Business Analytics & Data Science

Introduction

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Scope of Business Analytics and Data Science

BADS focusses on data-driven tools to guide decision-making

- **Analytics is the use of data, IT, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their business operations and make better, fact-based decisions.**
  [Evans, 2013]

- **Management decision-making process**

- **Means of computer-based decision support**
  - ☐ Tools to browse and summarize data
  - ☐ Extractions of patterns (association, co-occurrences)
  - ☐ Prediction of future states / developments
  - ☐ Recommending actions

informative

normative

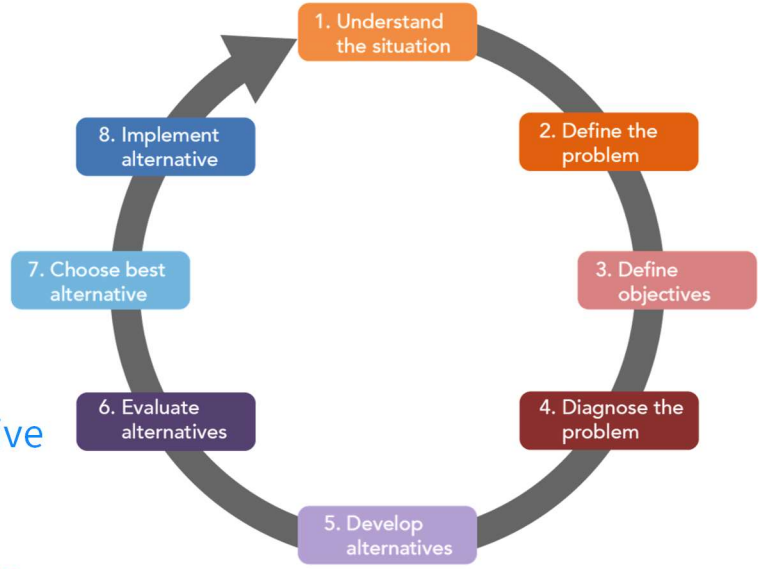
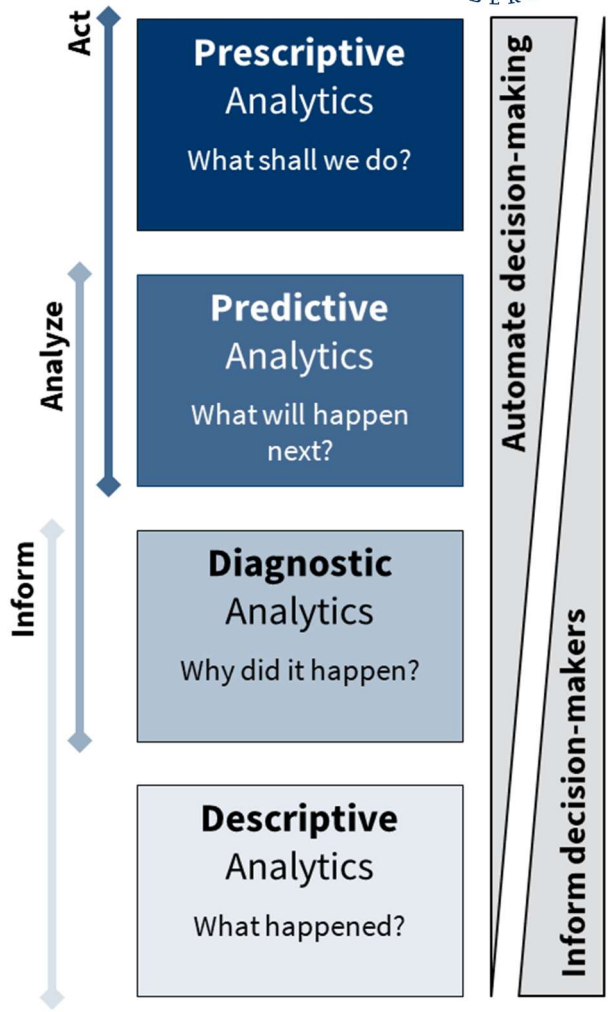


Image source: https://courses.lumenlearning.com/wm-organizationalbehavior/chapter/the-decision-making-process/

The Scope of Business Analytics

- **Descriptive analytics**
  - Use data to understand the past
  - Aggregation, clustering, unsupervised machine learning
- **Diagnostic analytics**
  - Depict data to maximize insight and minimize cognitive effort
  - Nontrivial for complex data
- **Predictive analytics**
  - Use historic data to detect generalizable patterns for forecasting what will happen in the future
  - Supervised machine learning, deep learning, …
- **Prescriptive analytics**
  - Use forecasts and other information to recommend specific actions
  - Optimization, treatment effects, reinforcement learning

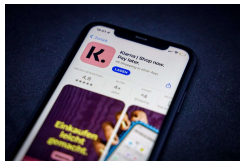


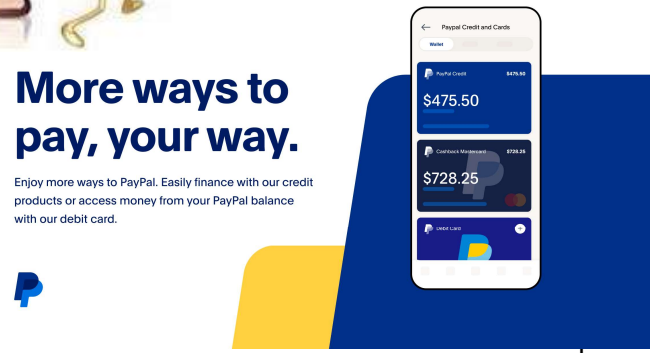
Business Use Case I: Credit Scoring

- Huge variety of financial products from traditional loans to on-demand rate payment
- Lender earns a fixed, contract-agreed fee…
- But has to hedge against (unexpected) losses
- Business question:

  how likely is it that the borrower repays if I approve their application?

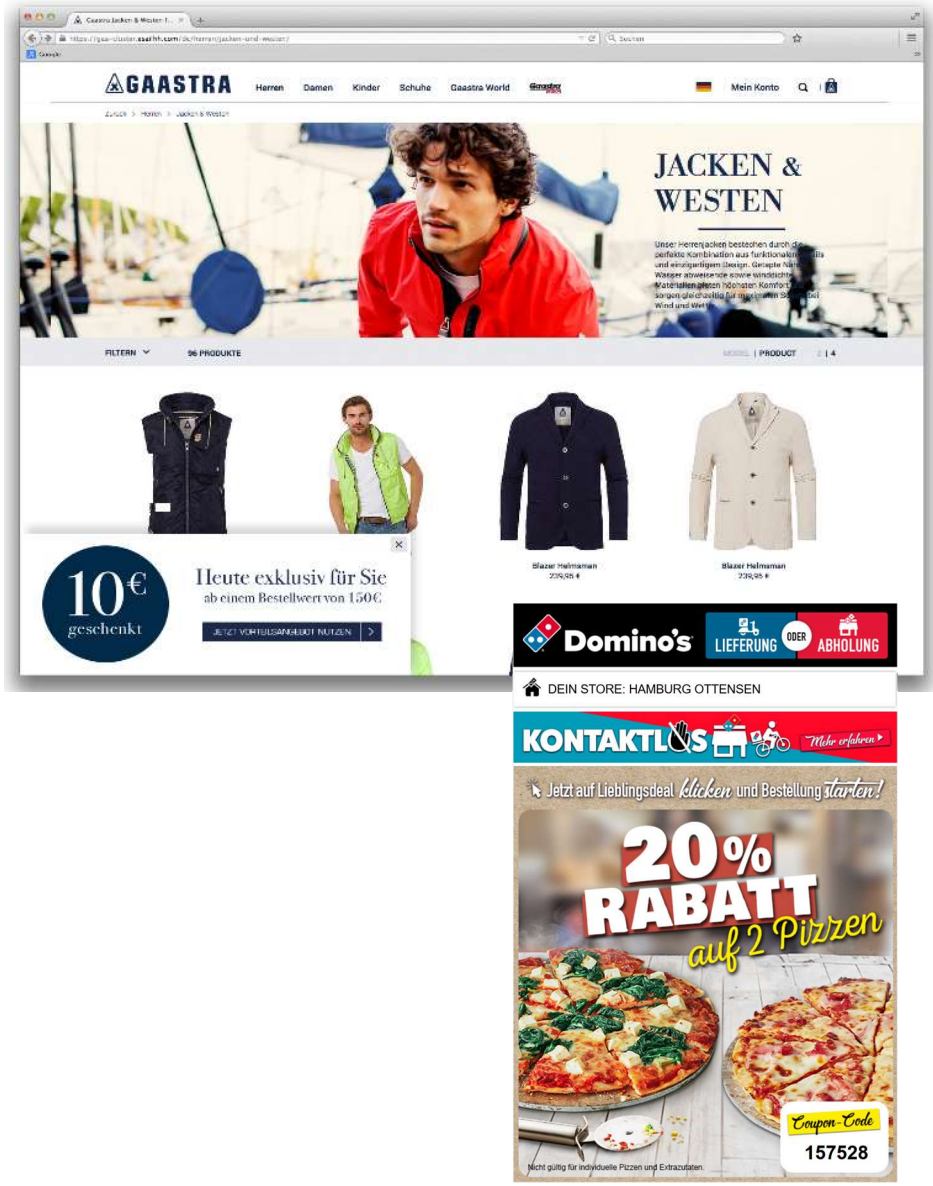
- Data Science support?





Business Use Case II: Digital Coupons

- **Dynamically inserted into a page (web or app)**
- **Aimed at stimulating sales**
- **Platform runs 24/7 at high scale**
- **Business question:**
  - Who should get a discount?
  - How much discount should we offer?
  - What kind of format is most persuasive?
  - …
- **Data Science support?**



Business Use Case II: Leasing Industry

- **Important channel to market durables**
  - Most prominently cars
  - Machinery, IT equipment, etc.
- **Typical setup**
  - Clients lease equipment for a given period
  - Provider receives monthly fee
  - Client returns the item when contract expires
  - Provides resales the used item in the second-hand market
- **Business question:**

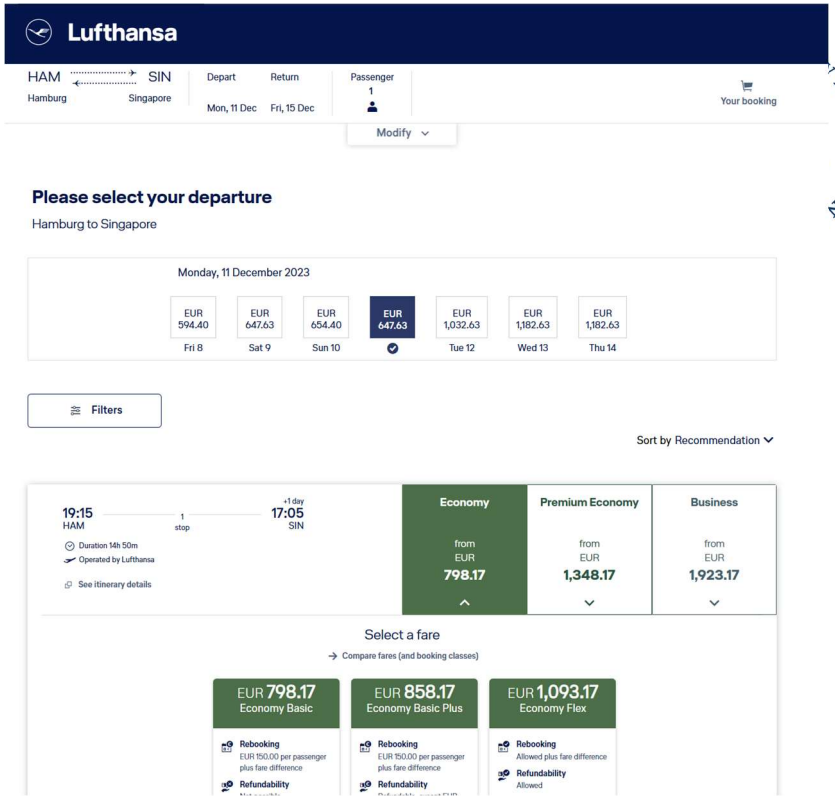
  how to price a leasing contracts?

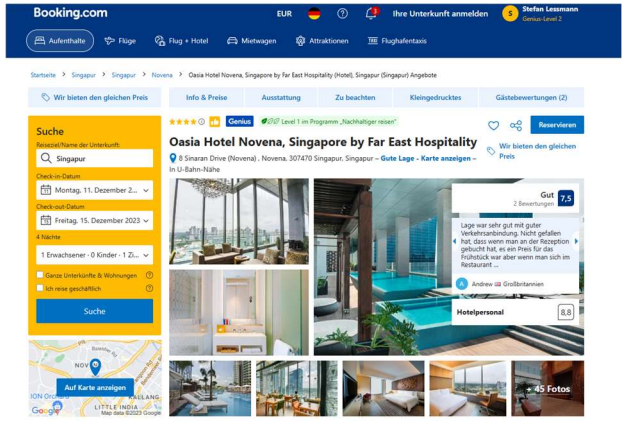
- **Data Science support?**

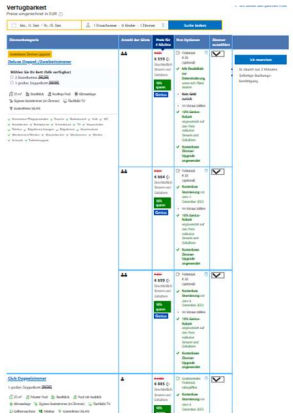
Business Use Case III: Tariff Design

- **Travel & hotel industry, transportation, app industry, etc.**
- **Much literature on price discrimination & dynamic pricing**
  - How supplier can maximize revenue
  - How to avoid premium customers moving to lower quality channel
- **Business question:**

  how many different groups of customers exist?
- **Data Science support?**





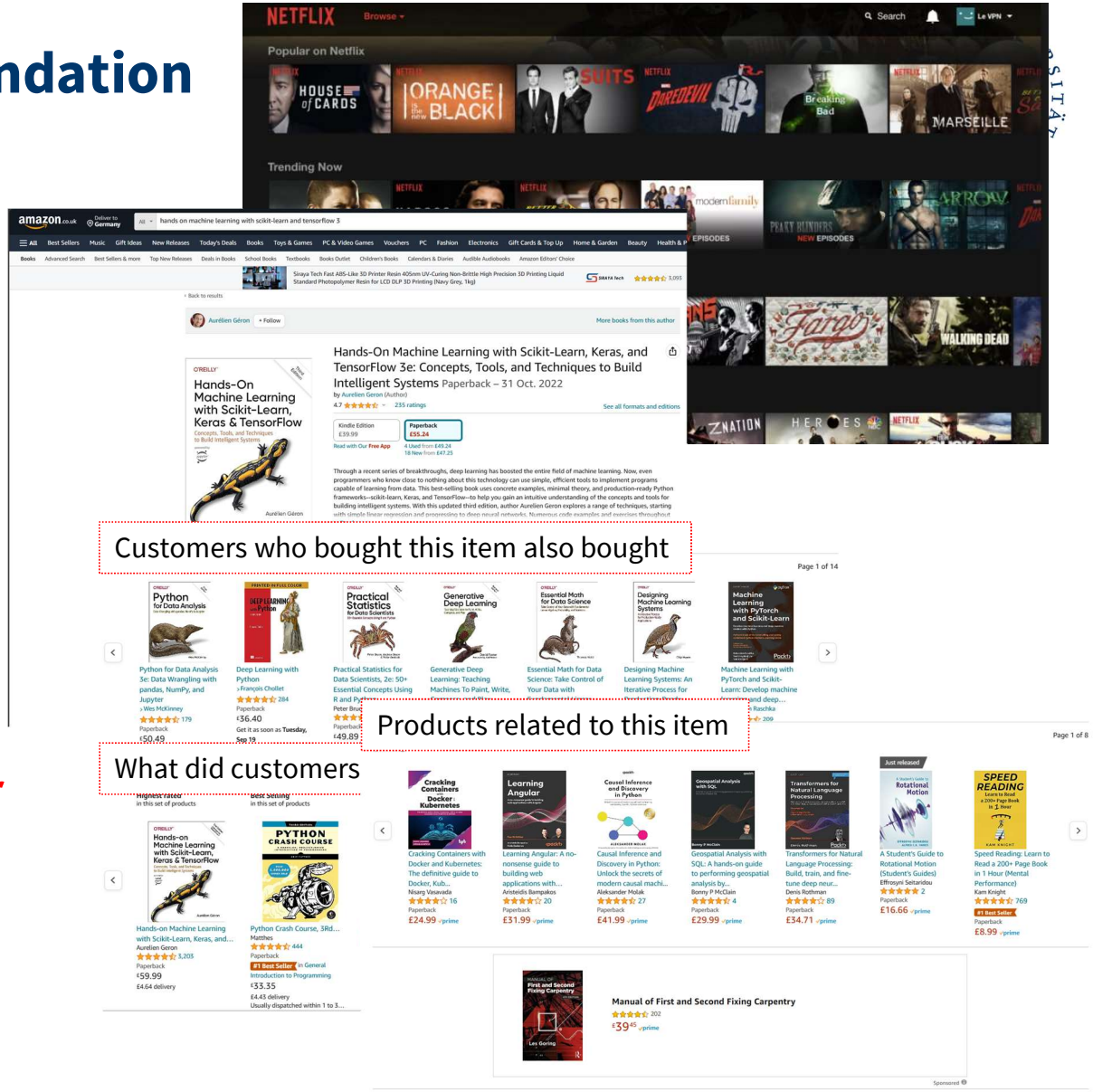


Business Use Case VI: Recommendation

- **E-Shops offer vast assortments**
- **Recommendation objectives**
  - Avoid information overload
  - Cross-/Up-sell clients
  - Enhance customer experience
- **Business question:**

  what products interest the customer the most?

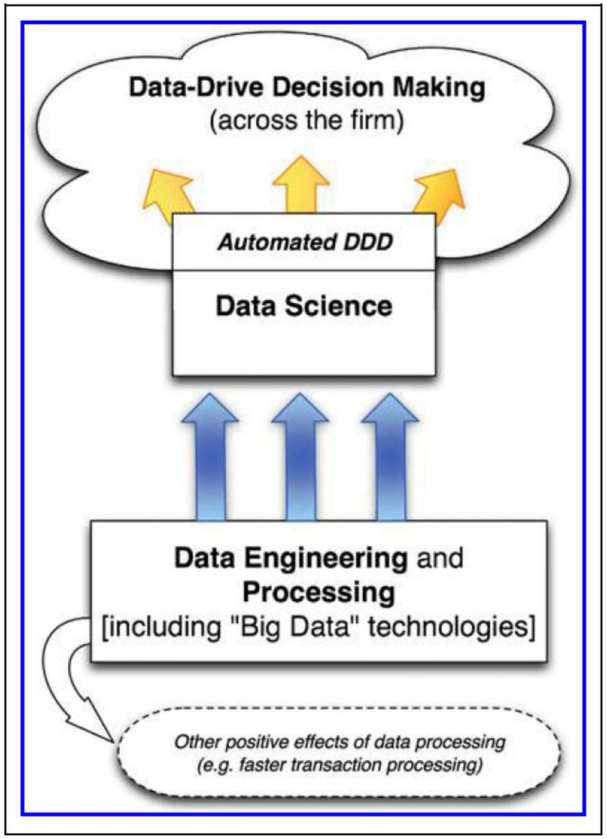
- **Data Science support?**



The Scope of Data Science

The methodology component in business analytics

- **Closely related to *data mining***
  - ***Data science***: Data science is the study of the generalizable extraction of knowledge from data (Dhar, 2013)
  - ***Data mining***: the computational process of discovering patterns in large data sets … The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use (Wikipedia)
- **Roughly: Business analytics = data science + business apps**
  - Data science should not be understood as a purely methodology focused field
  - Emphasize of communication ability for example commonly part of data scientists' skill set
  - Scope of application areas however broader than in business analytics



[Provost & Fawcett, 2013]

But How About AI?

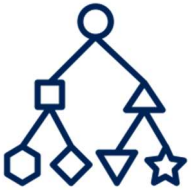
Machine Learning (ML) and Artificial Intelligence (AI)

Artificial Intelligence

Enable computers to mimic human behavior

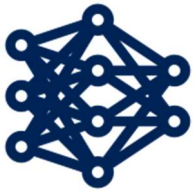
Machine Learning

Ability to learn without explicitly being programmed

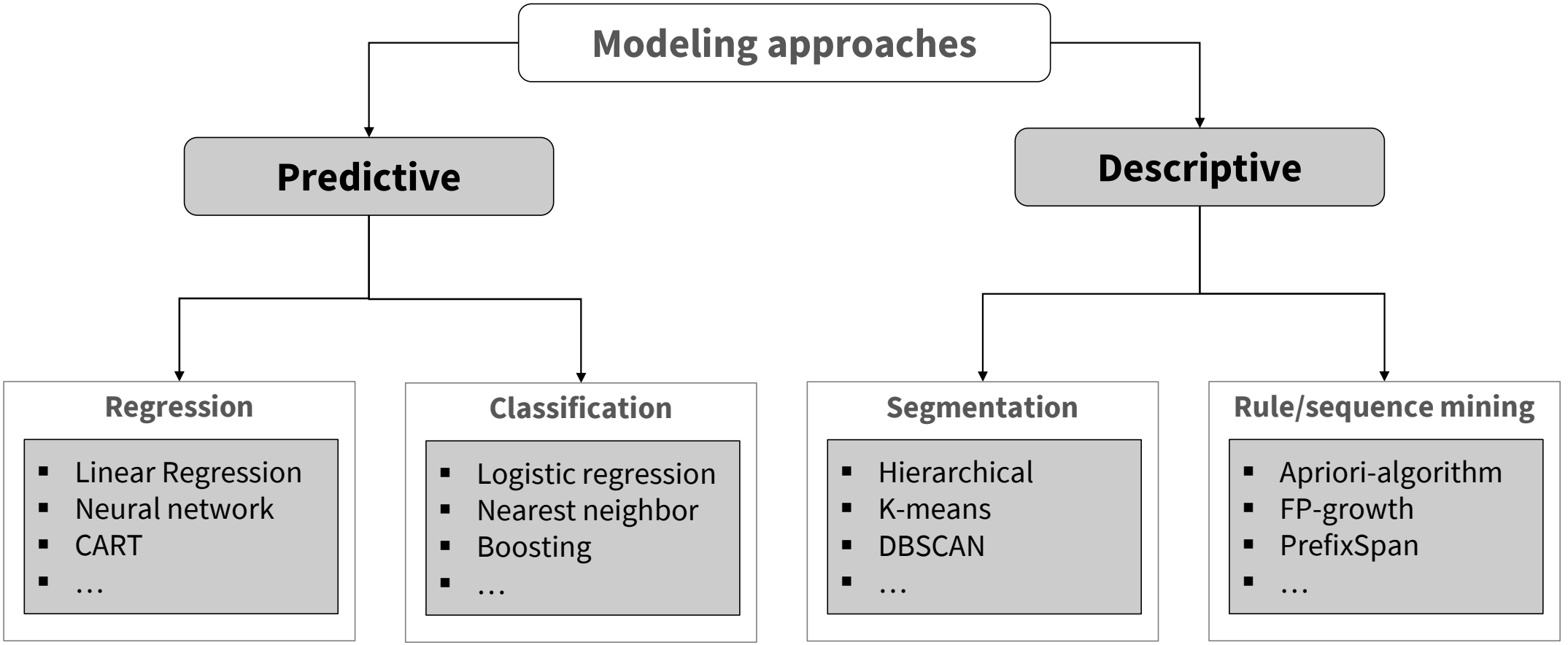


Deep Learning

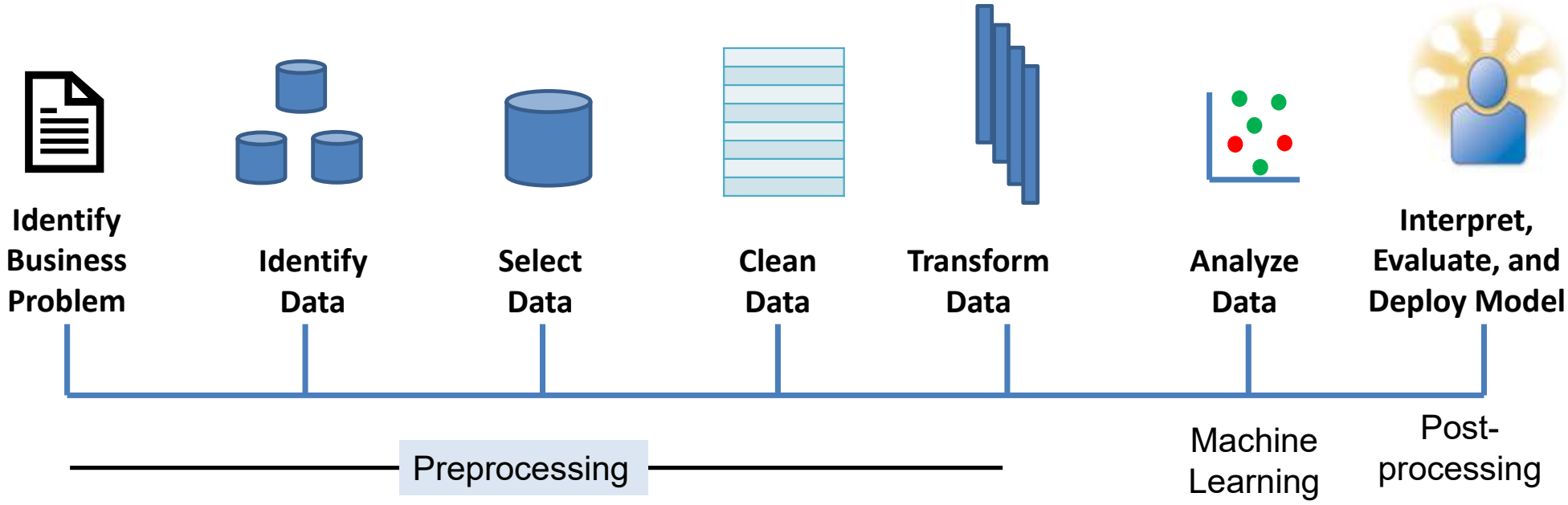
Ability to automatically extract features from data using artificial neural networks



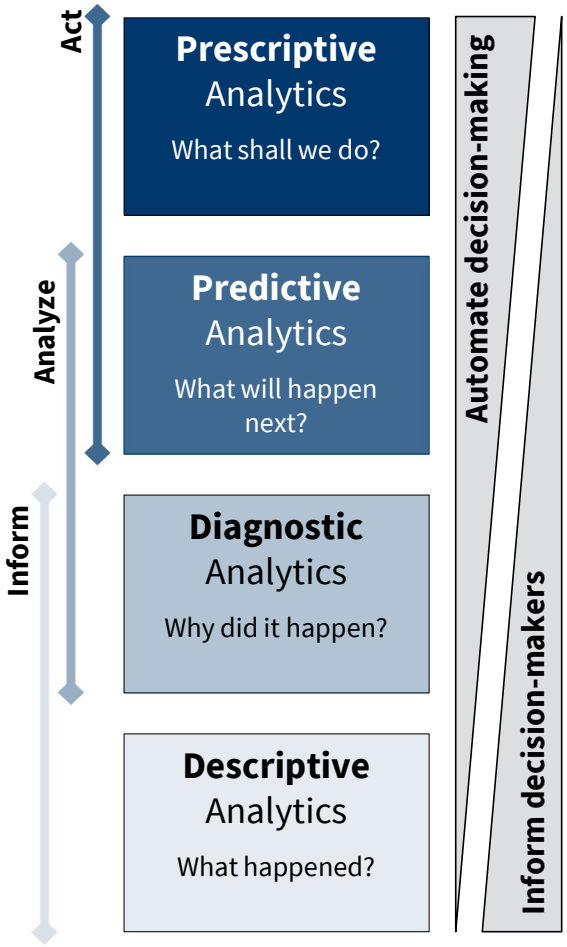
Data Science Models and Algorithms

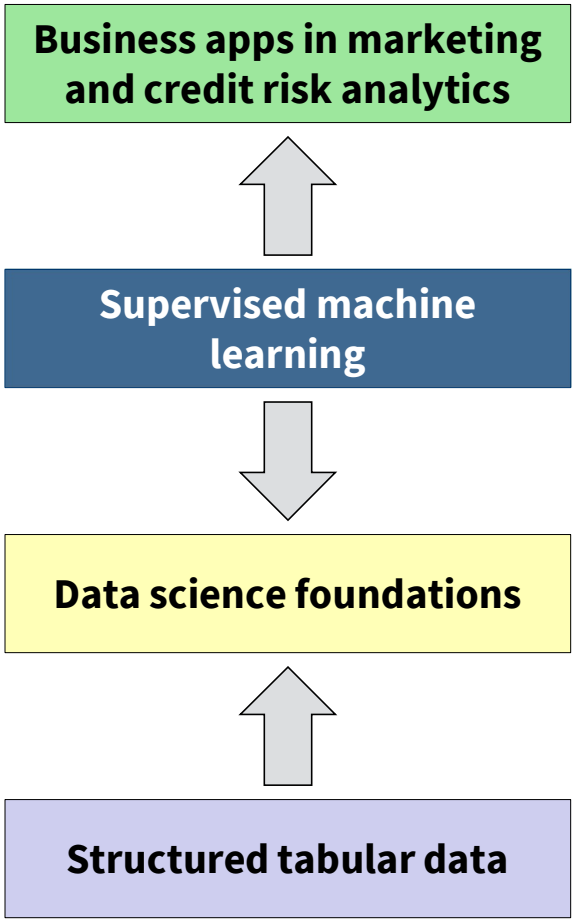


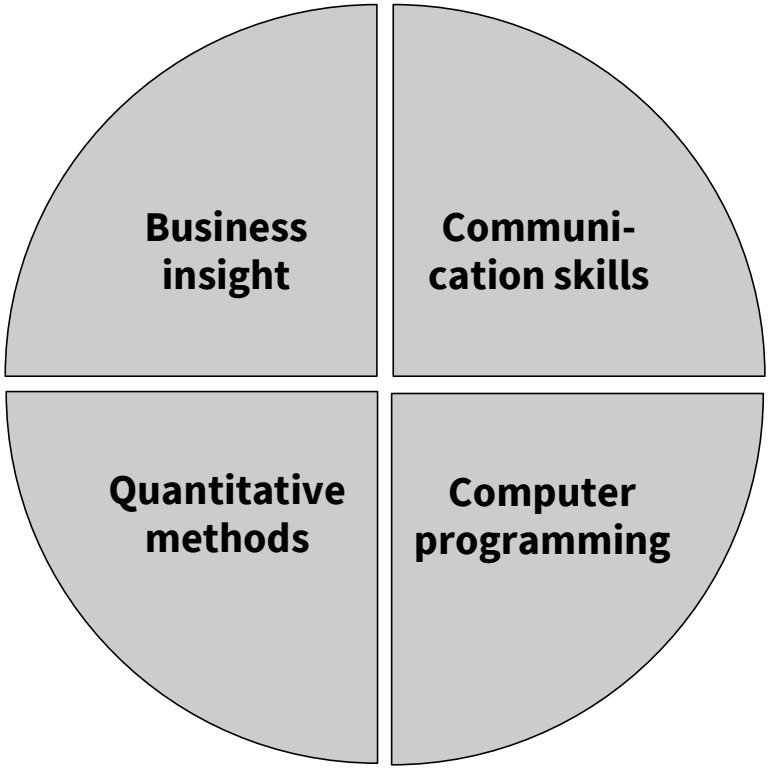
A Process Perspective Toward Machine Learning



BADS Focus and Teaching Objectives





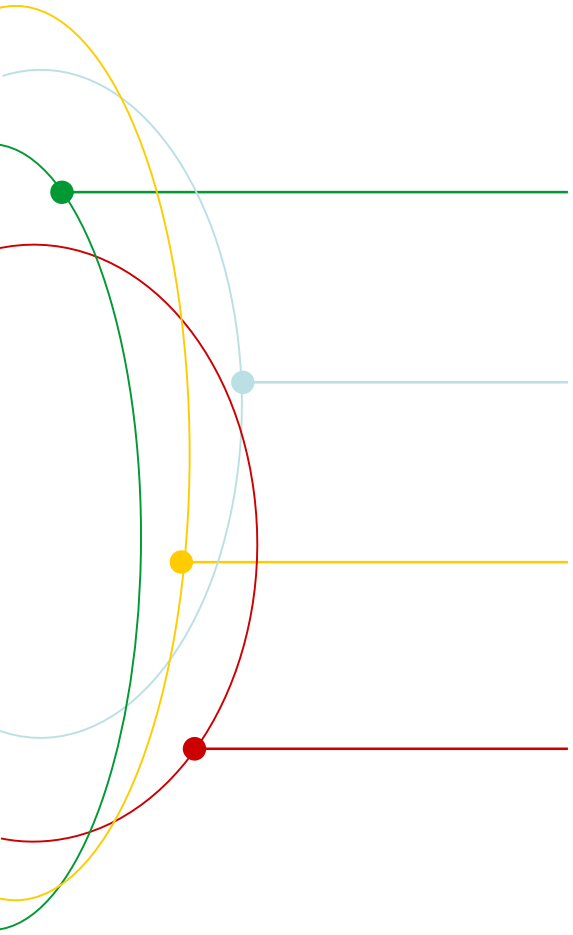


Learning Goals

The module is concerned with theories, concepts, and practices to support decision making by means of formal, data-driven methods.

- Students are familiar descriptive, predictive and prescriptive analytics, understand how they support decision-making and are familiar with corresponding use-cases.
- Given some data, students are able to select appropriate techniques to summarize and visualize the data so as to maximize managerial insight.
- Students understand the potential and also limitations of predictive analytics to aid decision-making. Given a decision task, they can discuss the relative merits and demerits of alternative algorithms and recommend a suitable prediction method.
- Students are able to interpret and diagnose black-box machine learning models
- Students are familiar with the principles of analytic programming in Python. They can develop analytical models, assess their statistical accuracy, and judge their business value.

Summary



Learning goals

- What business analytics is about
- What to expect from the course

Findings

- Key terms, definitions, relationships
- Forms of decision support by analytical models

Homework

- Identify business apps for descriptive analytics
- Dhar (2013) & Brynjolfsson et al. (2011)

What next

- Start learning Python
- Foundations of descriptive analytics

Literature

- Agarwal, R., & Dhar, V. (2014). Editorial—Big Data, Data Science, and Analytics: The opportunity and challenge for IS research. *Information Systems Research, 25*, 443-448.
- Brynjolfsson, E., Hitt, L. M., & Kim, H. H. (2011). Strength in Numbers: How Does Data-Driven Decision Making Affect Firm Performance? Available at SSRN: http://ssrn.com/abstract=1819486.
- De Mauro, A., Greco, M. and Grimaldi, M. (2015). What is big data? a consensual definition and a review of key research topics, 4th International Conference on Integrated Information, Madrid., AIP Publishing LLC, pp. 97–104.
- Dhar, V. (2013). Data science and prediction. *Communications of the ACM, 56*, 64-73.
- Germann, F., Lilien, G. L., & Rangaswamy, A. (2013). Performance implications of deploying marketing analytics. *International Journal of Research in Marketing, 30*, 114-128.
- Evans, J. R. (2013). *Business Analytics*: Prentice Hall.
- LaValle, S., Hopkins, M. S., Lesser, E., Shockley, R., & Kruschwitz, N. (2010). Analytics: The New Path to Value. In: MIT Sloan Management Review, Fall 2010.
- Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). Big Data: The Next Frontier for Innovation, Competition, and Productivity. In: McKinsey Global Institute.
- McAfee, A., & Brynjolfsson, E. (2012). Big data: The management revolution. *Harvard Business Review, 90*, 60-68.
- Provost, F., & Fawcett, T. (2013). Data science and its relation to Big Data and data-driven decision making. *Big Data, 1*, 51-59.
- Tambe, P. (2014). Big data investment, skills, and firm value. *Management Science, 60*, 1452-1469.

Thank you for your attention!

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