What is Data Science
And How You Can Leverage ML to Drive Revenue

A Straightforward, Short, and Non - Academic Approach for a Non – Technical Audience

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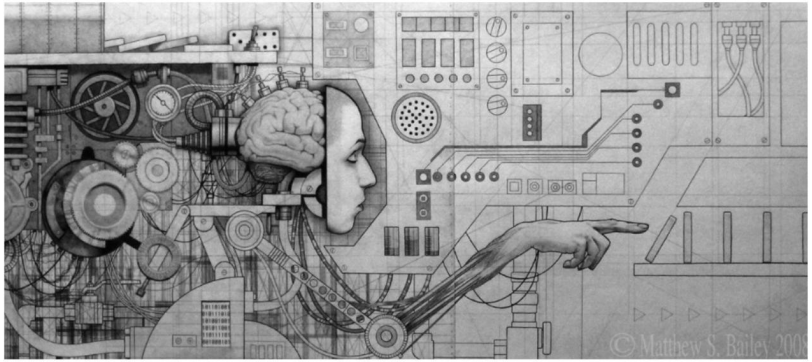

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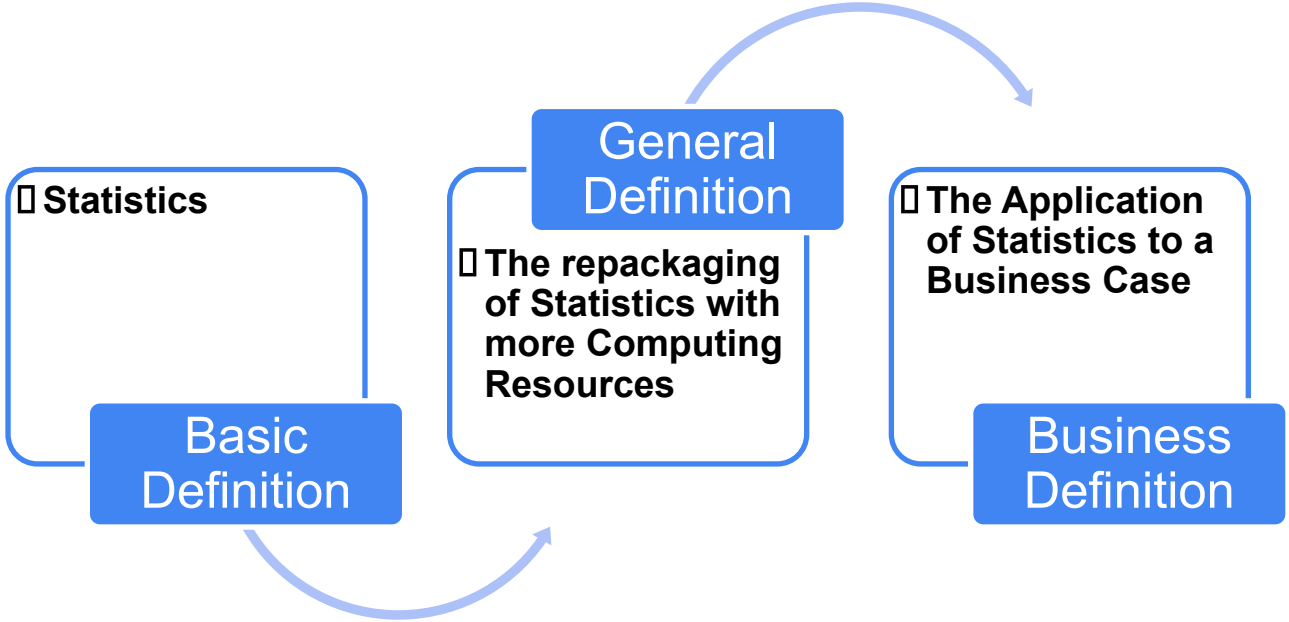
1. Definition: What is Data Science?



1. Definition: What are types of Data Science?

Artificial Intelligence is anything that is not biological that behaves biological

Machine Learning

An automated software program that reads data and makes decisions without additional explicit programming

Predictive Analytics

Supervised Learning

Reinforcement Learning

A software agent that observes then acts to receive rewards

Deep Learning

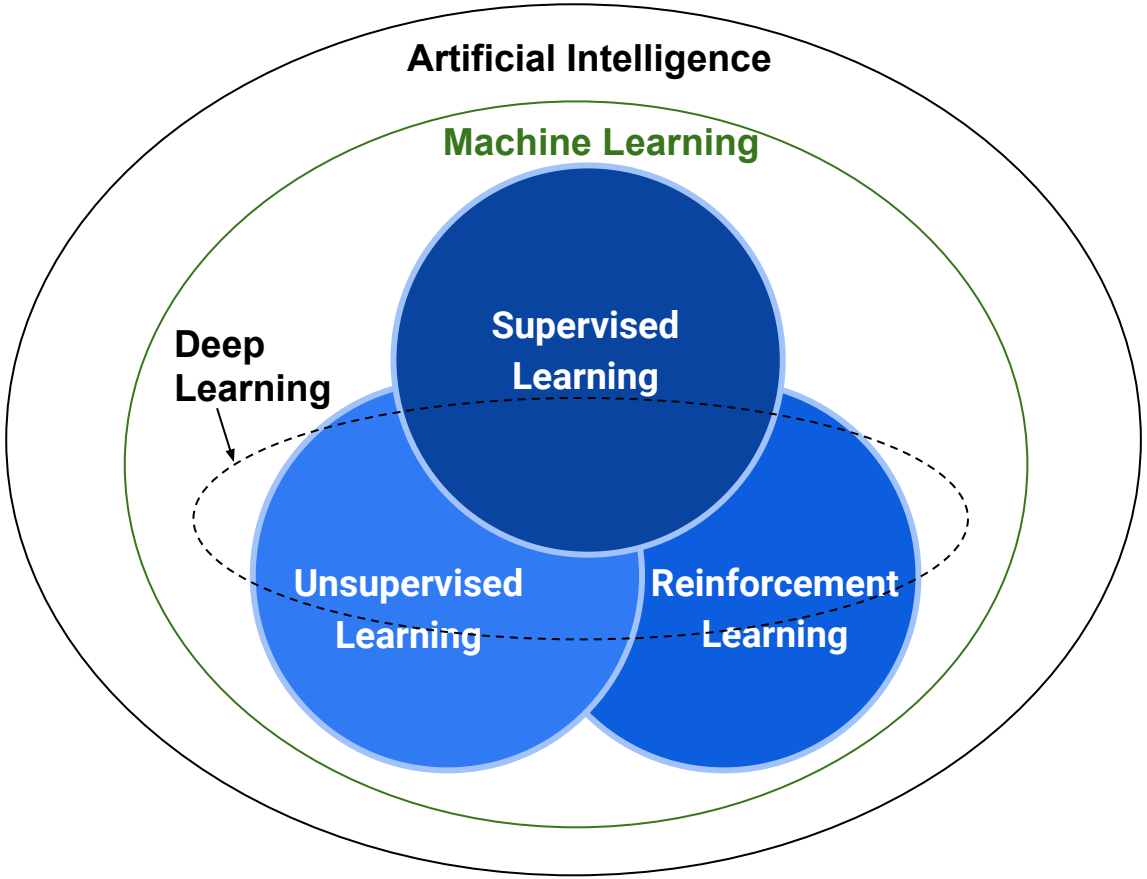
Machine Learning with depth or various layers, such as a Neural Network

Descriptive Analytics

Unsupervised Learning

Learning refers to fitting mathematical equations or the estimation process

1. The Current State of Definitions of Data Science



AI encompasses everything in ML

ML encompasses everything in Deep Learning, Supervised Learning, Unsupervised Learning, and Reinforcement Learning

There is either overlap or standalone states for Supervised Learning, Unsupervised Learning, and Reinforcement Learning

Deep Learning is an *extension* of Supervised Learning, Unsupervised Learning, and Reinforcement Learning

1. Applied (Un)Supervised Learning

Supervised refers to managing the instructions of the algorithm to predict a target

Subject Area	(*) Unsupervised Learning	Supervised Learning
Business	Inputs	Inputs & Outputs
Engineering	Drivers	Drivers & Outcomes
Mathematics	Regressors	Regressors & Regressands
Statistics	Independent Variables	Independent Variables & Dependent Variables
Psychometrics	Predictors	Predictors & Responses
General Science	Explanatory	Explanatories & Focuses
Linguistics	Descriptive	Descriptives & Predictive
Machine Learning	Unlabeled Training Data	Unlabeled Training Data & Labeled Training Data

(*) Unsupervised refers to the **lack** of instructions to manage the algorithm to predict a target because it is descriptive analytics, not predictive analytics.

2. Relabeling Defines Data Science and its Purpose

THEORY		APPLIED
Statistical Learning	→	Machine Learning
Fitting Equations or Estimating	→	Learning
Regression or Classification	→	Supervised Learning
Density Estimation	→	Clustering
Dimensionality Reduction	→	Data Reduction

3. Data Science Motto

All models are wrong, but some are useful.

George Box (1976)

4. Job Titles and the Data Science Profession

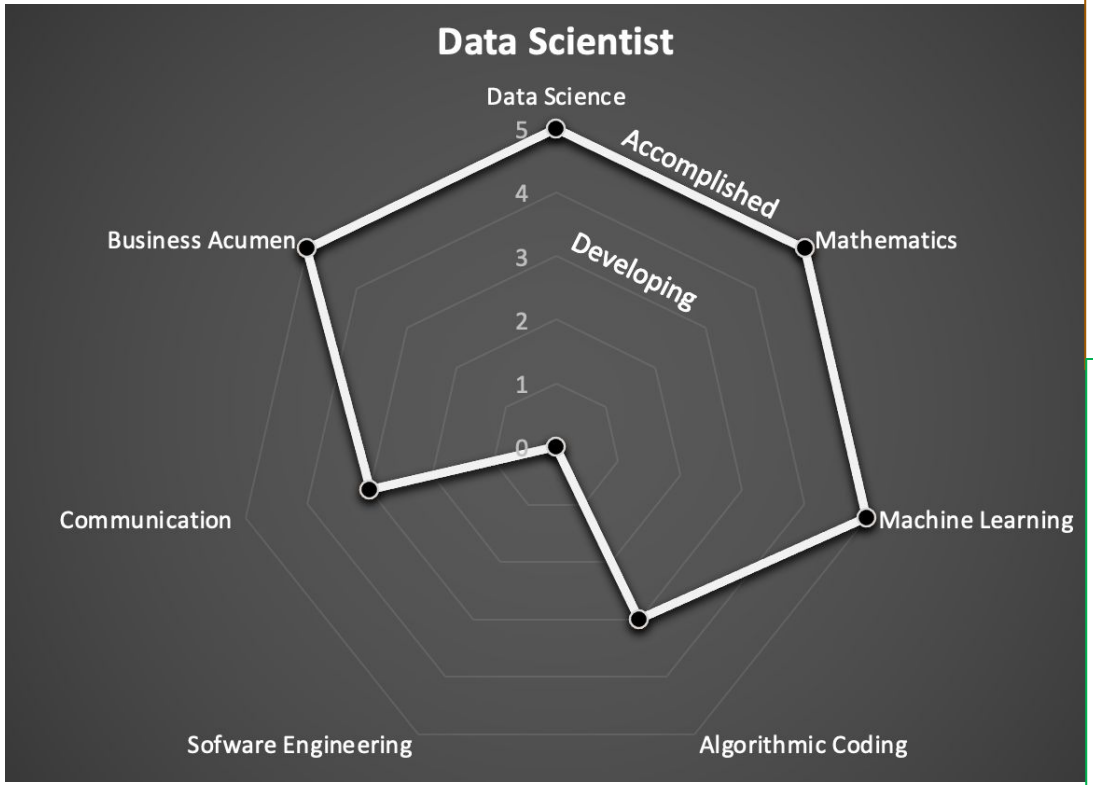
Prior Data Scientist Job Titles
Statistician
Operation Researcher
Econometrician (Statistical Economist)
Computational Linguist (Language Scientist)
Clinical Psychologist (Psychometrician)
Image Processing Engineer
Computer Scientist (*)

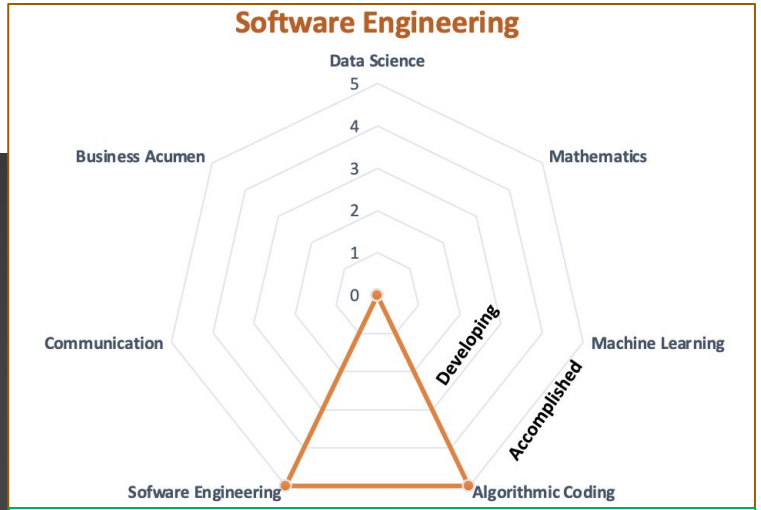
(*)
The overwhelming majority of Computer Scientists are **not** Data Scientists, but a small number of Computer Scientists are **exceptional** Data Scientists.

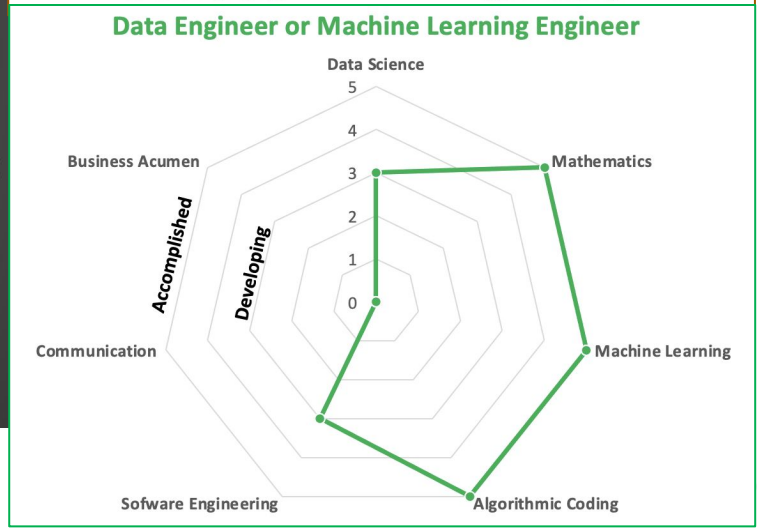
Wrong Data Scientist Job Titles
Software Engineer
Software Developer
Business Systems Analyst
Data Analyst
Data Engineer
IT Project Manager
Chief Technology Officer (CTO)
Computer Scientist (*)

(*) Short Sample Write-Up to Clarify the Difference: https://medium.com/p/a04497543052

4. Job Titles and their Skill Sets







4. Job Titles and their Skill Sets

The Labor Market for Data Scientists has more risk for organizations

- There are **more** people with a quantitative background who want to be Data Scientists than **real** Data Scientists by a wide margin. The risk of the **blind** leading the **blind** is always present.

Examples

(1) A Software Engineer claims that he or she can explain anything if they can code it up.

(2) A Physics Ph.D. may oversimplify Data Science after reading a book on Data Science.

(3) A Data Analyst claims to be a Data Scientist after reading and interpreting a dataset.

- If you think you need to select an intelligent Data Scientist, but with the wrong mindset, it will lead to a Data Science disaster for an organization.

Hearsay

Oversimplification

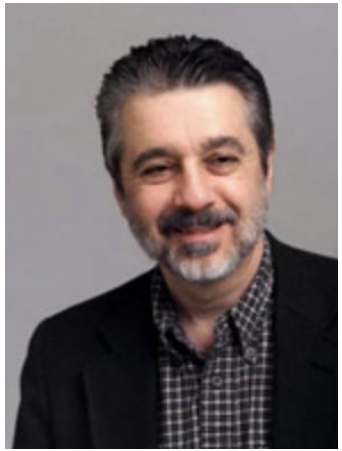
Bias

Underestimation

5. Where did Data Science come from?

William S. Cleveland

Professor of Statistics at Purdue University, Indiana



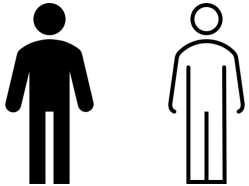
- Vote at the Statistical Symposium in **2001**
- Reasons provided for the establishment of Data Science.
  - ✔ The processing power of computers is increasing exponentially
  - ✔ The exponential growth of the quantity and quality of data, especially unstructured data
  - ✔ **The first source of Data Science:** https://www.jstor.org/stable/1403527 (The International Statistical Institute)
    - The first official sentence of Data Science: "***This document describes a plan to enlarge the major areas of technical work of the field of statistics. Because the plan is ambitious and implies substantial change, the altered field will be called "data science".***

- The term "Data Science" did **not** become popular, according to Google Search Analytics, until **2010**
  - ✔ From 2010 to the present time, Data Science projects were slowly funded first, then exponentially

Question

If you clone a human being, then

does the clone have artificial intelligence?



6. Some Data Science Use Cases for the Business

Business Use Case	Data Science Model	Improvement
Fraud Detection	**Anomaly Detection** as an Unsupervised Learning Model	Credit Risk Reduction
Propensity to Buy New Product Launch or Existing Product with New Feature Launch	Predictive Analytics with a **Classification** Model	Revenue Generator for Product Management
Sentiment Analysis How people outside the company view your organization and its reputation	**Natural Language Processing (NLP)** on all news reports on the company	Executives have an outside view or attitude of the company whether positive or negative
Customized Recommendations For individual customers with no assumptions about any customer	**Reinforcement Learning** to suggest what customers want in the company's product line	Increases the Return on Investment (ROI) and Profit Margins for the company
Explain Driving Business Factors What are the inputs to explain a $1 Billion Valuation as a Unicorn for Venture Capital Investment?	**Explanatory AI Regression Model** with **Automated Factor Selection** to reveal what drives a successful Startups from a set of various Startups	Ensures the the Return on Investment (ROI) and Maximizes Profit for investors

7. Models and Methodologies

Supervised Learning for Predictive Analytics

Classical Methodologies

- Linear Determinism
- Regularization
- Polarity
- Flow Chart
- Bayesian
- Nearest Neighbor

Static and Sequential
(1) Data
(2) Model
(3) Prediction

EXAMPLES

What is next month's Sales Volume Number?

Will the Customer buy or not buy?

Regression

Classification

Contemporary Methodologies

Ensemble Methods

Iterative from Weak to Strongly Accurate Models

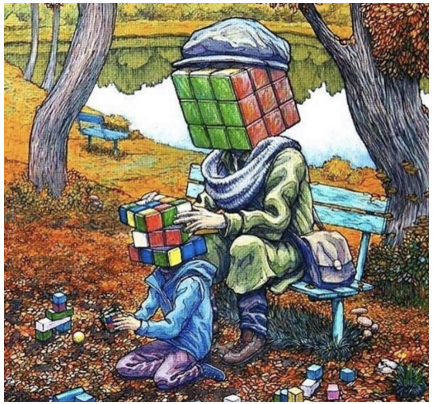
Reinforcement Learning

Iterative Reward Mechanism with No Assumptions

Deep Learning

Many Attempts of Estimating to Raise Accuracy

There are dozens of Models!



6. Unsupervised Learning and Descriptive Analytics

(Use Cases)

Clustering

Describe Structures in Datasets

Data Reduction Techniques

Pre – Model Preparation

Anomaly Detection

Fraud Detection

Feature Selection Automation

Inputs for Explainable AI and Predictive Analytics

Autoencoder

File Compression to Reduce Data Noise

Group Segmentation

Customer Segmentation

Should you ask your Supervisor about Unsupervised Learning? Yes!

8. Common Data Science Mistakes

Always Inaccurate
Reselect Inputs
Change Model

Confusing Cause and Effect
Endogeneity or Simultaneity

The Old Way does not work anymore
Regime Switching

Too Many Similar Features
Multicollinearity or try Deep Learning

Same Model, Different Results
High Variance

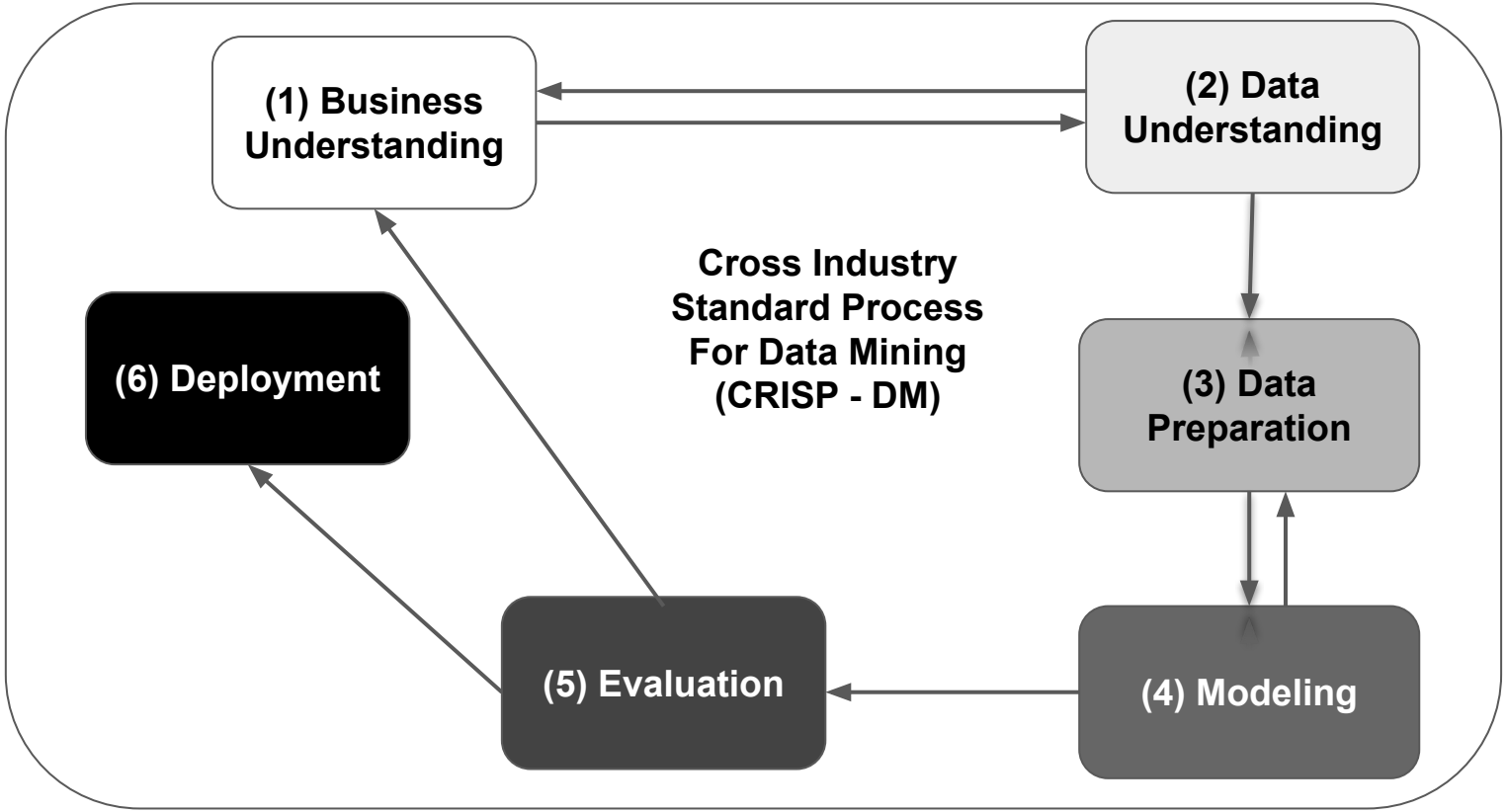
Overgeneralizing
Overfitting

Missing Data causes No Prediction
Wrong Model

More Data, Less Usefulness
High Bias

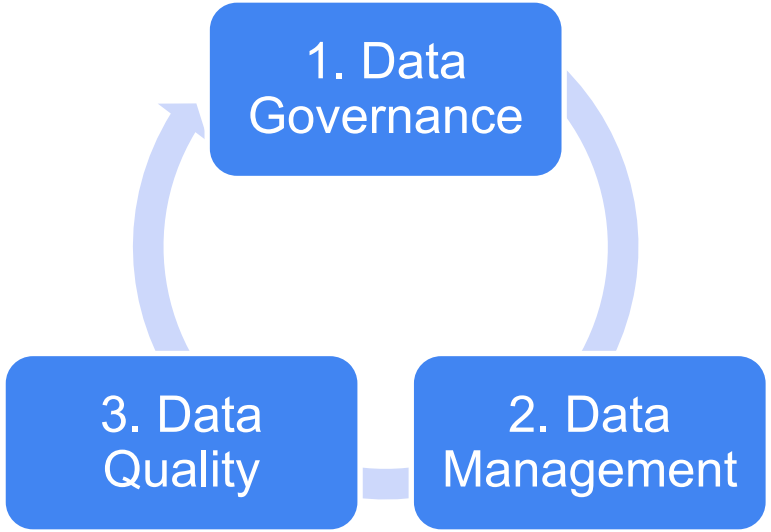
Misclassification
Type I, False Positive

9. Generalized Data Science Workflow



Similar to Agile Software Development, but more Business Interaction and more Business Impact

10. Data Science Governance



All the practices and processes that ensure the management of data assets in an organization is Data Governance.

The execution of Data Governance is Data Management.

The highest priority of Data Management is Data Quality.

The definition of Data Quality is Usefulness.

Short Sample Write Up: https://medium.com/codex/data-governance-from-a-data-scientist-dab4a80cd551

Thank you, and I hope I have raised your knowledge base and interest in Data Science.

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