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FIT1043 Introduction to Data Science

Week 1, Data Science Process

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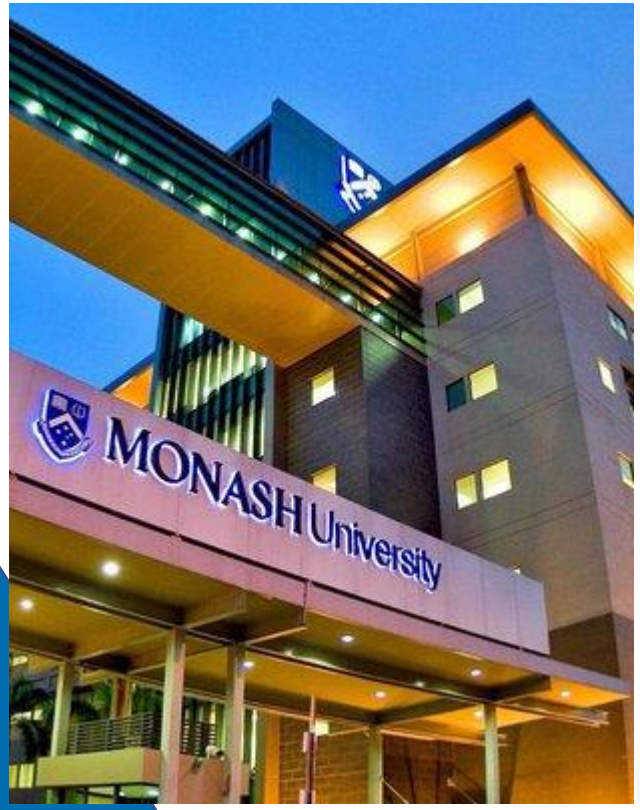
Monash University Malaysia

Data Science Process

ePub Section 1.3



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Learning Outcomes

Week 1

By the end of this week you should be able to:

- Explain what is data science and Drew Conway's Venn diagram
- Comprehend the usefulness of machine learning
- Explain different components of a data science process
- Differentiate data science from other related disciplines
- Learn how to install and start coding in Python with Jupyter Notebook
    - To be achieved in your tutorial / laboratory session

The Data Science Process

ePub Section 1.3

What happens in a Data Science project?

- Illustrating the process
  - A quick walkthrough illustrating the s
- The standard value chain
  - Our model of the process

What is Data Science?

Quote from Hal Varian

The ability to **take data** and;

- to be able to **understand** it,
- to **process** it,
- to **extract value** from it,
- to **visualize** it,
- to **communicate** it

That's going to be a hugely important skill in the next decades.

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The Data Science Process

Illustrating the Process

- Many different tasks come together to complete a Data Science project
  - A data scientist should be familiar with most, but doesn't need to be an expert in all

- Not all are labelled as Data Science
  - Some from other field such as computer engineering, business, ...

image source: "Young Business Man Holding a Tablet" by Pic Basement

1. Pitching ideas:

For data science projects to investors / managers

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image src: Stephen Ausmus acquired from USDA ARS, public domain.

2. Collecting data:

Researchers preparing to x-ray a patient.

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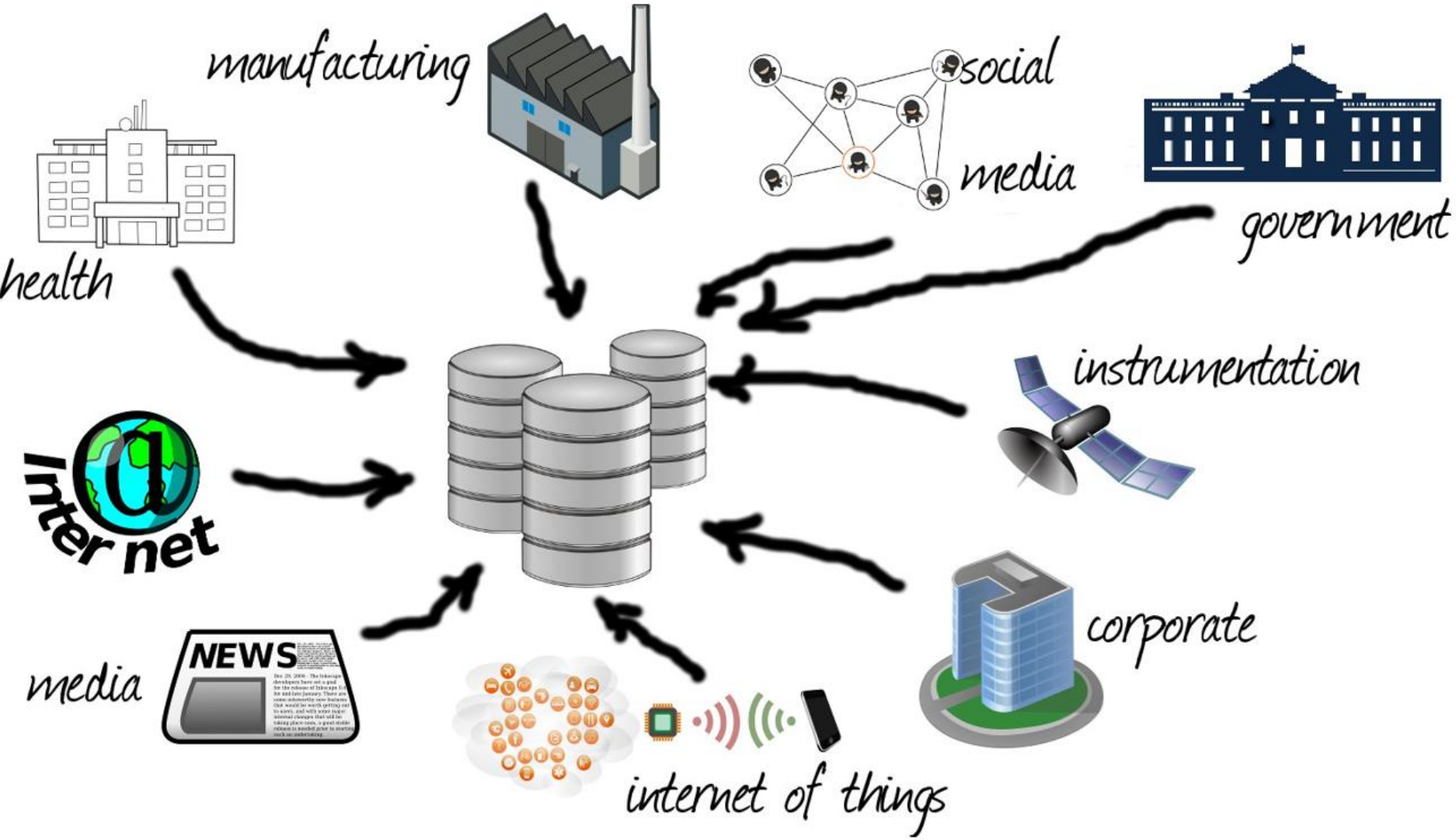
3. Integration:

Data can come from many different sources.



icons from by Openclipart.org, public domain

4. Interpretation:

Data can be described using a database schema.

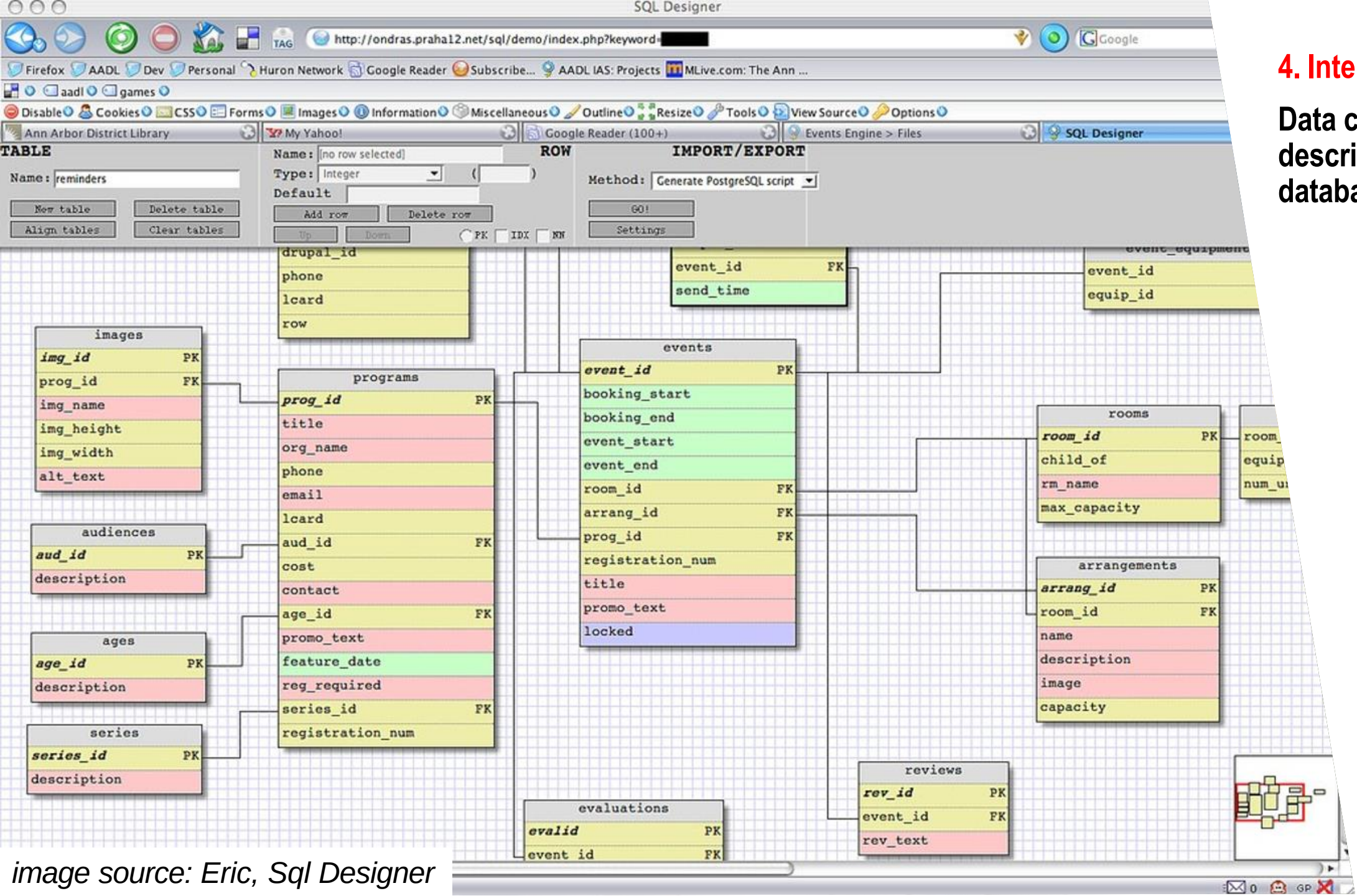


image source: Eric, Sql Designer

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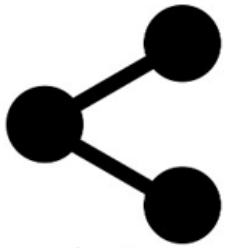
achiving

storage

privacy

legal & compliance

safety



sharing

metadata

management

ethics

5. Governance:

(i) caring for the data and its subjects.

(ii) managing data standards and formats.

icons from by Openclipart.org, public domain; Good and Evil by AJC ajcann.wordpress.com

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6. Engineering:

Data engineers make the back-end work

image source: by Intel Free Press

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7. Wrangling:

Inspecting and cleaning the data.

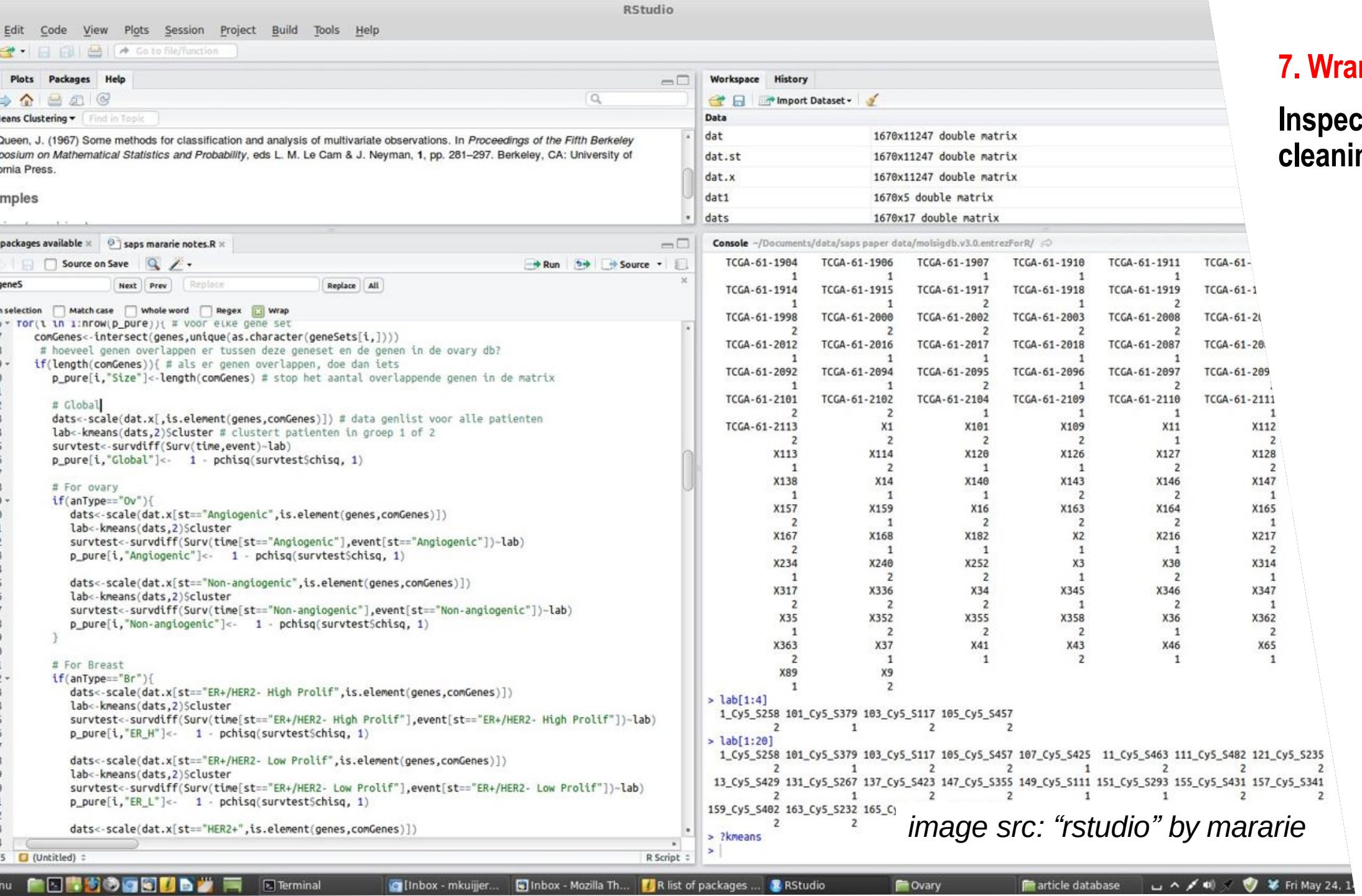

image src: "rstudio" by marariе

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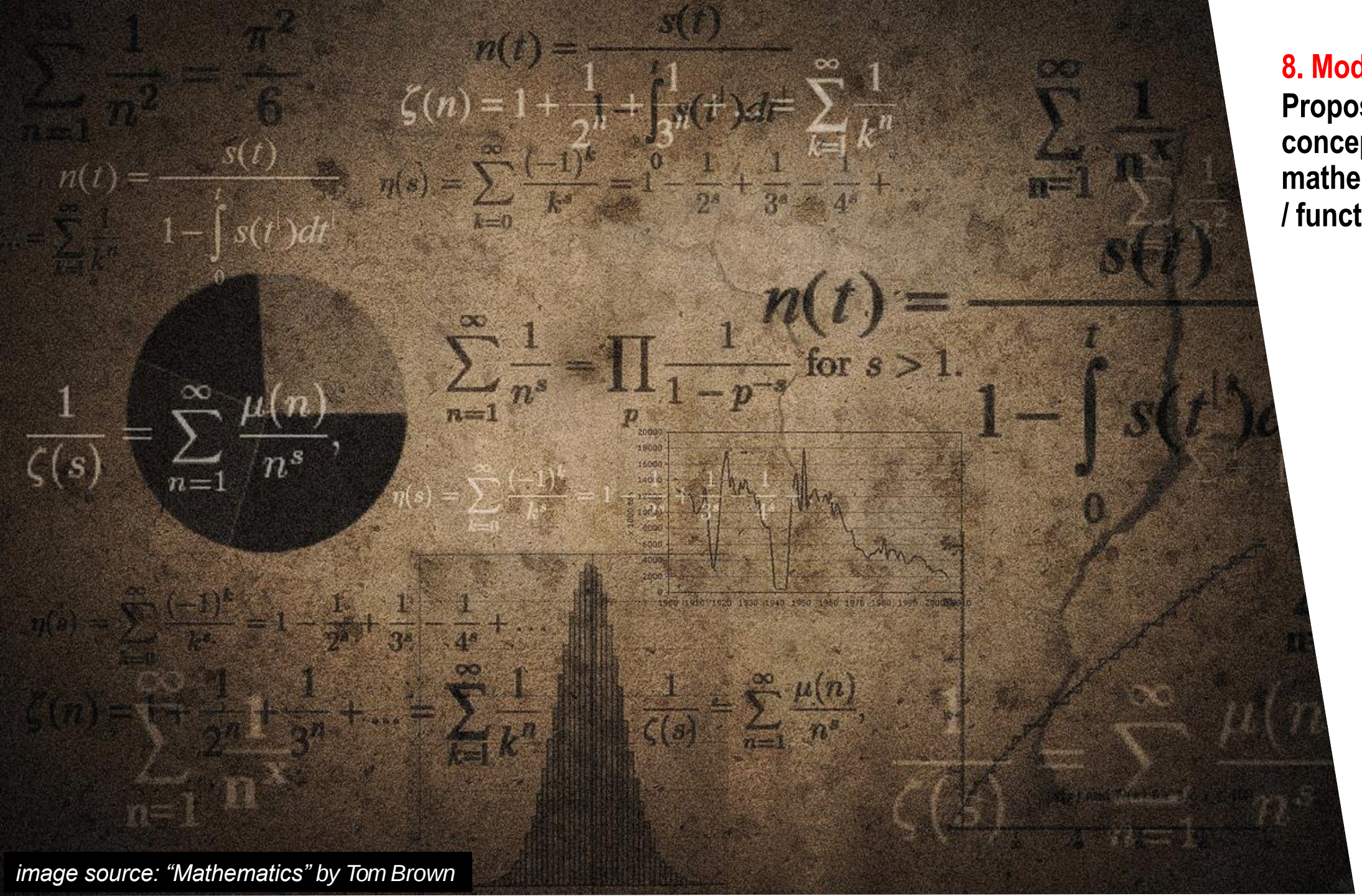

image source: "Mathematics" by Tom Brown

8. Modelling:

Proposing a conceptual / mathematical / functional model.

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8. Modelling:

Analyst building models with his favourite tool.

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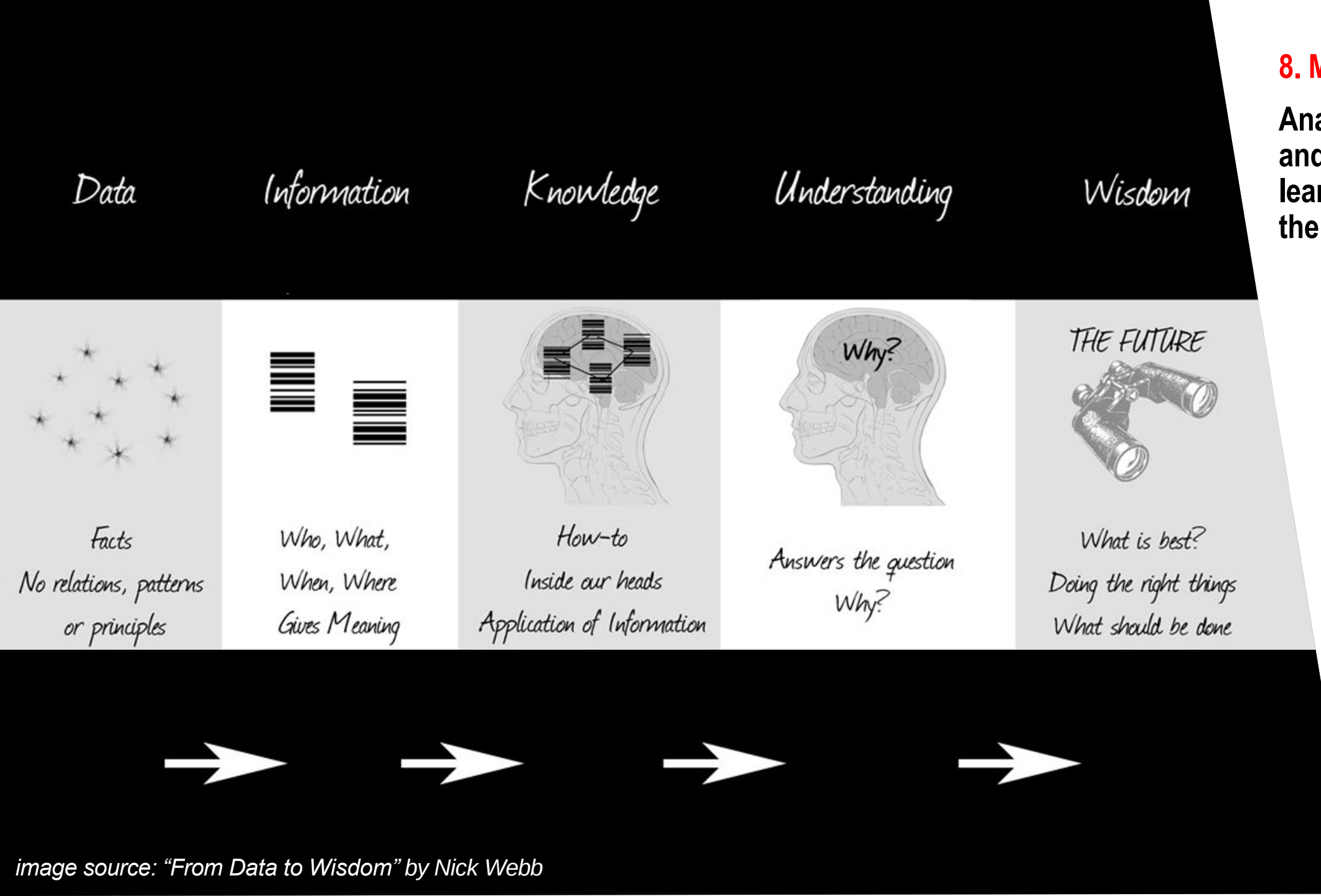

image source: "From Data to Wisdom" by Nick Webb

8. Modelling:

Analysis, statistics and/or machine learning works on the data.

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9. Visualisation:

Visualising data to interpret it and present results.

image source: Stephen Ausmus acquired from USDA ARS, public domain

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9. Visualisation:

Choosing appropriate visualizations for the data. Many different options exist!

image source: "Visualization Matrix" cropped, by Lauren Manning

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10. Operationalize:

Putting the results to work.

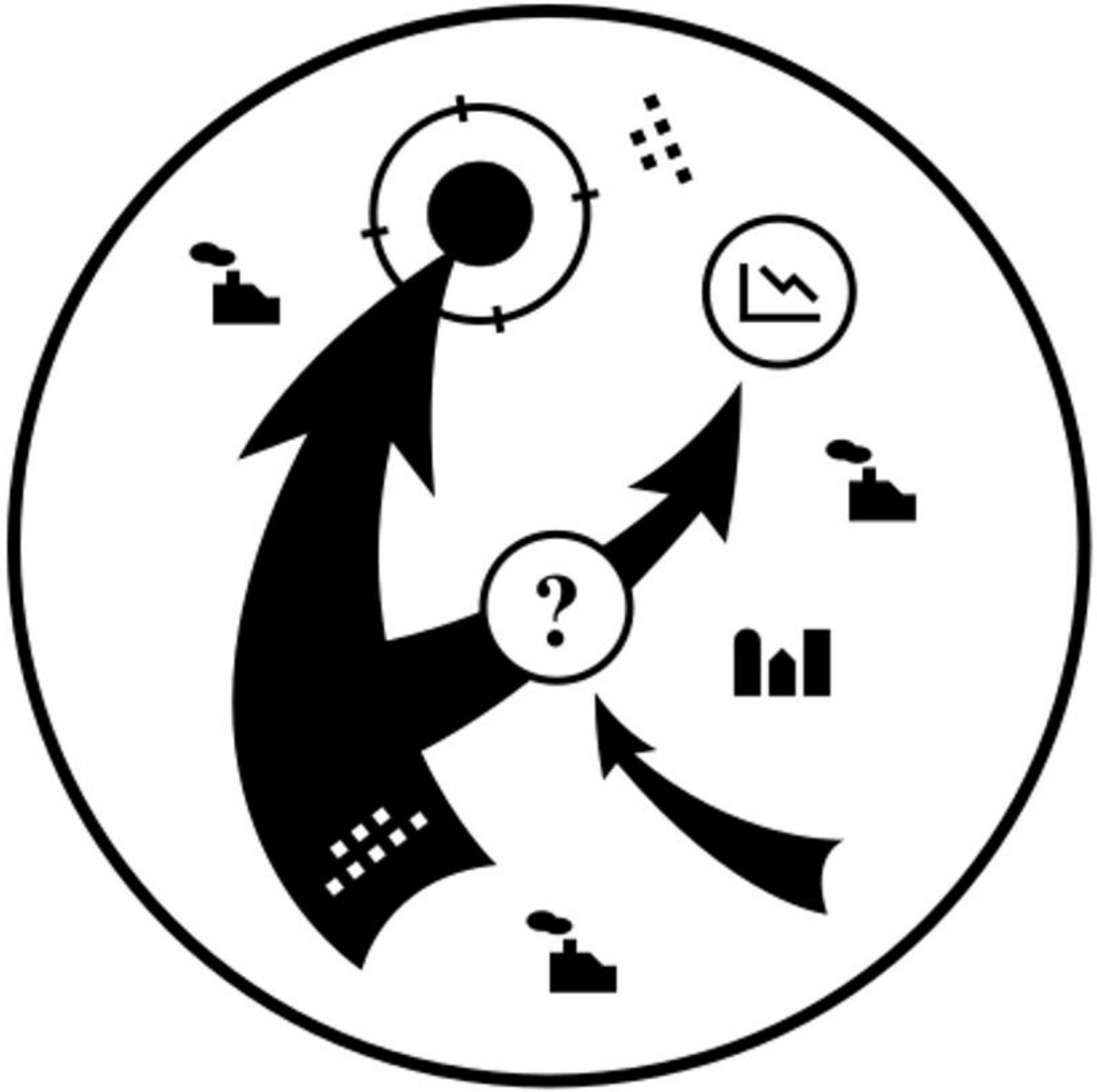

image source "Illustration of Strategy“ by Denis Fadeev

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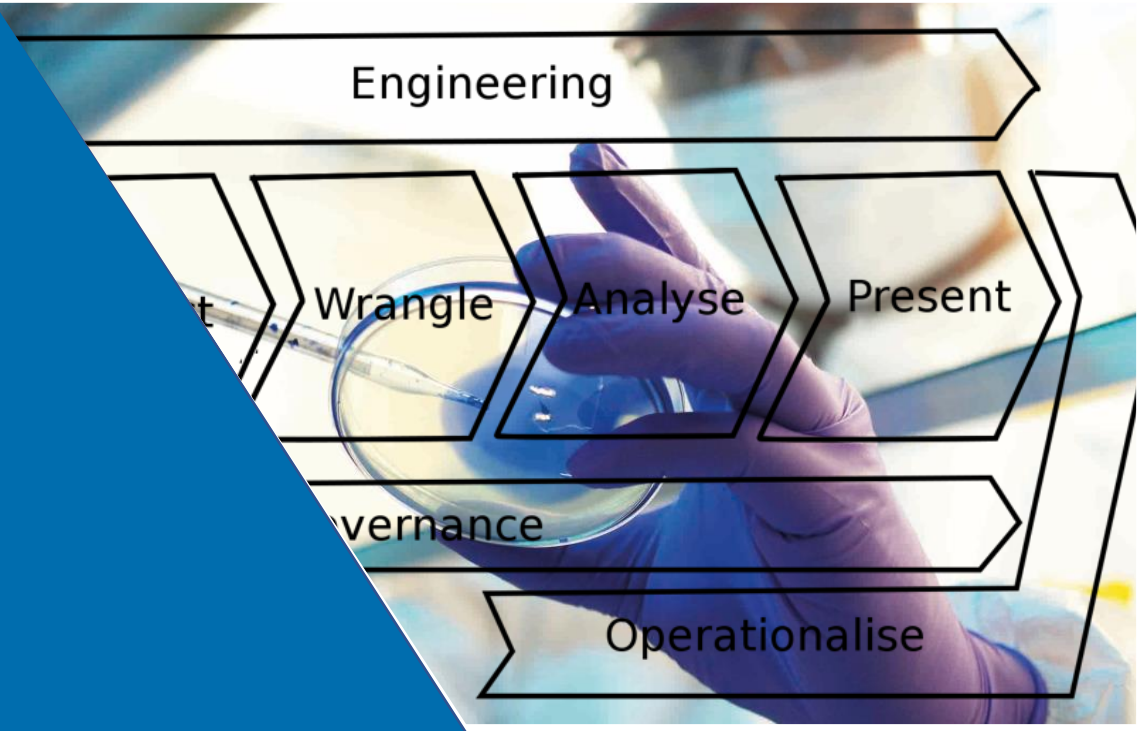
Data Science Process

Standard Value Chain:

Our Mode of the Process



Parts of a Data Science Project

Collection

- Getting the data

Engineering

- Storage and computational resources across full lifecycle

Governance

- Overall management of data across full lifecycle

Wrangling

- Data pre-processing, cleaning

Analysis

- Discovery (learning, visualisation, etc.)

Visualization

- Arguing the case that the results are significant and useful

Operationalize

- Putting the results to work, so as to gain benefits or value

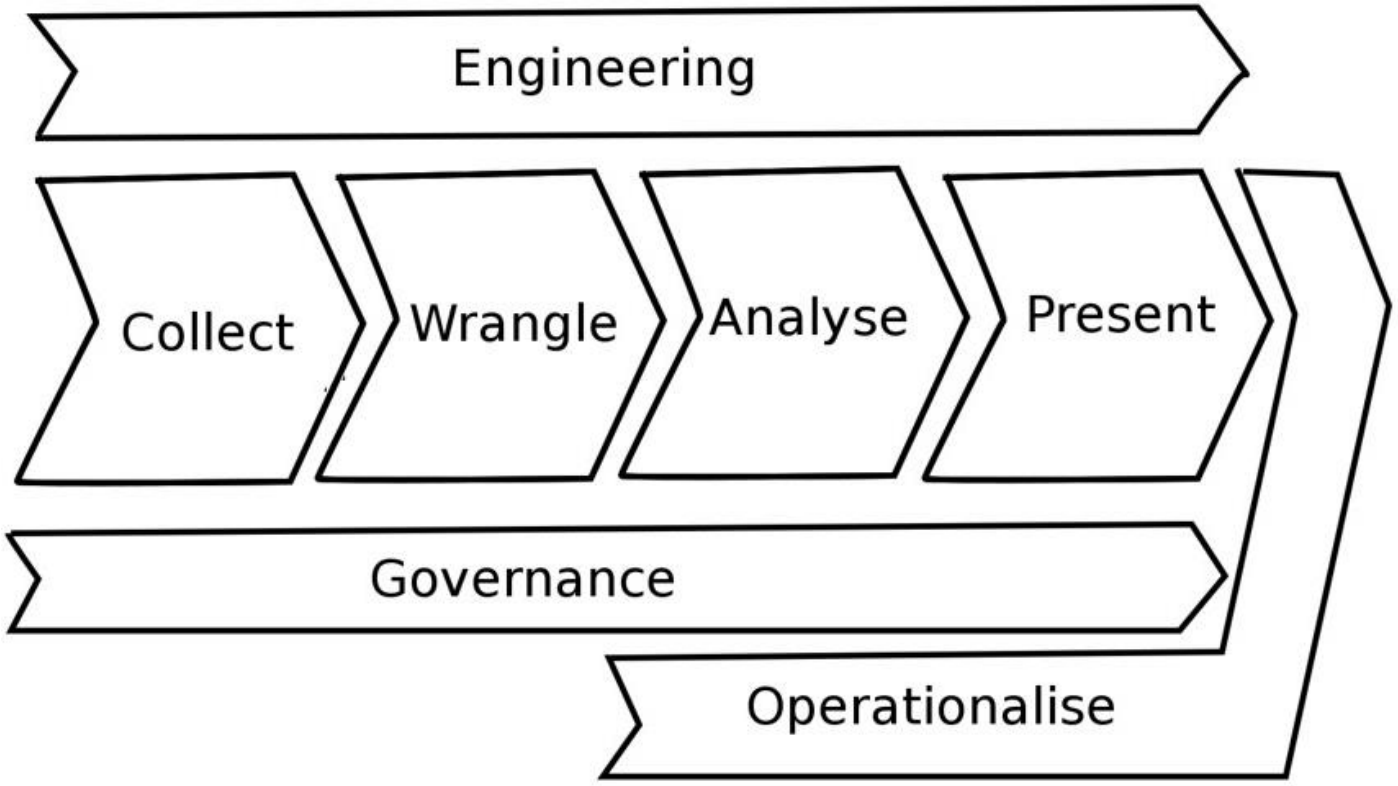
We call this the Standard Value Chain.

Data Science Process

from *Doing Data Science* by Schutt and O'Neil, 2013, (available digitally through library)

Chapter 1 of the book provides the following visualisation of the **standard value chain** for a data science project.

A typical data scientist has a different mix of skills as well as domain knowledge

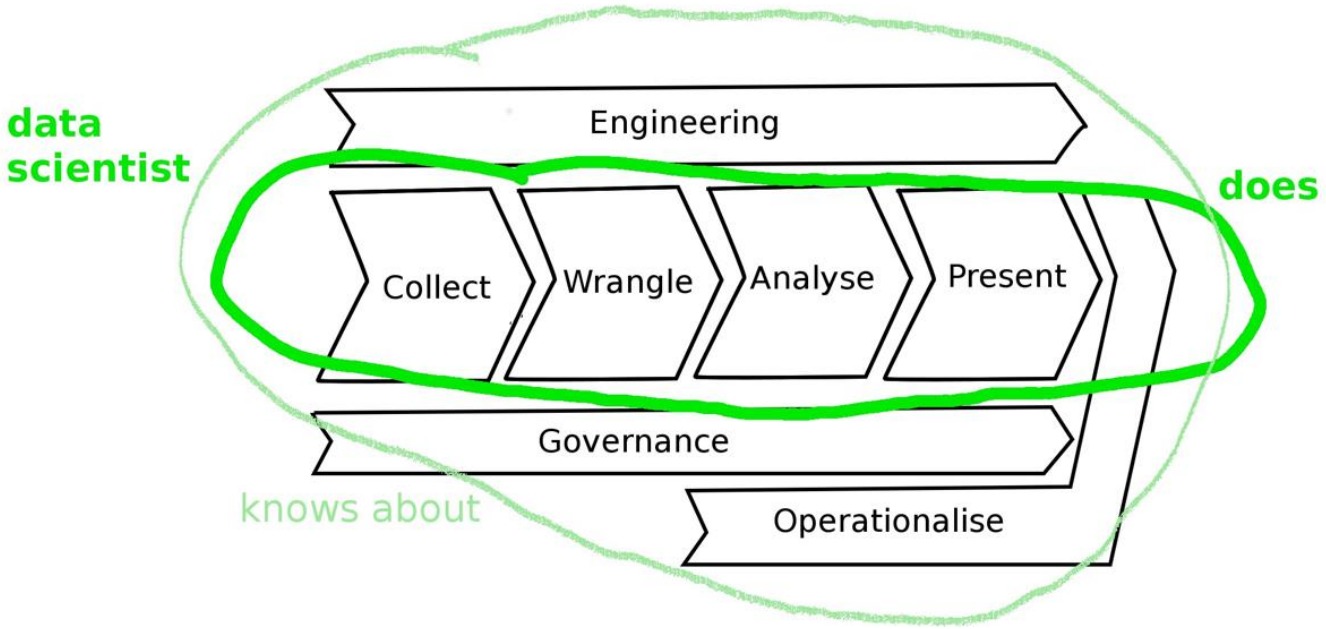


Data Science Process

from *Doing Data Science* by Schutt and O'Neil, 2013, (available digitally through library)

Data Scientist

Addresses the data science process to extract meaning / value from data



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Data Science Process

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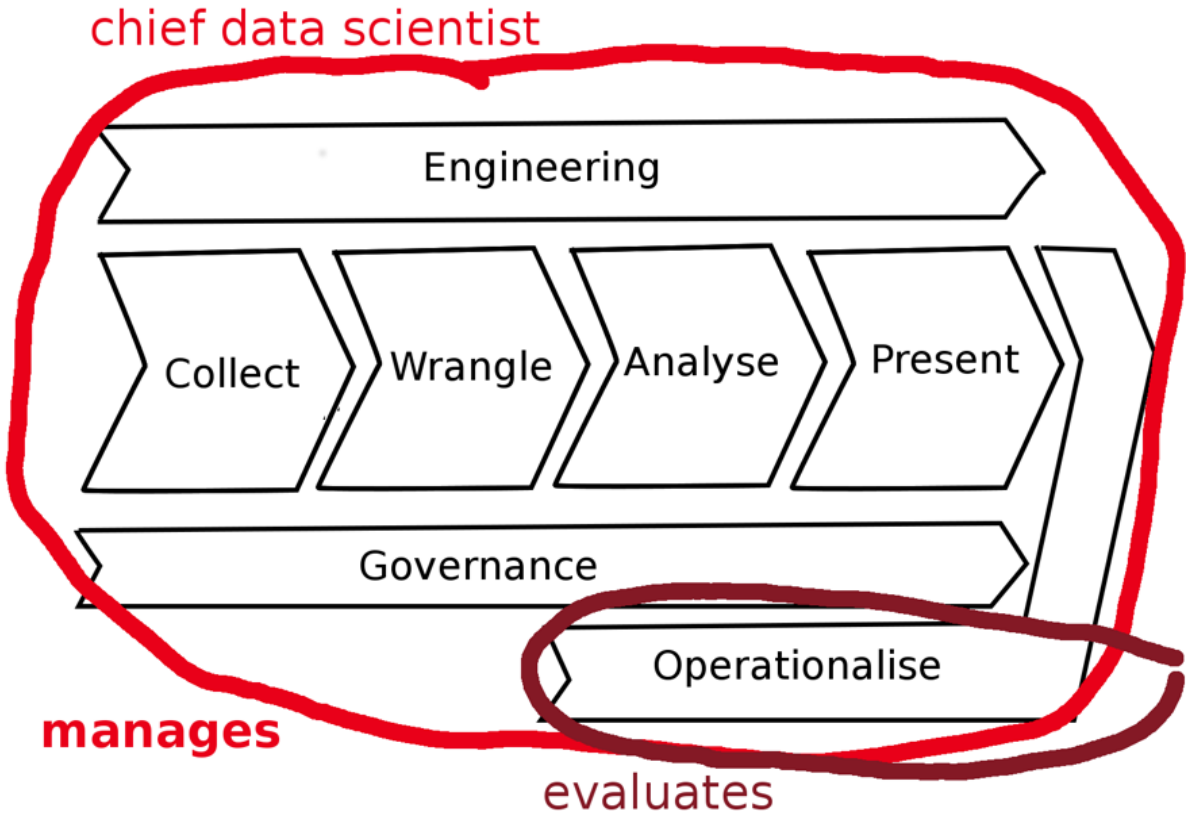
Chief Data Scientist

A form of chief scientist who addresses data management, data engineering and data science goals.

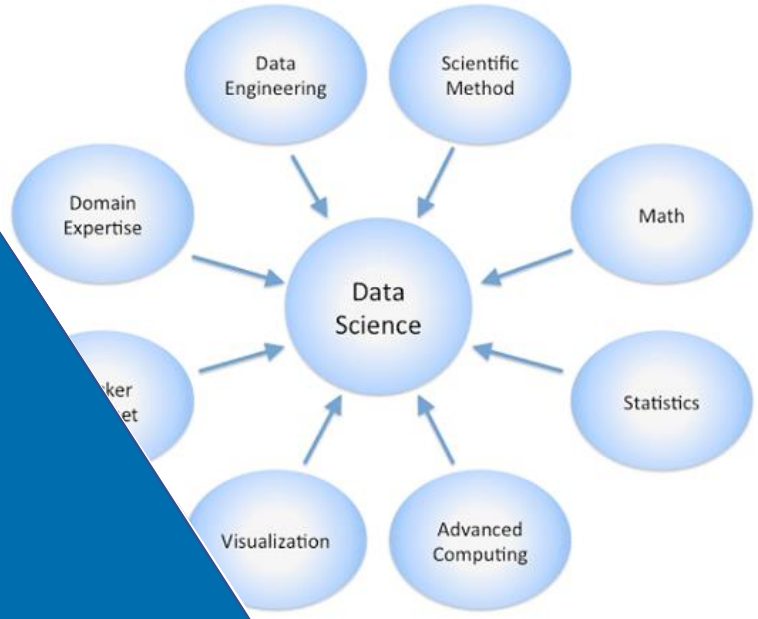
Chief Scientist

corporate position, responsible for science related aspects of a company/organisation



Relationship of Data Science to Other Disciplines

http://growtrue.net/coursera-data-science-courses/



Related: Data Engineering

Building scalable systems for storage, processing data

Hadoop,

Databases,

Distributed processing,

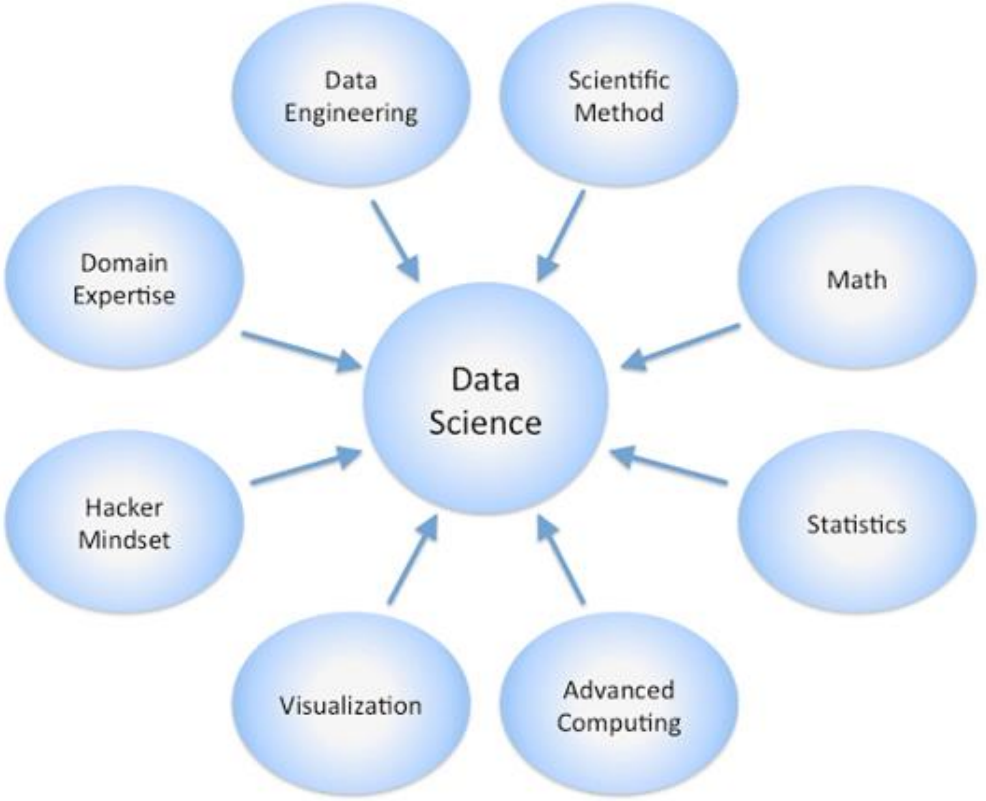
Datalakes,

Cloud computing,

GPUs,

Data wrangling, …

Huge, continuous improvement ....



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Related: Data Analyst

Performing analysis and understanding results

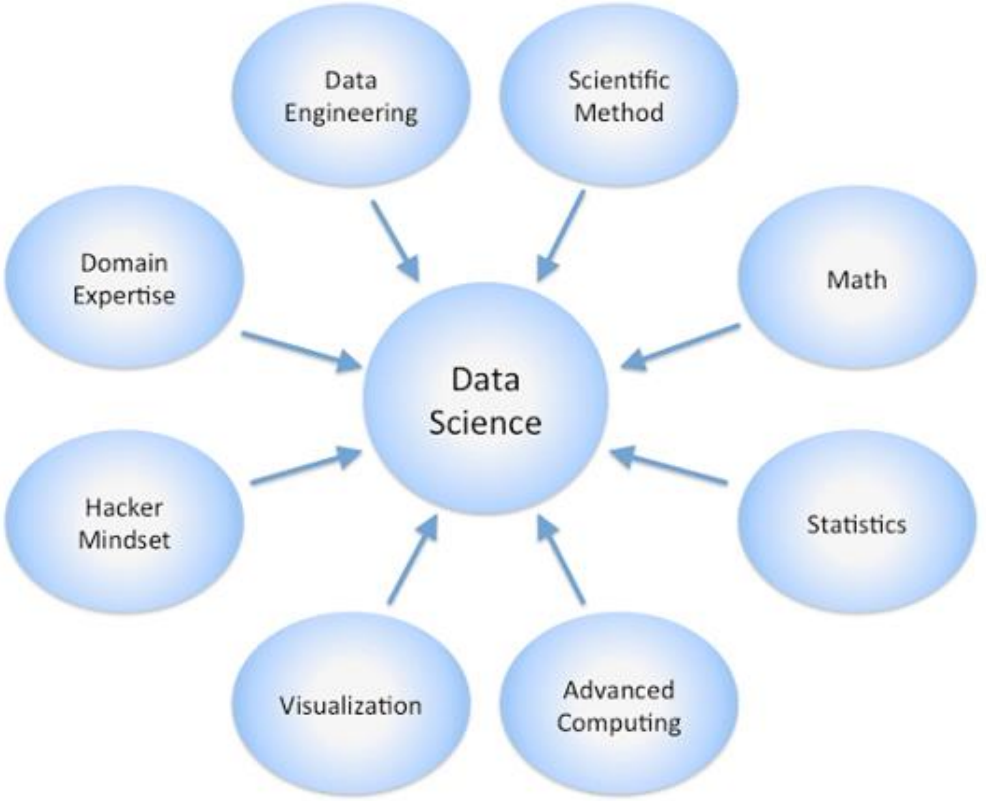
R and Microsoft Azure Machine Learning

Machine learning,

Computational statistics,

Visualisation, ...

Huge, continuous improvement ....



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Related: Data Management

Managing data through its lifecycle

ANDS

Ethics,

Privacy,

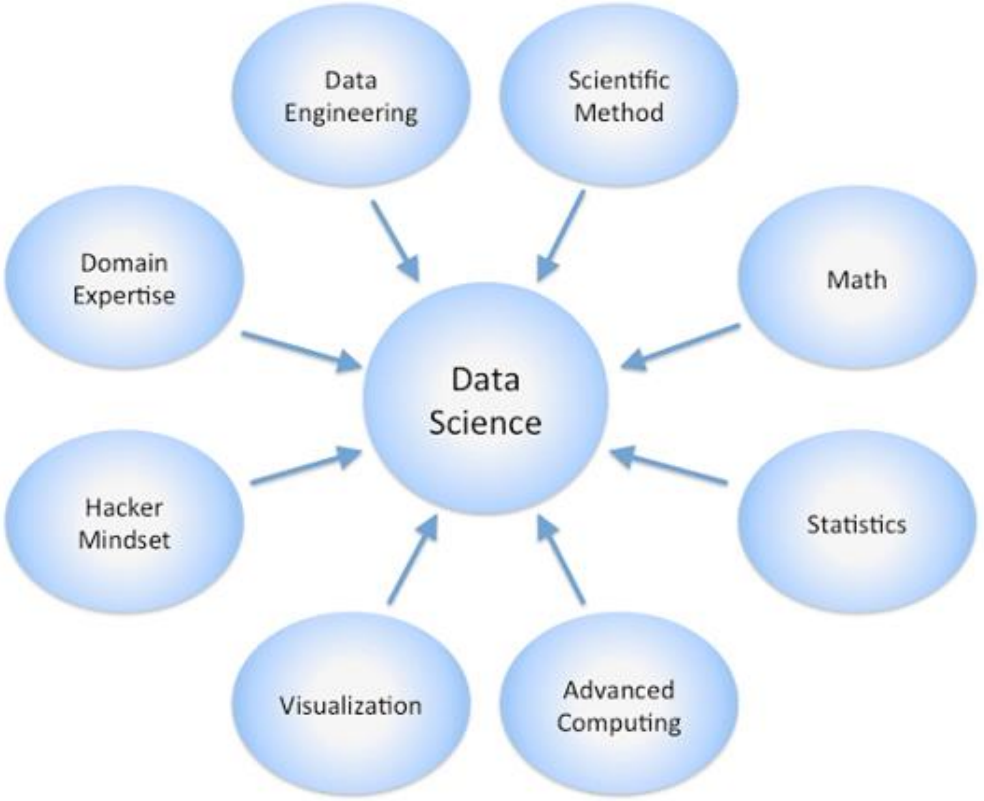
Providence,

Curation,

Backup,

Governance, ...

Huge, continuous improvement ....



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Home Activities

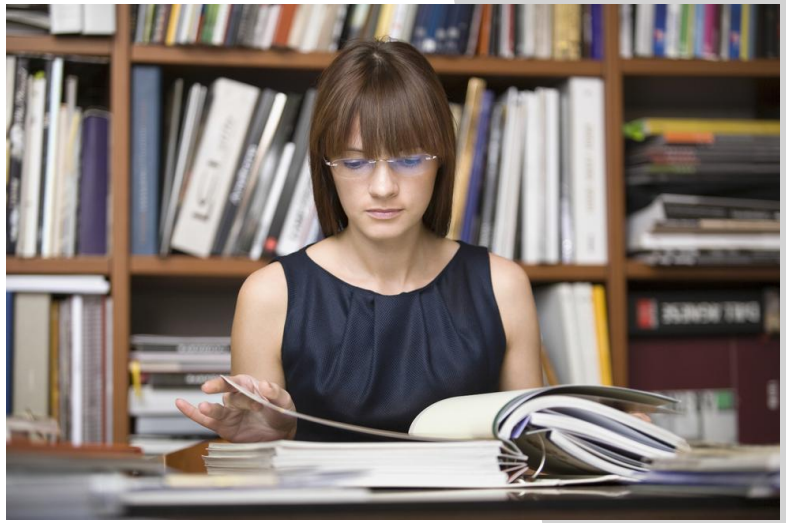
Suggested Activities for the week end

Videos

Watch *Cukier's TED talk on "Big Data"*

Watch the CERN video, *"Big Data" from Tim Smith*

Links to resources providing historical background to data science:



Wolfram Alpha: computable knowledge history

Cloud Infographic: Evolution Of Big Data

The Web Technology timeline

A brief history of Data Science

What is Data Science?

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Recap: Learning Outcomes

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