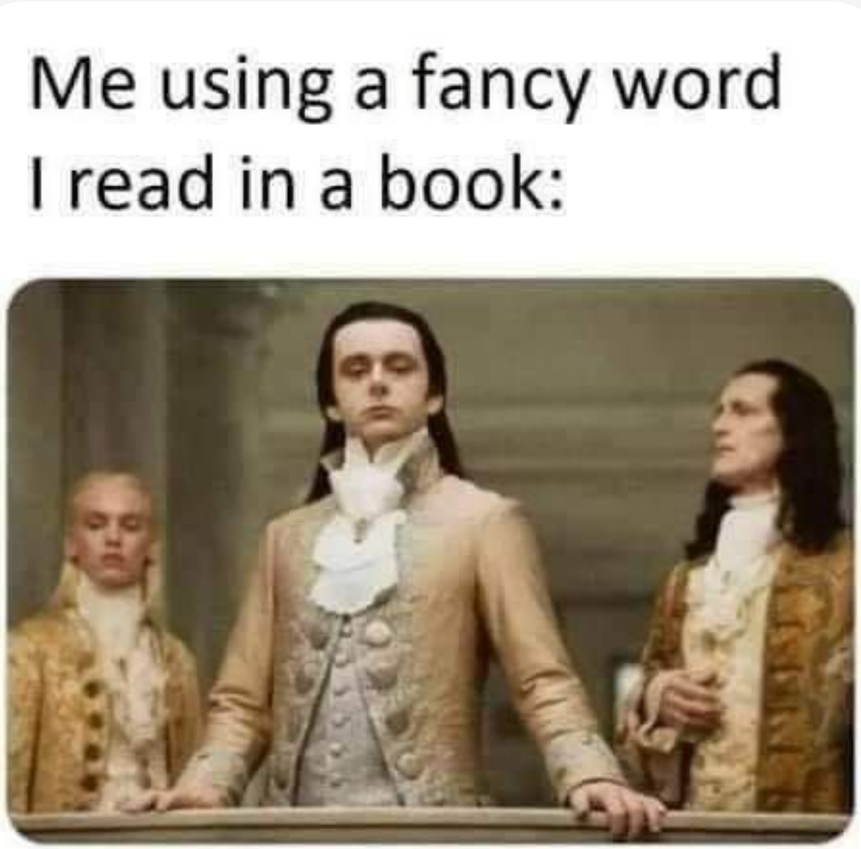
WHAT DO THE WORDS MEAN?



You have likely heard the words **Data Science (DS)**, **Machine Learning (ML)** and **Artificial Intelligence (AI)**.

These are often used as synonyms, **buuuut, they are not :)**

What do they mean? - Let's try some differentiation.

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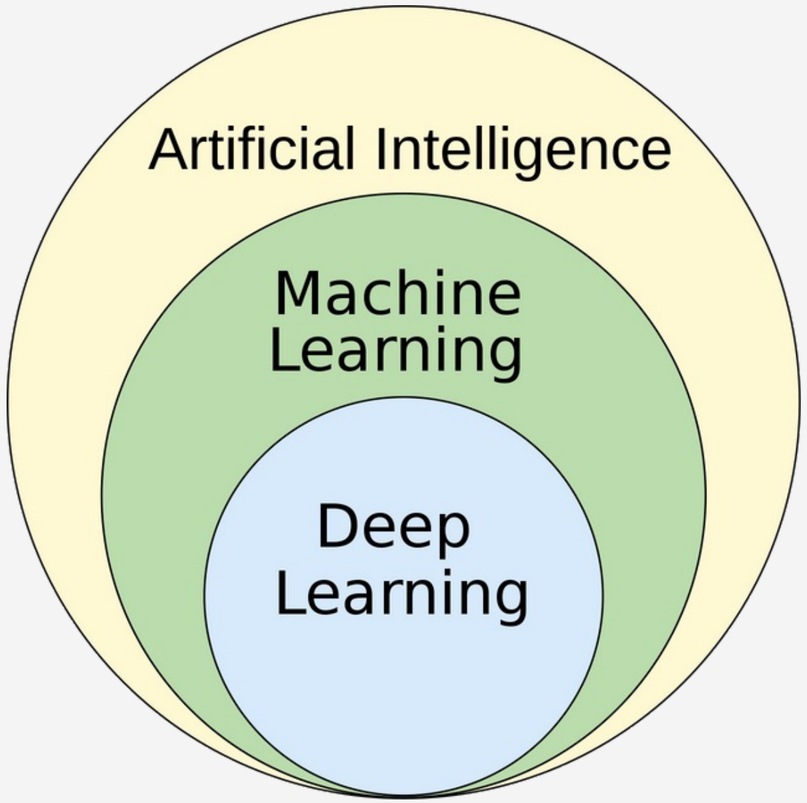
WHAT DO THE WORDS MEAN?

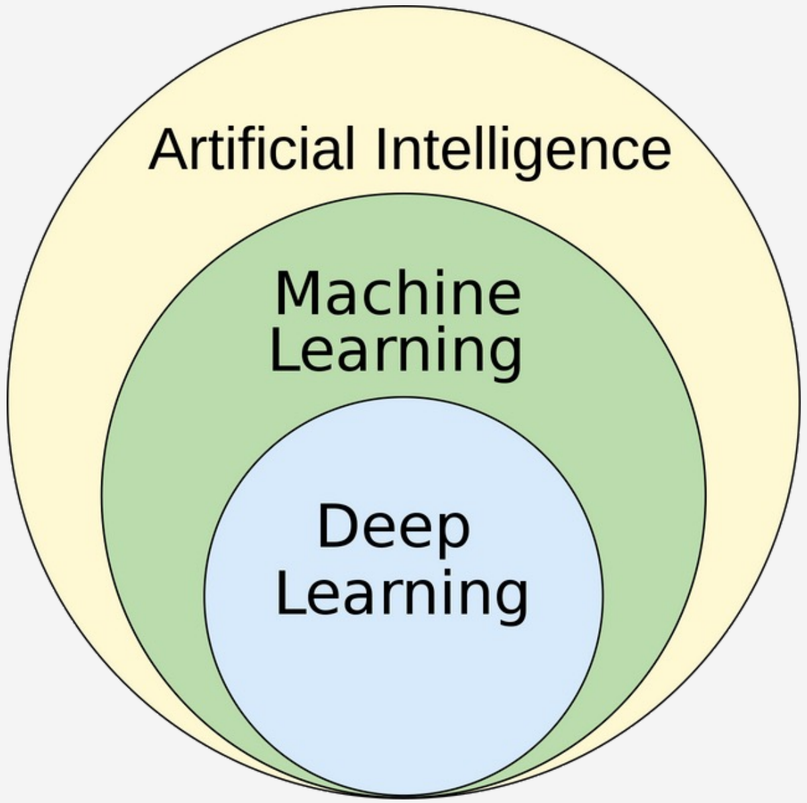


DATA SCIENCE != MACHINE LEARNING

Machine learning - development of algorithms that enable computers to learn from data and make predictions or decisions (with human-like performance or better).

Data Science (DS) - a variety of techniques for extracting knowledge from data. This involves cleaning, normalizing, and analyzing large data to uncover patterns and trends.

WHAT DO THE WORDS MEAN?



Artificial Intelligence:

- The ability of computing systems to achieve human-like performance on complex tasks
- Conceptual umbrella term

- AI is the **outcome, not the method**

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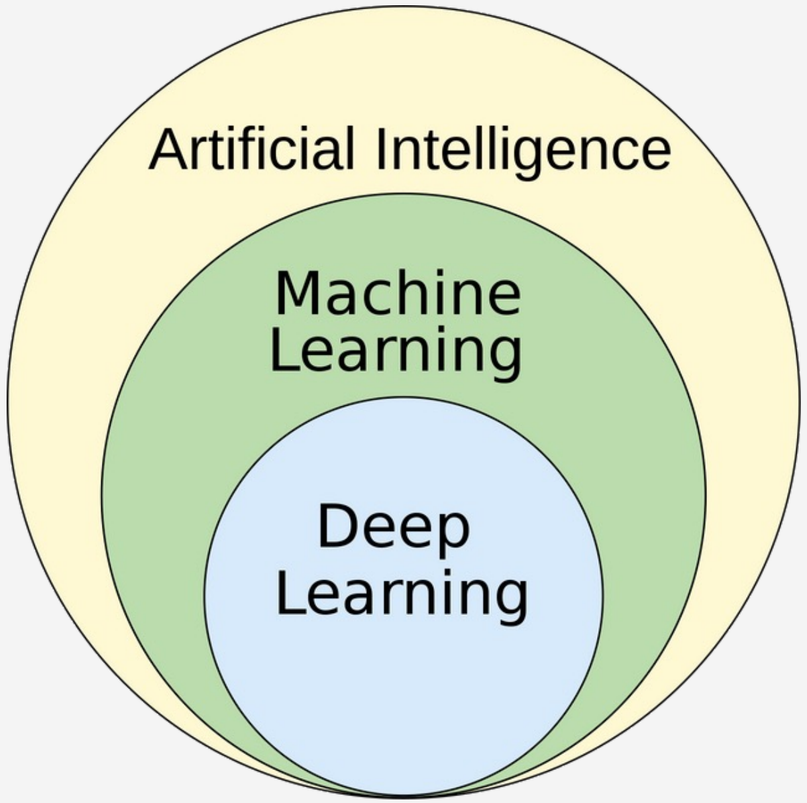

Machine Learning:

- "Technologies and algorithms that enable systems to identify patterns, make decisions, and improve themselves through experience and data" [1]
- Machine learning is methodology.

- Currently our most successful way of achieving AI

1. https://ai.engineering.columbia.edu/ai-vs-machine-learning/

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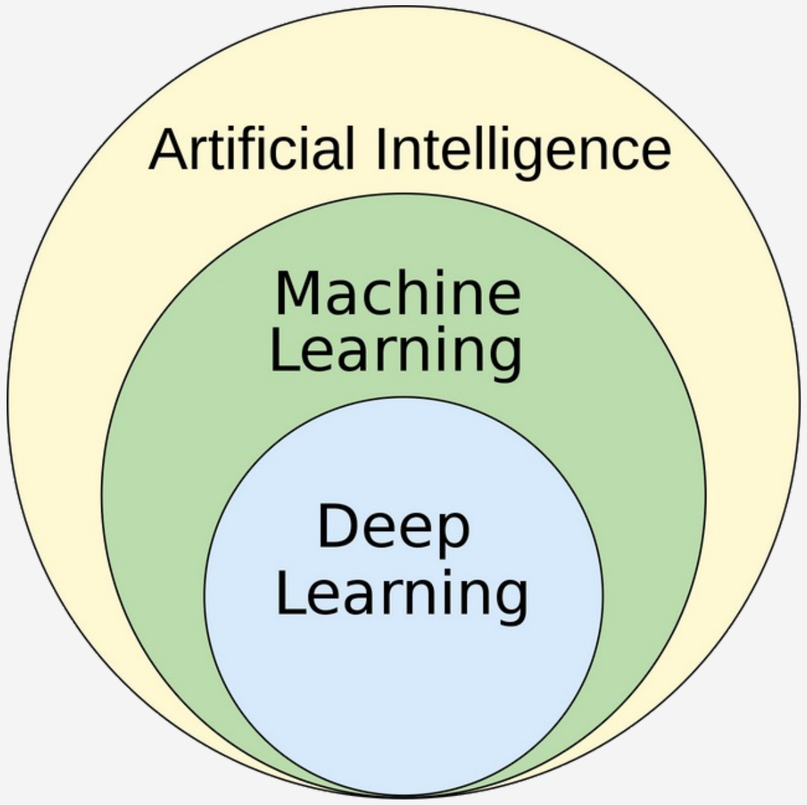

Deep Learning:

- When you do **ML** by means of a **deep neural network**
- This is a type of/sub-class of (ML).

Data science is often taken to mean ML/AI, but the term is much broader than that!

...and this is not a course on ML/AI.

WHAT IS DATA SCIENCE?

Data Science combines math, statistics, programming and algorithms with **domain expertise** in order to extract insights from data.
- **IBM**

Data Science is the processing and analysis of data with the goal of **learning something** about its characteristics or answer a scientific question.
- **HeaDS**

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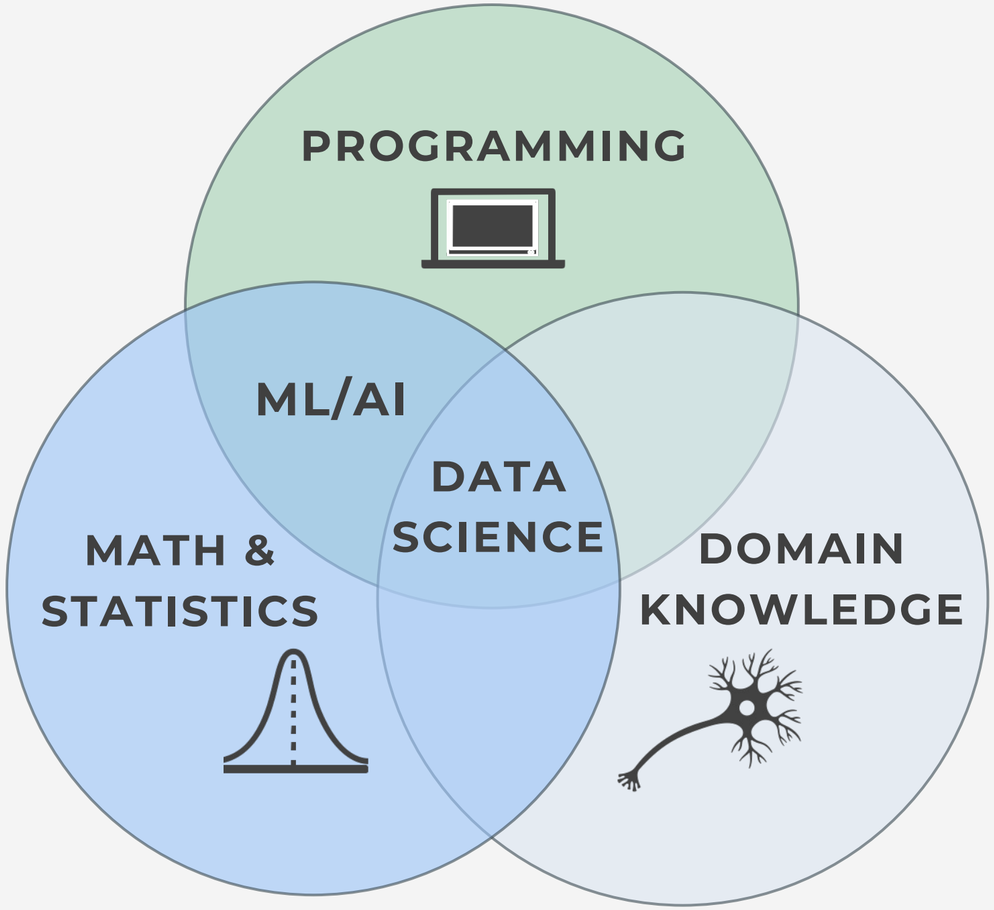
WHAT IS DATA SCIENCE?

- A **cross-disciplinary** undertaking that draws on many disciplines and is in turn becoming part of many disciplines.
- Data matters, one size analysis does not fit all.



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WHY DO WE WORK WITH DATA?

Goal: To extract knowledge about how the world works and, if possible, make generalizations and predictions.

Data Science is the more **formalized process** where we make use of tools such as computers and algorithms to help us make sense of **vast amounts data**.

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ROLES

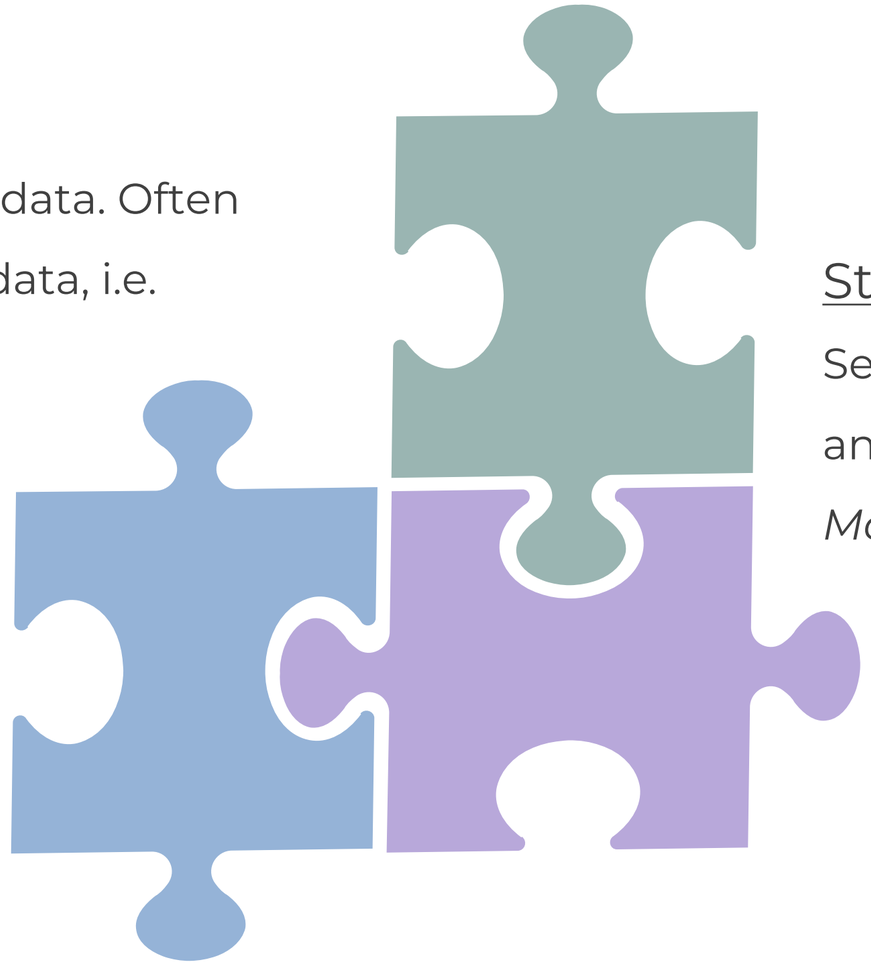
Not everybody is involved in every step.

Data Collector:

Produces or gives access to the data. Often has domain knowledge on the data, i.e. doctors working at the hospital

Principal Investigator:

Introduces the research question



Statistician/Mathematician:

Selects the appropriate tests and/or models

May do the data science analysis

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Data Scientist (Computer Scientist / Bioinformatician)

Does the data wrangling, cleaning and pre-processing

Does the data analysis

May standardize and/or implement as software

Visualisations expert:

Makes the plots to illustrate results

Selects proper type of plot

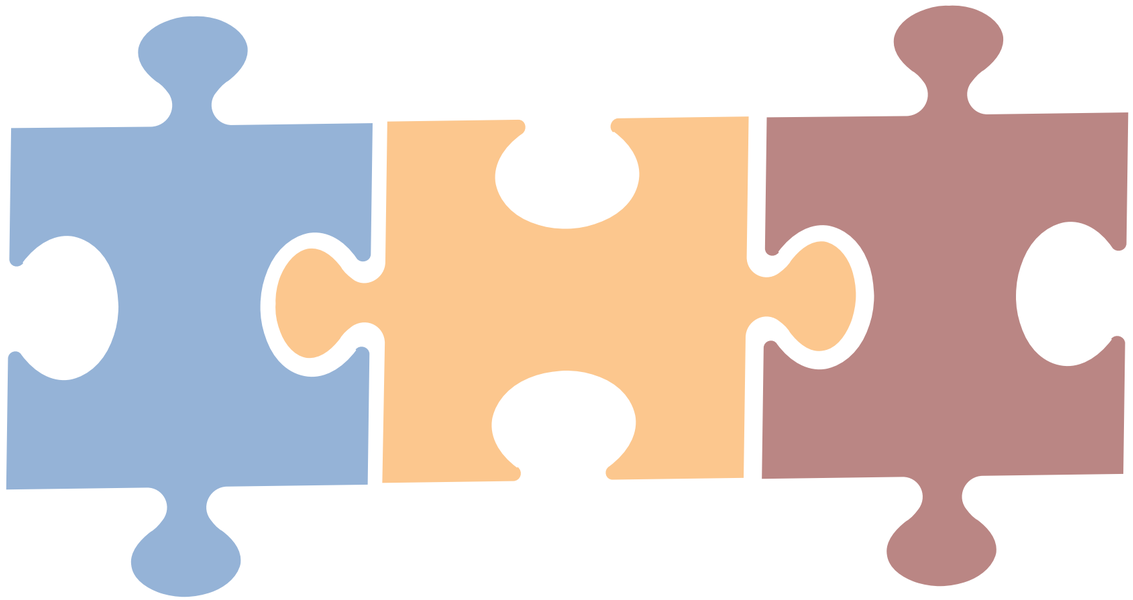
Focus on interpretability and accessibility

Domain expert:

Sparring about results

Biological/clinical relevance

Scientific Publication



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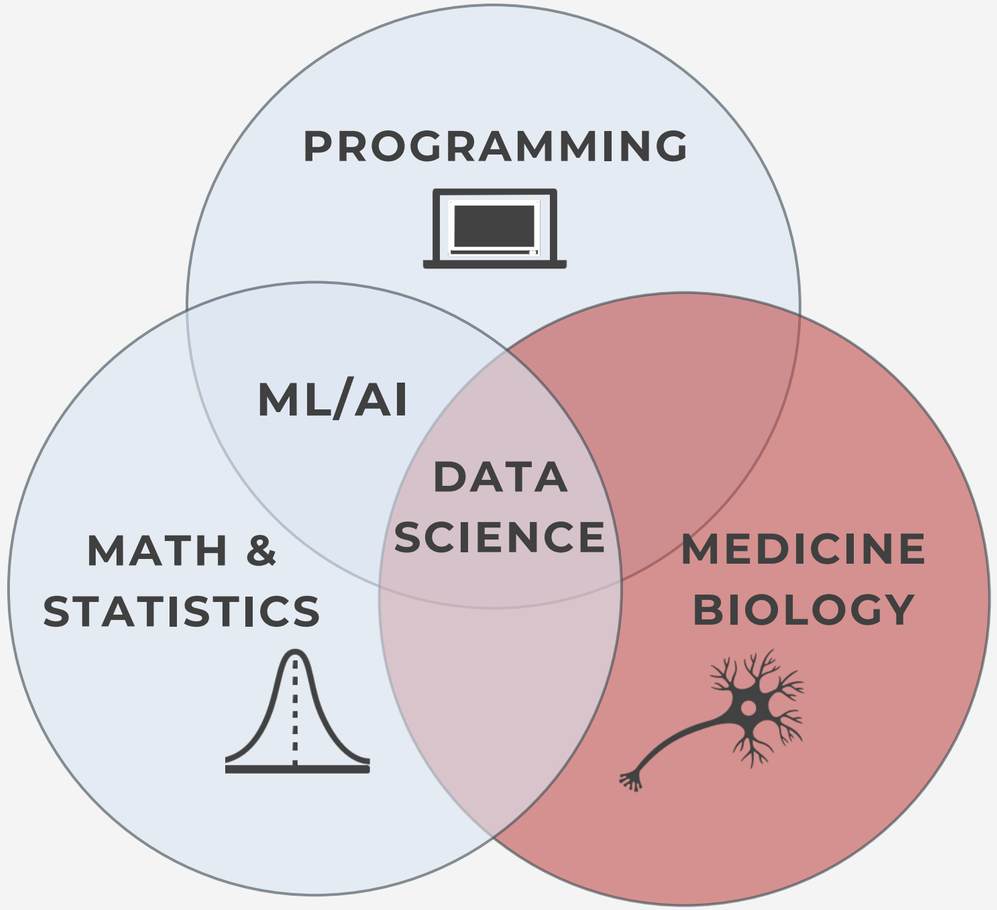
WHAT IS HEALTH DATA SCIENCE?

In **Health Data Science** the domains of interest are medicine (micro)biology, biochemistry, etc.

Field is concerned with:

- Biological mechanisms central to disease development
- Discovery and assessment of disease specific drug treatment
- Disease progression and patient survival
- **Personalized medicine**



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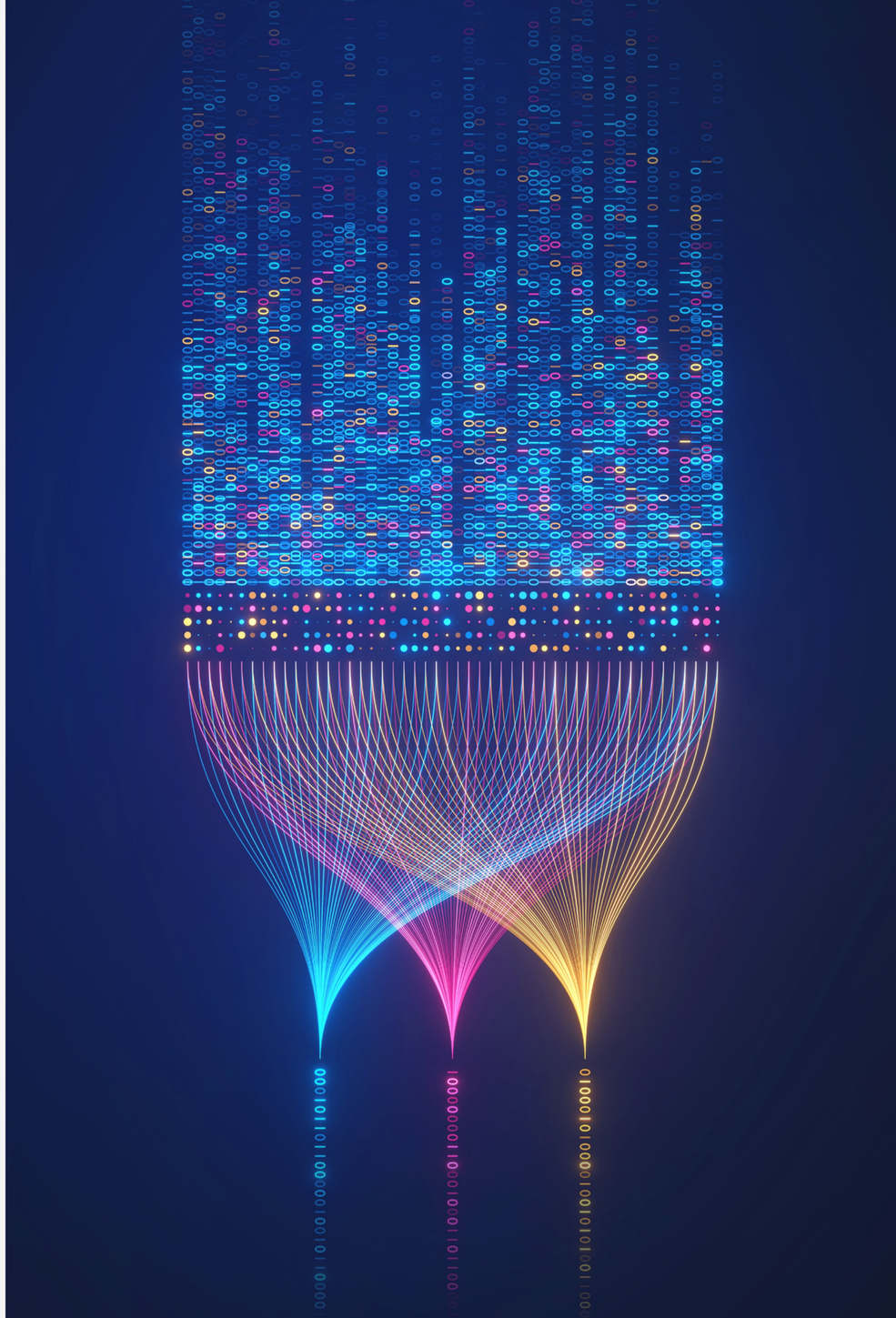
WE HAVE THE WHAT – NOW THE WHY?

The world is becoming data driven!

- Amount and quality of data is growing every year
- Now data drive research questions & theory
- **Improve *your* science**, as well as your **CV**
- **Teach the next generation** how to utilize big data!



ANALYSIS OF BIG BIO-MEDICAL DATA

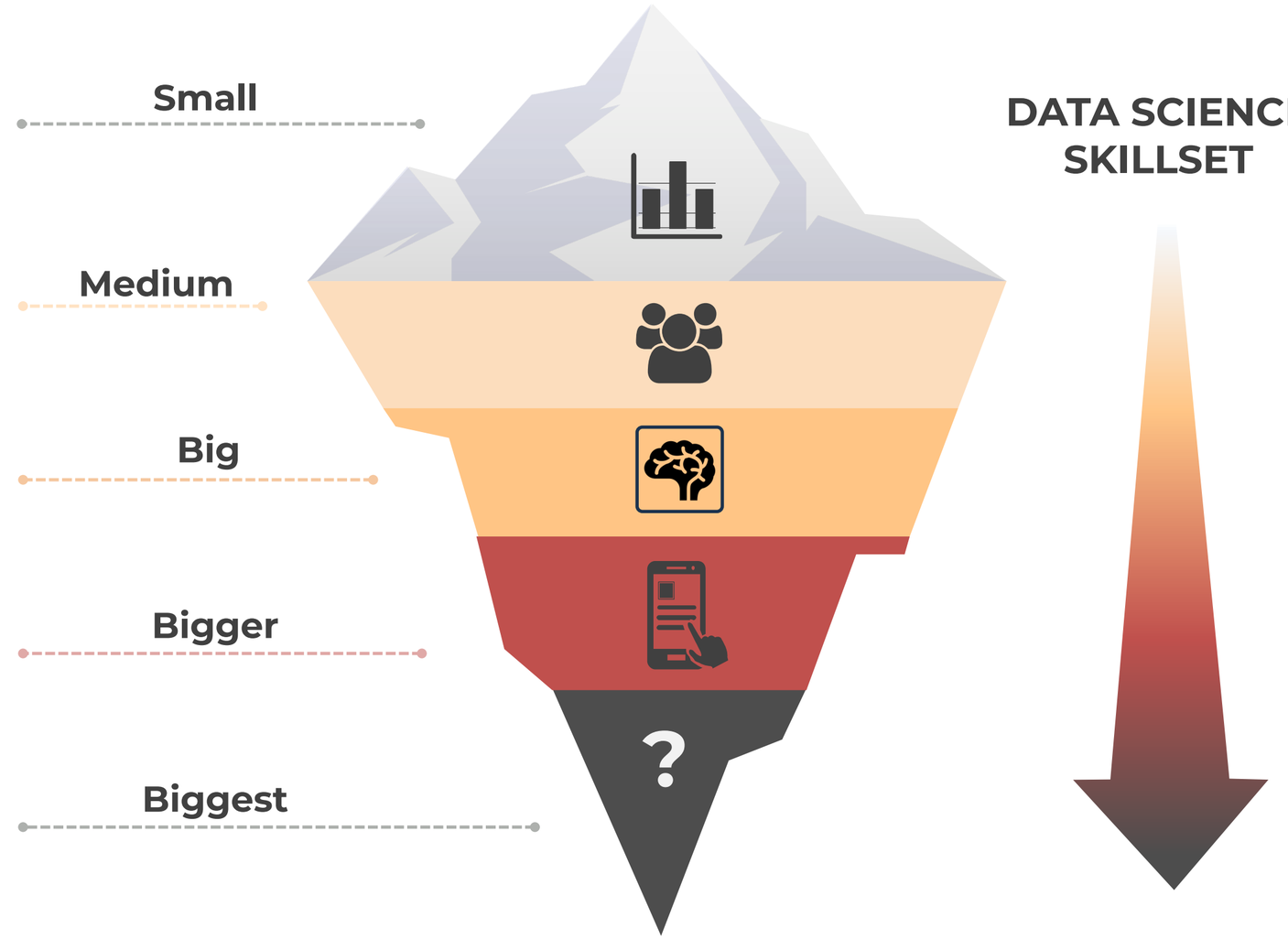
Research /Clinical Studies

Registries & Questionnaires
Pharmacological Databases

Biological (omics) Databases
Medical Image Data

Wearable Devices
Search Engine Data

‘Future’ Data



Mentimeter

Q4:

After this introduction, how do you see the importance of data science to you personally (i.e. in your research, for collaboration, etc.)?

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GROUP DISCUSSION – 1.0

Which of the **roles** we have introduced **do you see yourself in**?

Do you have people in your group or among your collaborators to fill the other roles? If not, **what are the alternatives?**

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