資料探勘
(Data Mining)

資料探勘介紹
(Introduction to data mining)

1092DM01
MBA, IM, NTPU (M5026) (Spring 2021)
Tue 2, 3, 4 (9:10-12:00) (B8F40)

Min-Yuh Day
戴敏育
Associate Professor
副教授
Institute of Information Management, National Taipei University
國立臺北大學 資訊管理研究所
https://web.ntpu.edu.tw/~myday

2021-02-23

戴敏育 博士
(Min-Yuh Day, Ph.D.)

國立臺北大學
National Taipei University

國立台北大學 資訊管理研究所 副教授

中央研究院 資訊科學研究所 訪問學人

國立台灣大學 資訊管理 博士

Publications Co-Chairs, IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2013-)

Program Co-Chair, IEEE International Workshop on Empirical Methods for Recognizing Inference in TExt (IEEE EM-RITE 2012-)

Publications Chair, The IEEE International Conference on Information Reuse and Integration (IEEE IRI)

國立臺北大學
National Taipei University

資料探勘
(Data Mining)
Contact Information

戴敏育 博士 (Min-Yuh Day, Ph.D.)

副教授 (Associate Professor)

國立臺北大學 資訊管理研究所

Institute of Information Management, National Taipei University

電話： 02-86741111 ext. 66873

研究室： 商8F12

地址： 23741 新北市三峽區大學路 151 號

Email：myday@gm.ntpu.edu.tw

網址：http://web.ntpu.edu.tw/~myday/

國立臺北大學
109學年度第2學期
課程大綱
Spring 2021 (2021.02 - 2021.06)

- 課程名稱：**資料探勘 (Data Mining)**
- 授課教師：戴敏育 (Min-Yuh Day)
- 開課系所：資管所碩士班
- 開課資料：選修 半學年 3 學分 (3 Credits, Elective)
- 上課時間：週二 2, 3, 4 (9:10-12:00)
- 上課教室：商8F40 (台北大學三峽校區)

教學目標

1. 瞭解資料探勘基本概念與研究議題。。
2. 具備資料探勘實務操作能力。
3. 進行資料探勘相關之資訊管理研究。

Course Objectives

1. Understand the fundamental concepts and research issues of data mining.
2. Equip with Hands-on practices of data mining.
3. Conduct information systems research in the context of data mining.

內容綱要

- 本課程介紹資料探勘基本概念、研究議題、與實務操作。
- 課程內容包括
  1. 資料探勘介紹
  2. ABC：人工智慧，大數據，雲端運算
  3. Python資料探勘的基礎
  4. 資料科學與資料探勘：發現，分析，可視化和呈現數據
  5. 非監督學習：關聯分析，購物籃分析
  6. 非監督學習：集群分析，行銷市場區隔
  7. 監督學習：分類和預測
  8. 機器學習和深度學習
  9. 卷積神經網絡、遞歸神經網絡、強化學習
  10. 社交網絡分析
  11. 資料探勘個案研究

Course Outline

NTPU
國立臺北大學
National Taipei University

- This course introduces the fundamental concepts, research issues, and hands-on practices of data mining.
- Topics include
  1. Introduction to data mining
  2. ABC: AI, Big Data, Cloud Computing
  3. Foundations of Data Mining in Python
  4. Data Science and Data Mining: Discovering, Analyzing, Visualizing and Presenting Data
  5. Unsupervised Learning: Association Analysis, Market Basket Analysis
  6. Unsupervised Learning: Cluster Analysis, Market Segmentation
  7. Supervised Learning: Classification and Prediction
  8. Machine Learning and Deep Learning
  9. Convolutional Neural Networks, Recurrent Neural Networks, Reinforcement Learning
  10. Social Network Analysis
  11. Case Study on Data Mining

資訊管理研究所
系核心能力
(Core Competence)

- 資訊科技新知探索與系統開發應用 80 %
- 網路行銷企劃能力 10 %
- 論文寫作與獨立研究能力 10 %

校四大基本素養
(Four Fundamental Qualities)

- 專業 (Professionalism)
  - 創意思考與問題解決 (Creative thinking and Problem-solving) 30 %
  - 綜合統整(Comprehensive Integration) 30 %
- 人際 (Interpersonal Relationship)
  - 溝通協調 (Communication and Coordination) 10 %
  - 團隊合作 (Teamwork) 10 %
- 倫理 (Ethics)
  - 誠信正直(Honesty and Integrity) 5 %
  - 尊重自省(Self-Esteem and Self-reflection) 5 %
- 國際觀 (International Vision)
  - 多元關懷 (Caring for Diversity) 5 %
  - 跨界宏觀 (Interdisciplinary Vision) 5 %

商學院學習目標
(College Learning Goals)

- Ethics/Corporate Social Responsibility
- Global Knowledge/Awareness
- Communication
- Analytical and Critical Thinking

系所學習目標
(Department Learning Goals)

- Information Technologies and System Development Capabilities
- Internet Marketing Management Capabilities
- Research capabilities

課程大綱 (Syllabus)

國立臺北大學 National Taipei University

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2021/02/23	資料探勘介紹 (Introduction to data mining)
2	2021/03/02	ABC：人工智慧，大數據，雲端運算 (ABC: AI, Big Data, Cloud Computing)
3	2021/03/09	Python資料探勘的基礎 (Foundations of Data Mining in Python)
4	2021/03/16	資料科學與資料探勘：發現，分析，可視化和呈現數據 (Data Science and Data Mining: Discovering, Analyzing, Visualizing and Presenting Data)
5	2021/03/23	非監督學習：關聯分析，購物籃分析 (Unsupervised Learning: Association Analysis, Market Basket Analysis)
6	2021/03/30	資料探勘個案研究 I (Case Study on Data Mining I)

課程大綱 (Syllabus)

國立臺北大學 National Taipei University

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2021/04/06	非監督學習：集群分析，行銷市場區隔 (Unsupervised Learning: Cluster Analysis, Market Segmentation)
8	2021/04/13	監督學習：分類和預測 (Supervised Learning: Classification and Prediction)
9	2021/04/20	期中報告 (Midterm Project Report)
10	2021/04/27	監督學習：分類和預測 (Supervised Learning: Classification and Prediction)
11	2021/05/04	機器學習和深度學習 (Machine Learning and Deep Learning)
12	2021/05/11	卷積神經網絡 (Convolutional Neural Networks)

課程大綱 (Syllabus)

國立臺北大學 National Taipei University

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2021/05/18	資料探勘個案研究 II (Case Study on Data Mining II)
14	2021/05/25	遞歸神經網絡 (Recurrent Neural Networks)
15	2021/06/01	強化學習 (Reinforcement Learning)
16	2021/06/08	社交網絡分析 (Social Network Analysis)
17	2021/06/15	期末報告 I (Final Project Report I)
18	2021/06/22	期末報告 II (Final Project Report II)

教學方法與教學活動
(Teaching methods and activities)

- 講授 (Lecture)
- 討論 (Discussion)
- 實習 (Practicum)

評量方式
(Evaluation Methods)

- 個人報告 (Individual Presentation) 60 %
- 團體報告 (Group Presentation) 10 %
- 個案分析報告 (Case Report) 10 %
- 課堂參與 (Class Participation) 10 %
- 作業 (Assignment) 10 %

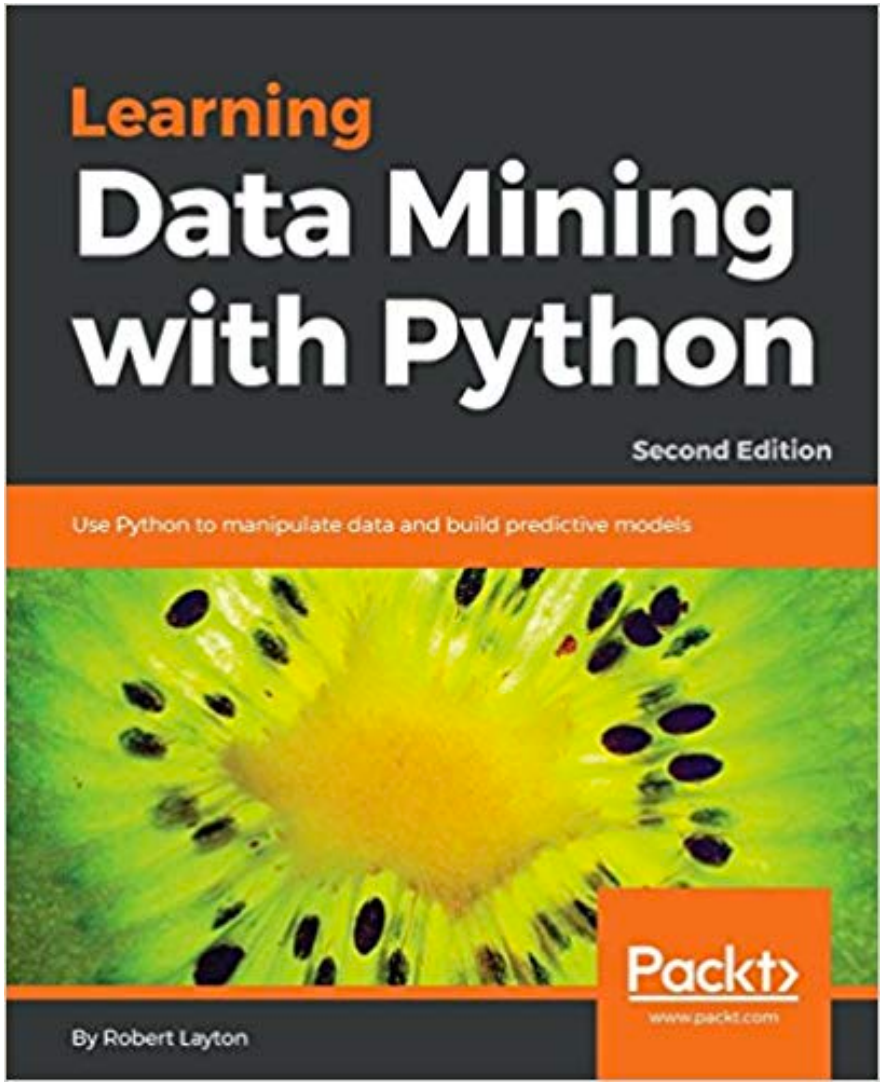
指定用書
(Required Texts)

- Robert Layton (2017), Learning Data Mining with Python, Second Edition, Packt Publishing.

參考書目
(Reference Books)

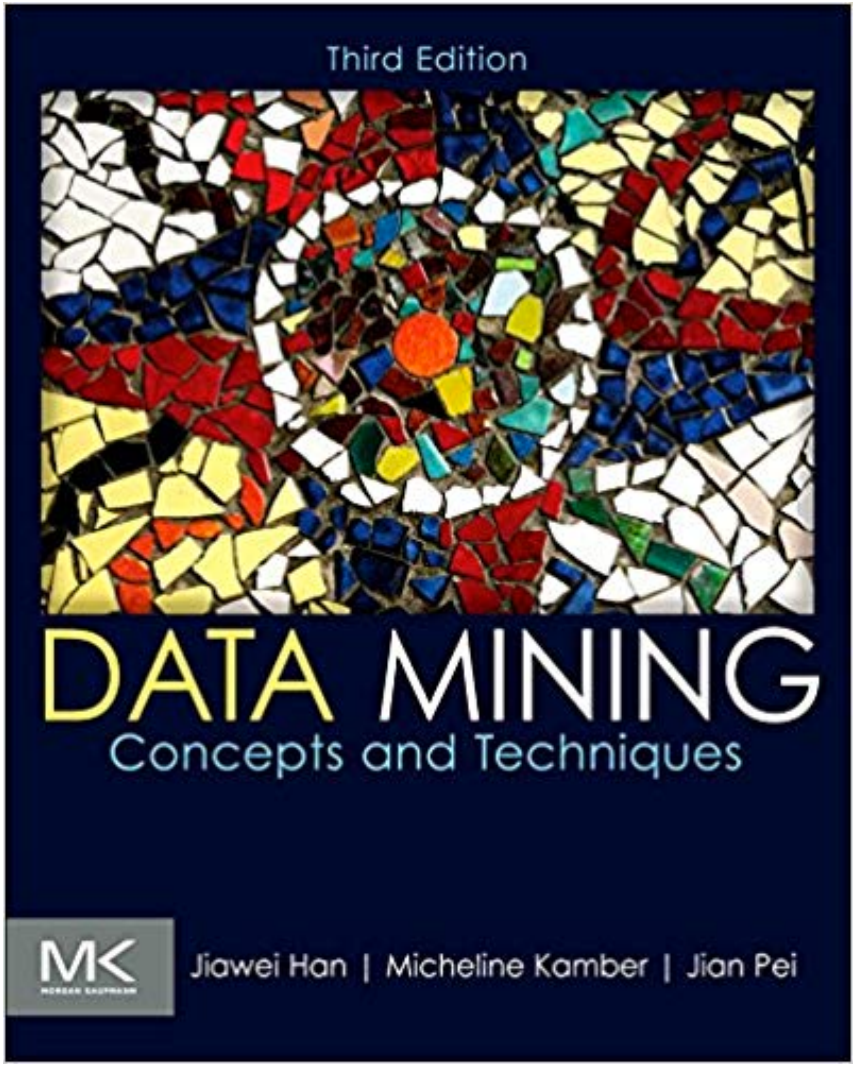
- Aurélien Géron (2019),
  Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems,
  2nd Edition, O'Reilly Media.

Learning Data Mining with Python - Second Edition, Robert Layton, Packt Publishing, 2017



Source: https://www.amazon.com/Learning-Data-Mining-Python-Second/dp/1787126781

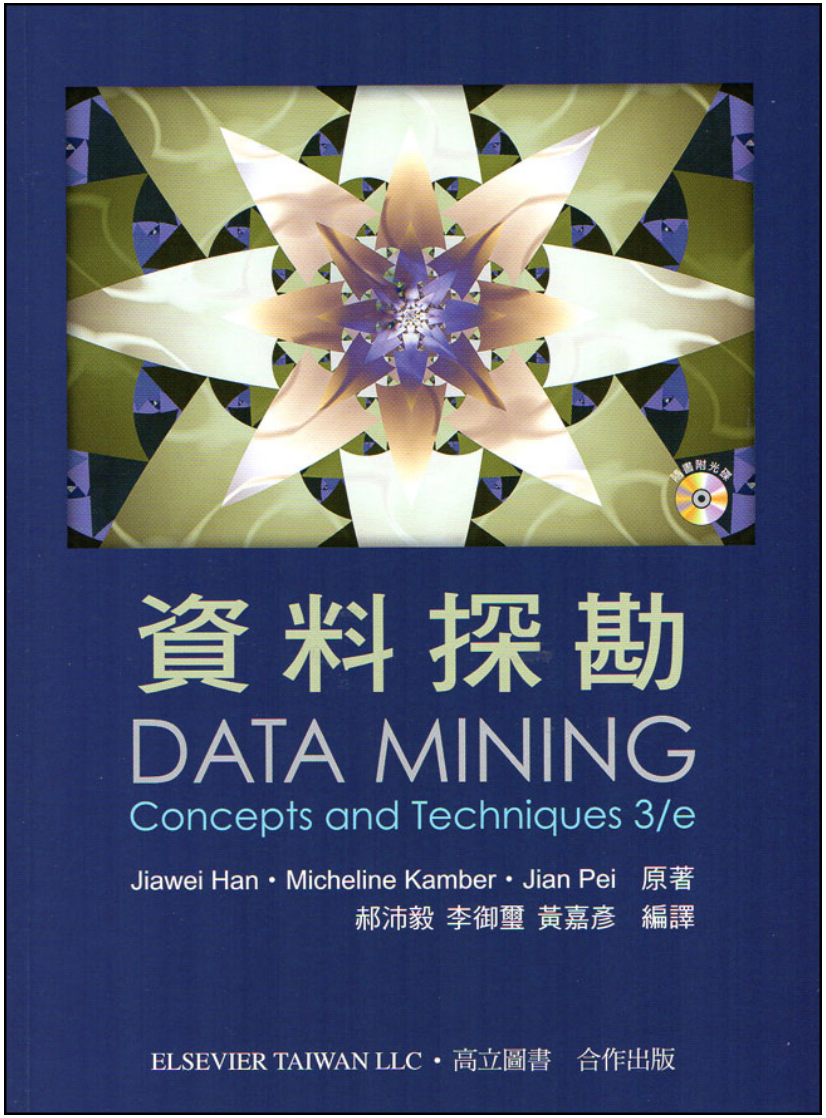
Data Mining: Concepts and Techniques, Third Edition, Jiawei Han, MichelineKamber and Jian Pei, Morgan Kaufmann, 2011



Source: https://www.amazon.com/Data-Mining-Concepts-Techniques-Management/dp/0123814790

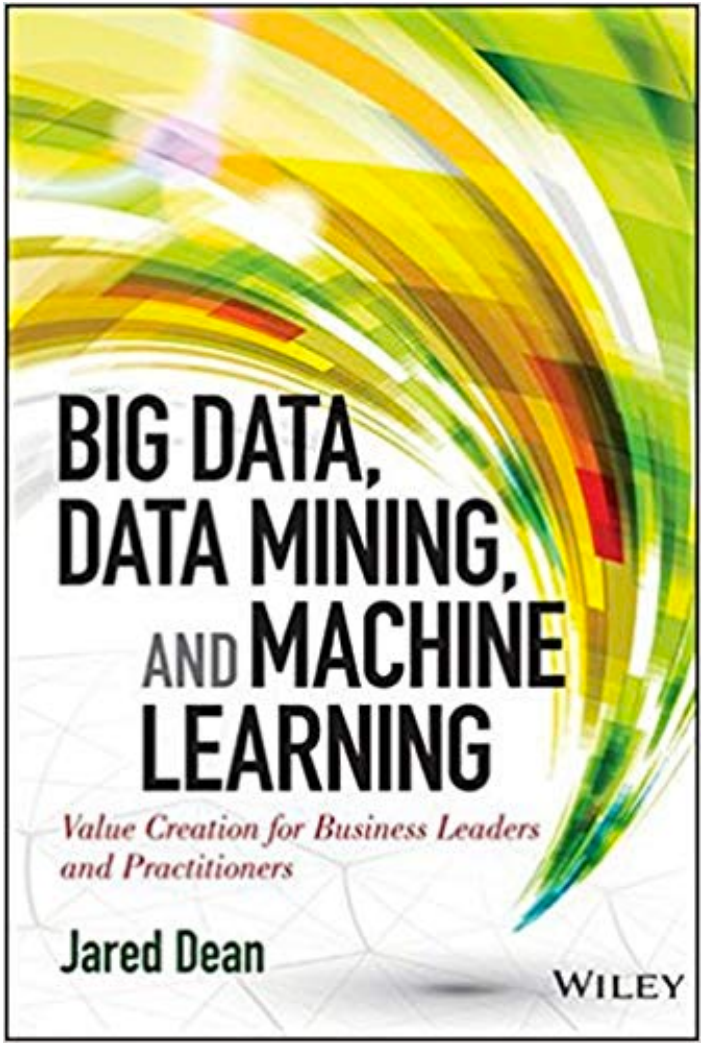
郝沛毅, 李御璽, 黃嘉彥 編譯, 資料探勘

(Jiawei Han, Micheline Kamber, Jian Pei, Data Mining - Concepts and Techniques 3/e), 高立圖書, 2014



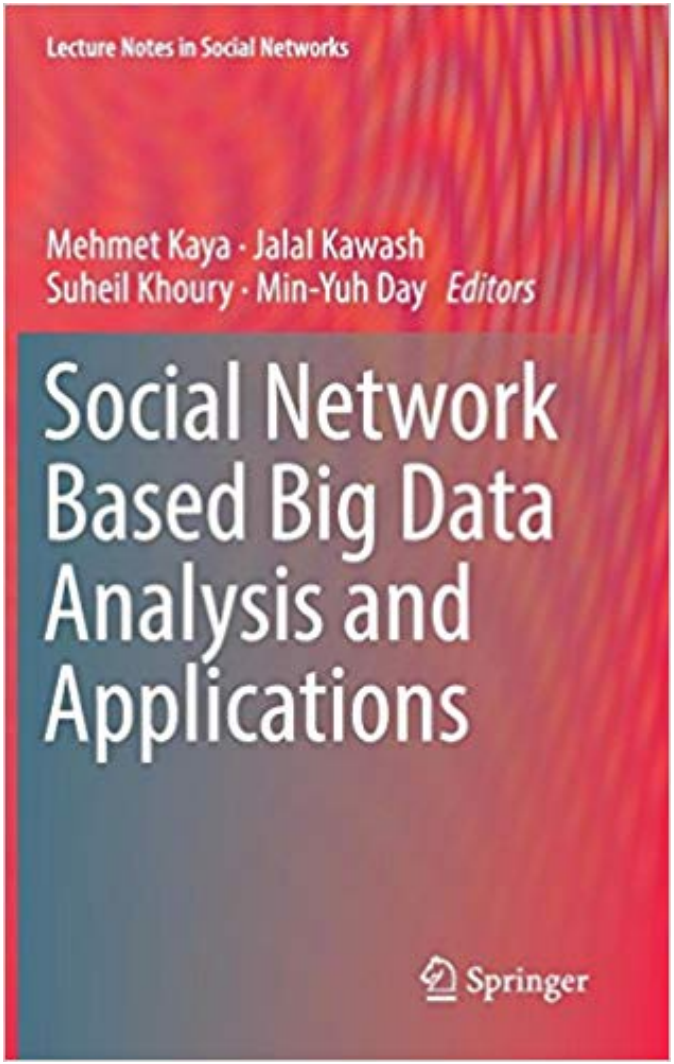
Source: http://www.books.com.tw/products/0010646676

Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners, Jared Dean, Wiley, 2014.



Source: https://www.amazon.com/Data-Mining-Machine-Learning-Practitioners/dp/1118618041

Social Network Based Big Data Analysis and Applications, Lecture Notes in Social Networks, Mehmet Kaya, Jalal Kawash, Suheil Khoury, Min-Yuh Day, Springer International Publishing, 2018.

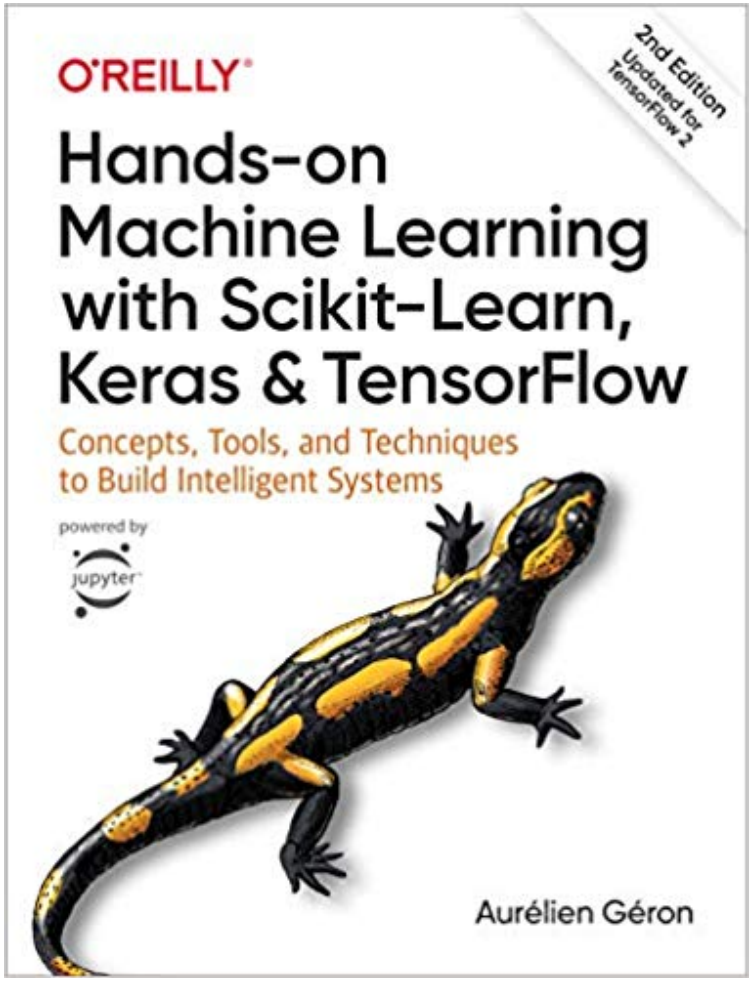


Source: https://www.amazon.com/Network-Analysis-Applications-Lecture-Networks/dp/3319781952

Aurélien Géron (2019),

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition

O'Reilly Media, 2019



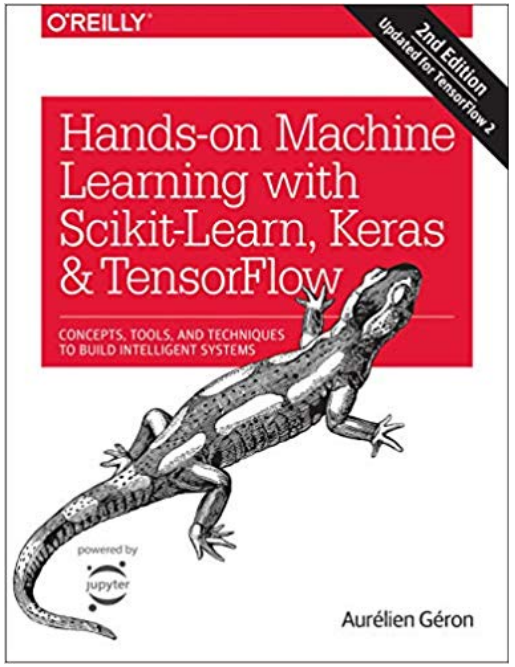
https://github.com/ageron/handson-ml2

Source: https://www.amazon.com/Hands-Machine-Learning-Scikit-Learn-TensorFlow/dp/1492032646/

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow

Notebooks

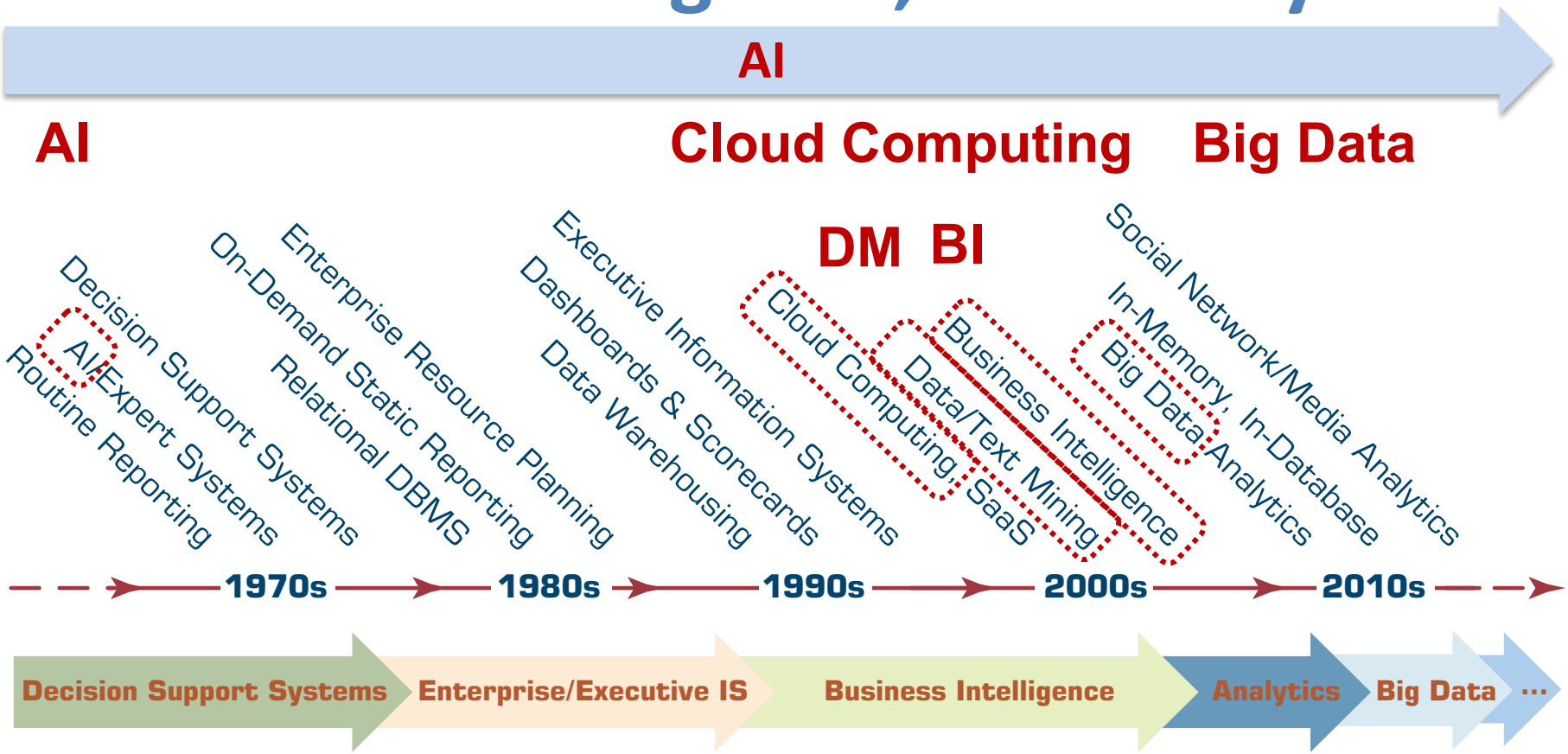
1. The Machine Learning landscape
2. End-to-end Machine Learning project
3. Classification
4. Training Models
5. Support Vector Machines
6. Decision Trees
7. Ensemble Learning and Random Forests
8. Dimensionality Reduction
9. Unsupervised Learning Techniques
10. Artificial Neural Nets with Keras
11. Training Deep Neural Networks
12. Custom Models and Training with TensorFlow
13. Loading and Preprocessing Data
14. Deep Computer Vision Using Convolutional Neural Networks
15. Processing Sequences Using RNNs and CNNs
16. Natural Language Processing with RNNs and Attention
17. Representation Learning Using Autoencoders
18. Reinforcement Learning
19. Training and Deploying TensorFlow Models at Scale



https://github.com/ageron/handson-ml2

AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics

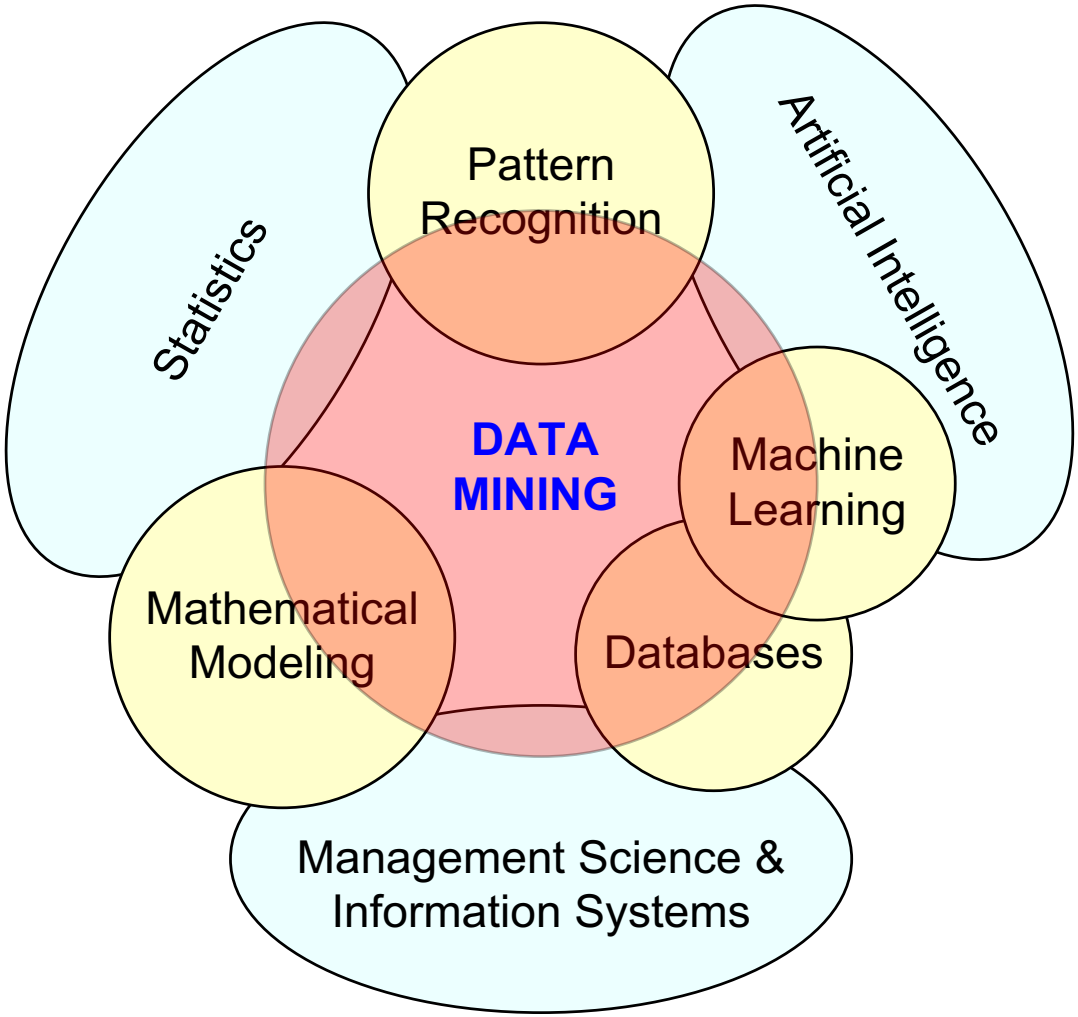


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017),
Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Mining
Is a Blend of Multiple Disciplines

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Mining at the Intersection of Many Disciplines



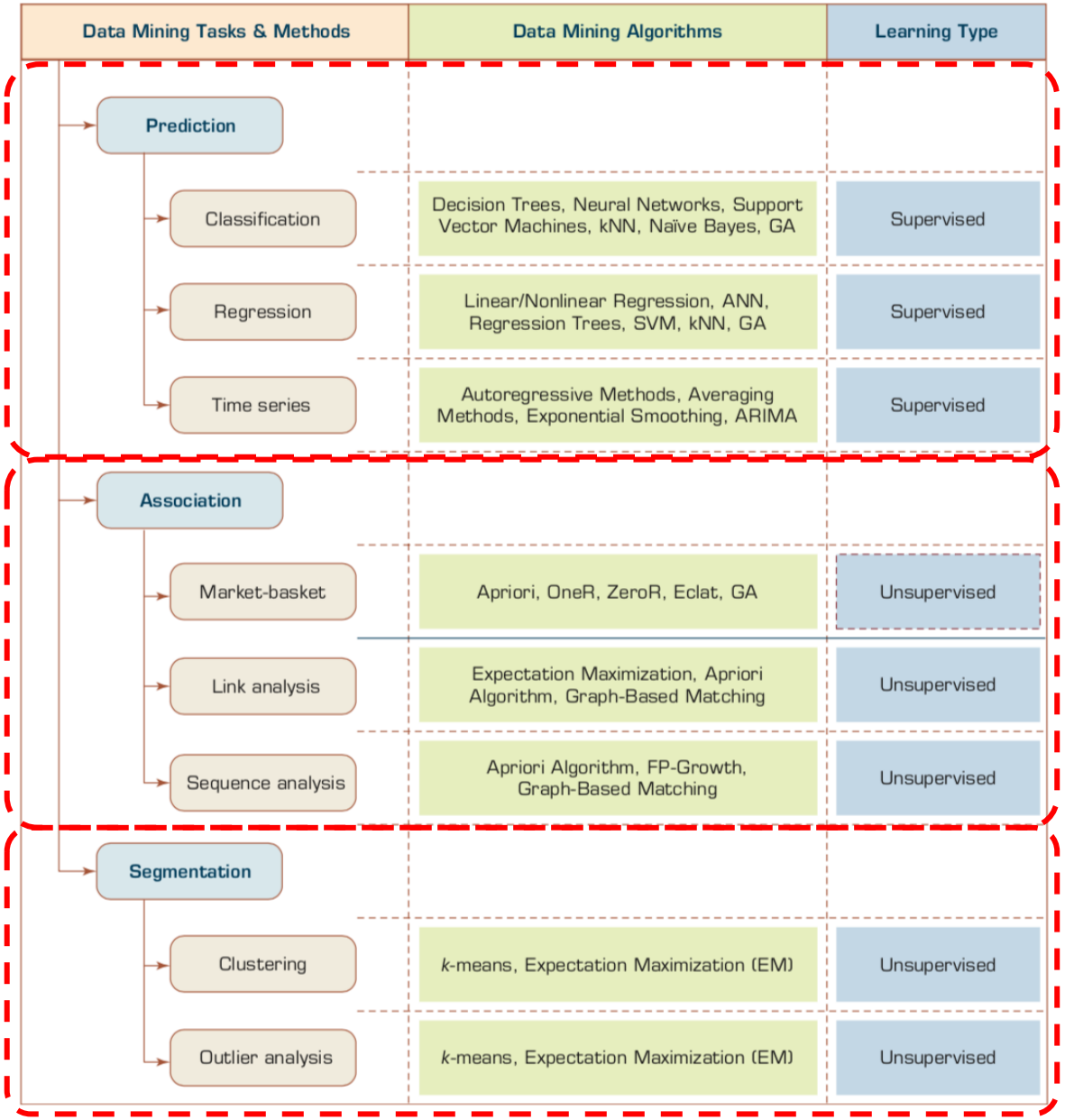
Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Data Mining Tasks & Methods

Prediction

Association

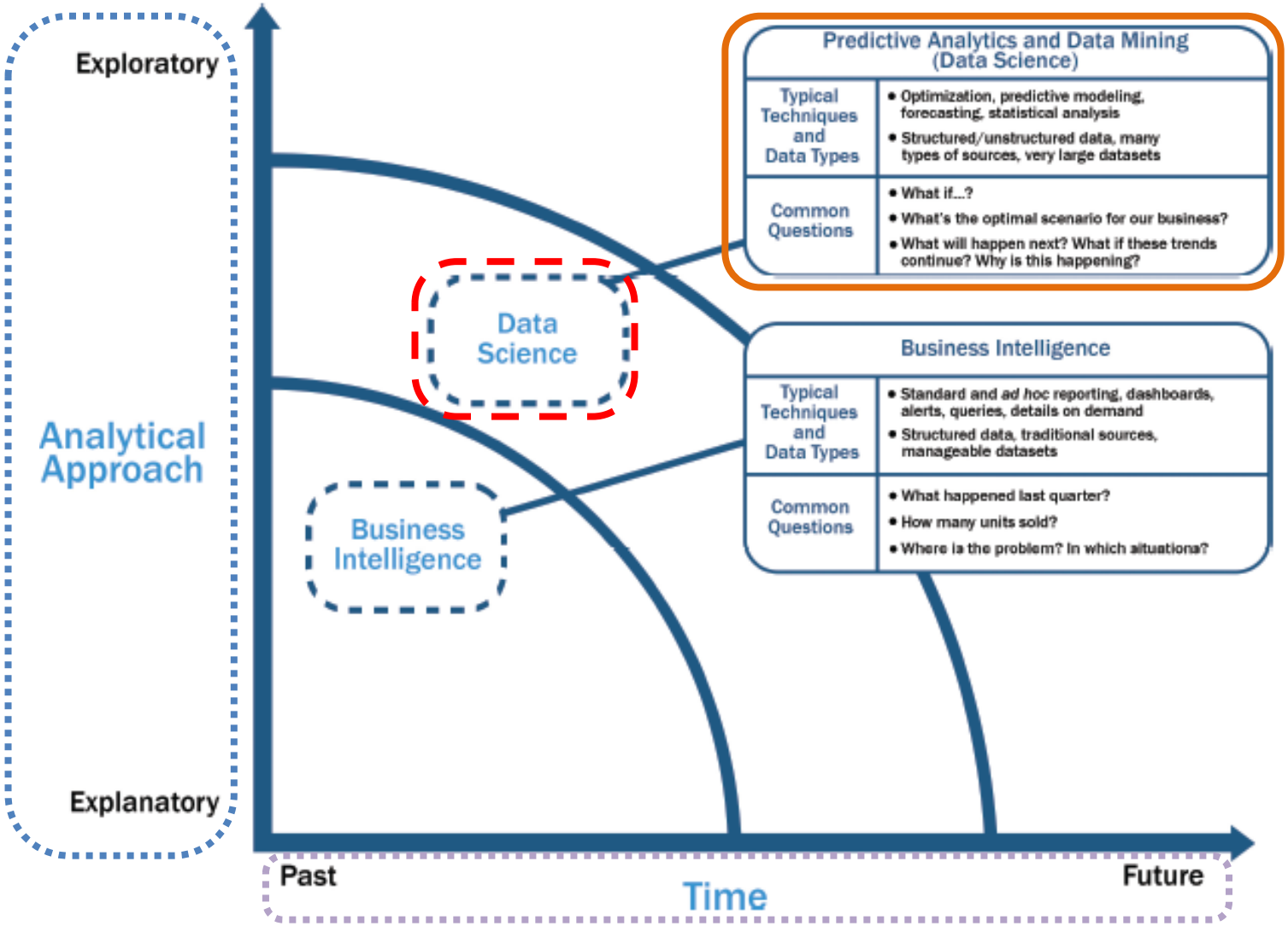
Segmentation



Data Mining Tasks & Methods	Data Mining Algorithms	Learning Type
Prediction		
Classification	Decision Trees, Neural Networks, Support Vector Machines, kNN, Naïve Bayes, GA	Supervised
Regression	Linear/Nonlinear Regression, ANN, Regression Trees, SVM, kNN, GA	Supervised
Time series	Autoregressive Methods, Averaging Methods, Exponential Smoothing, ARIMA	Supervised
Association		
Market-basket	Apriori, OneR, ZeroR, Eclat, GA	Unsupervised
Link analysis	Expectation Maximization, Apriori Algorithm, Graph-Based Matching	Unsupervised
Sequence analysis	Apriori Algorithm, FP-Growth, Graph-Based Matching	Unsupervised
Segmentation		
Clustering	*k*-means, Expectation Maximization (EM)	Unsupervised
Outlier analysis	*k*-means, Expectation Maximization (EM)	Unsupervised

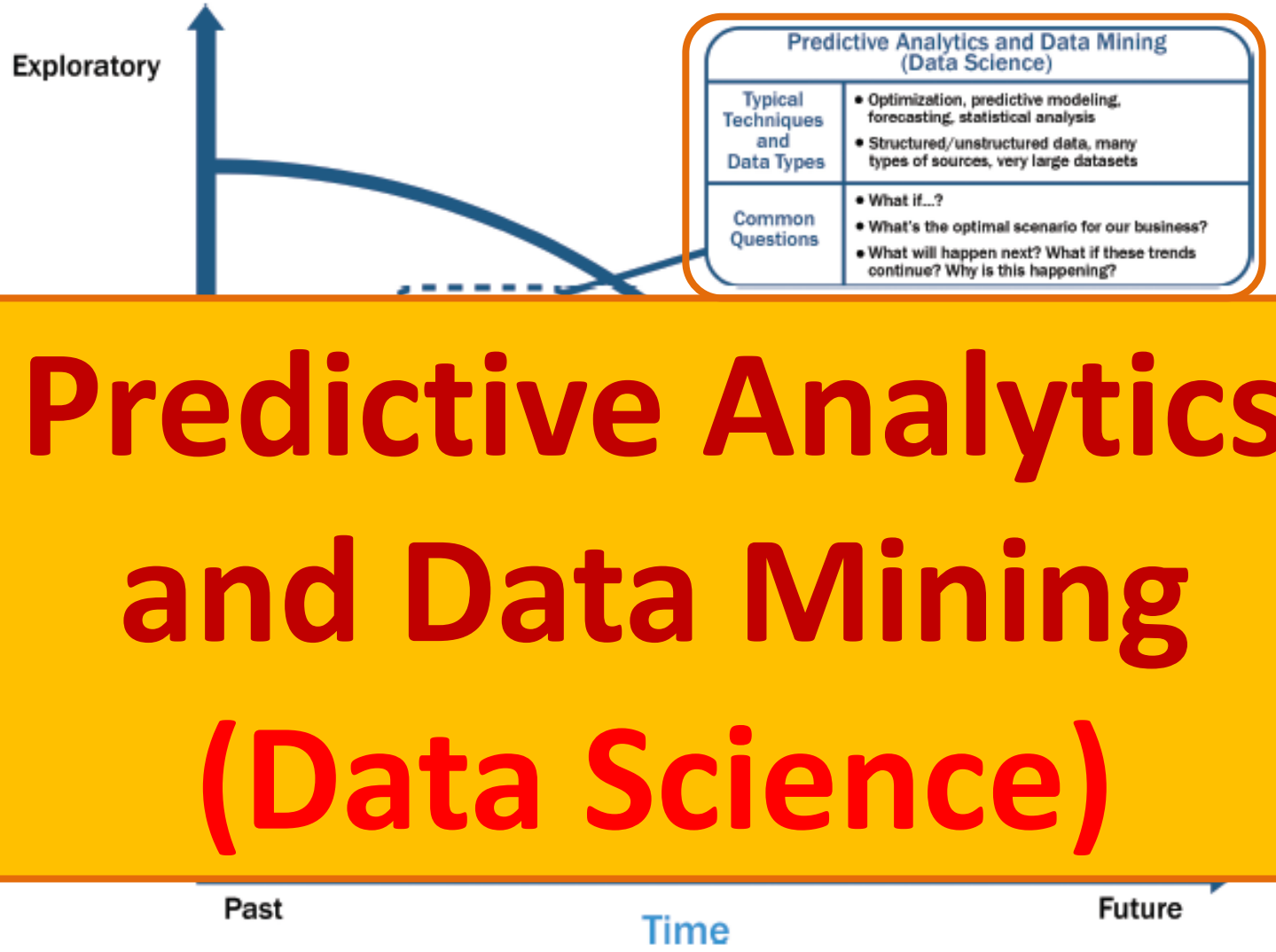
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Science and Business Intelligence



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Data Science and Business Intelligence



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Predictive Analytics and Data Mining (Data Science)

Structured/unstructured data, many types of sources, very large datasets

Optimization, predictive modeling, forecasting statistical analysis

What if…?
What's the optimal scenario for our business?
What will happen next?
What if these trends countinue?
Why is this happening?

Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Data Mining:

Core Analytics Process

The KDD Process for Extracting Useful Knowledge from Volumes of Data

Source: Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996). The KDD Process for Extracting Useful Knowledge from Volumes of Data. Communications of the ACM, 39(11), 27-34.

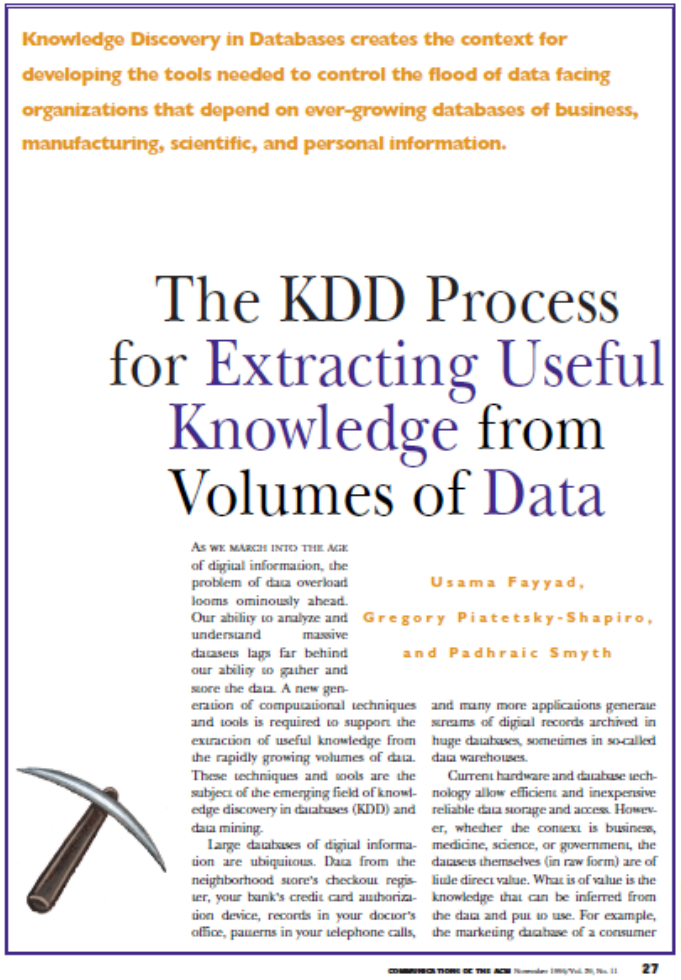
Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996).

The KDD Process for

Extracting Useful Knowledge

from Volumes of Data.

Communications of the ACM, 39(11), 27-34.



Knowledge Discovery in Databases creates the context for developing the tools needed to control the flood of data facing organizations that depend on ever-growing databases of business, manufacturing, scientific, and personal information.

The KDD Process for Extracting Useful Knowledge from Volumes of Data

Usama Fayyad,
Gregory Piatetsky-Shapiro,
and Padhraic Smyth

As we march into the age of digital information, the problem of data overload looms ominously ahead. Our ability to analyze and understand massive datasets lags far behind our ability to gather and store the data. A new generation of computational techniques and tools is required to support the extraction of useful knowledge from the rapidly growing volumes of data. These techniques and tools are the subject of the emerging field of knowledge discovery in databases (KDD) and data mining.

Large databases of digital information are ubiquitous. Data from the neighborhood store's checkout register, your bank's credit card authorization device, records in your doctor's office, patterns in your telephone calls, and many more applications generate streams of digital records archived in huge databases, sometimes in so-called data warehouses.

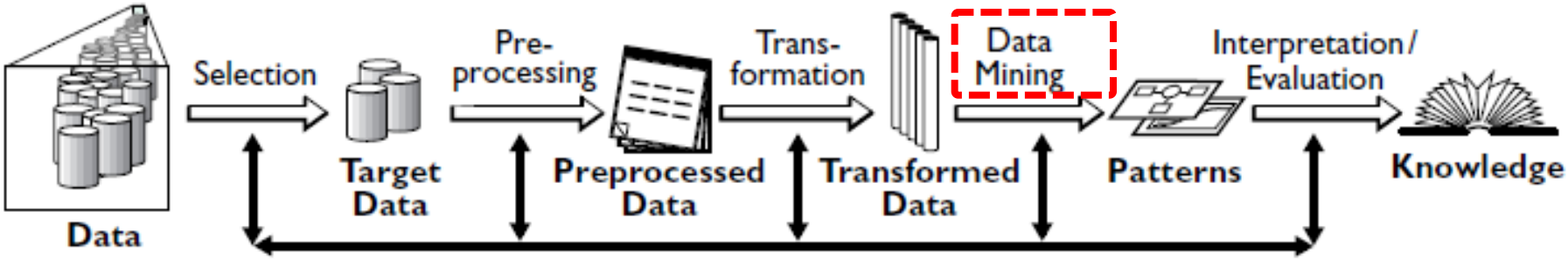
Current hardware and database technology allow efficient and inexpensive reliable data storage and access. However, whether the context is business, medicine, science, or government, the datasets themselves (in raw form) are of little direct value. What is of value is the knowledge that can be inferred from the data and put to use. For example, the marketing database of a consumer

TERRY WEEHER

Data Mining

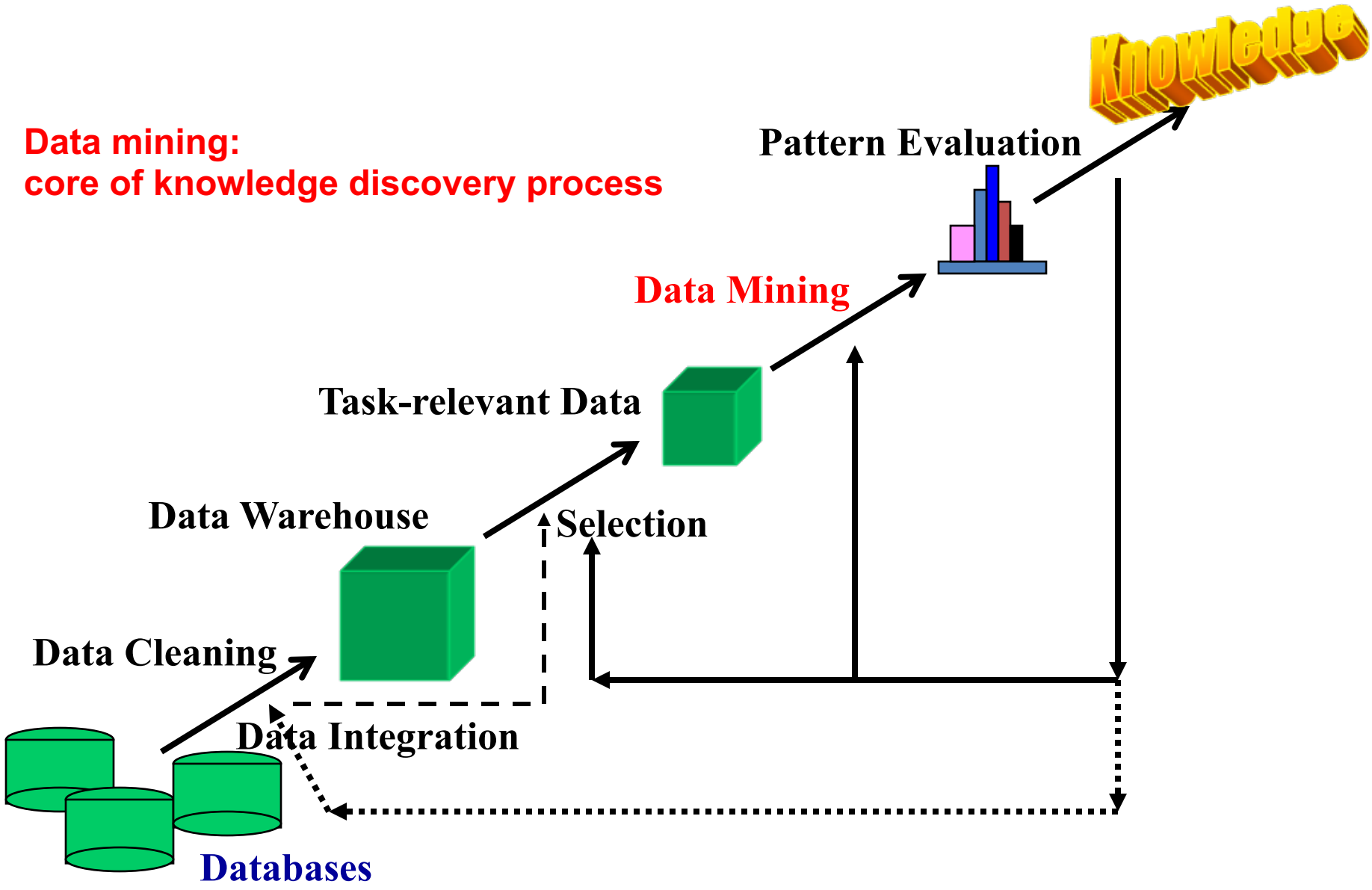
Knowledge Discovery in Databases (KDD) Process

(Fayyad et al., 1996)



Source: Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996). The KDD Process for Extracting Useful Knowledge from Volumes of Data. Communications of the ACM, 39(11), 27-34.

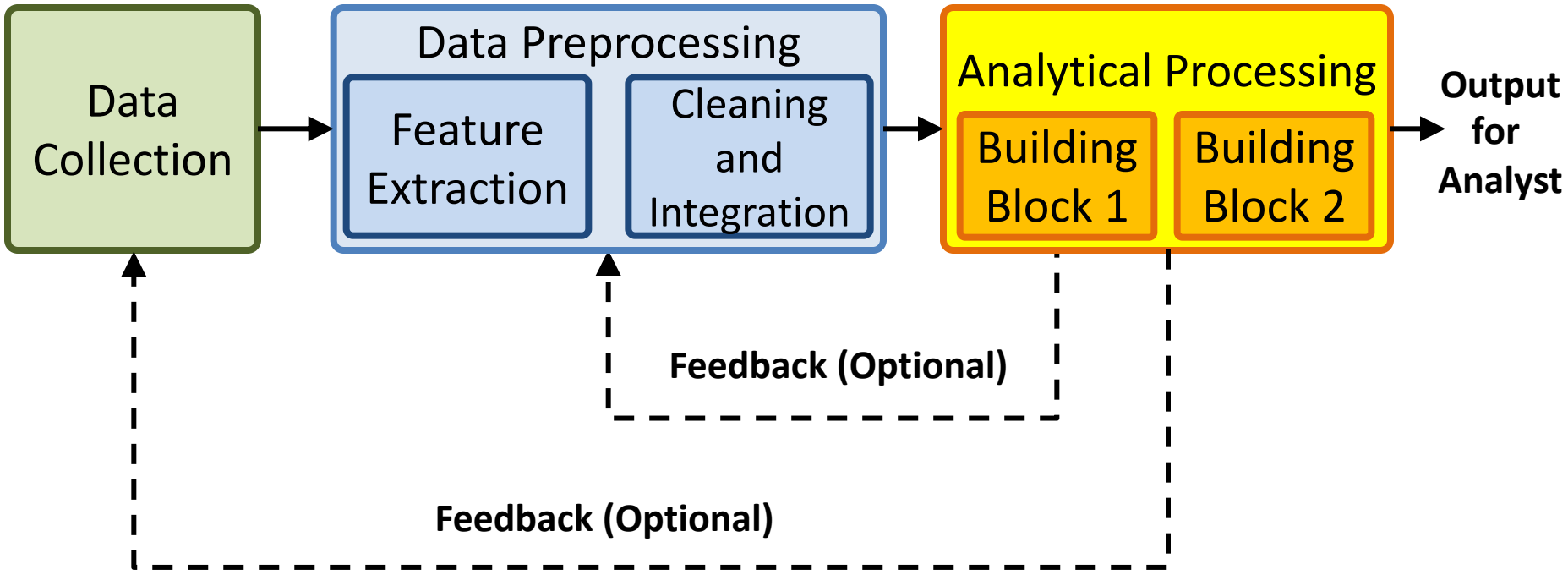
Knowledge Discovery (KDD) Process



Source: Han & Kamber (2006)

Data Mining Processing Pipeline

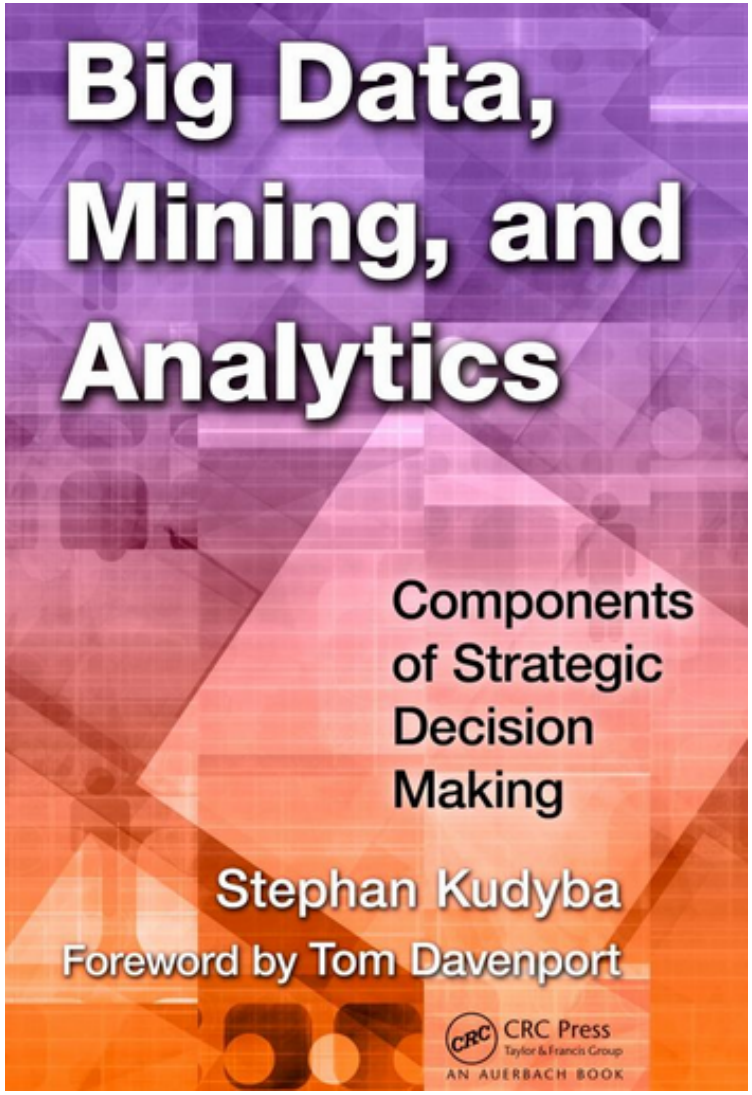
(Charu Aggarwal, 2015)



Source: Charu Aggarwal (2015), Data Mining: The Textbook Hardcover, Springer

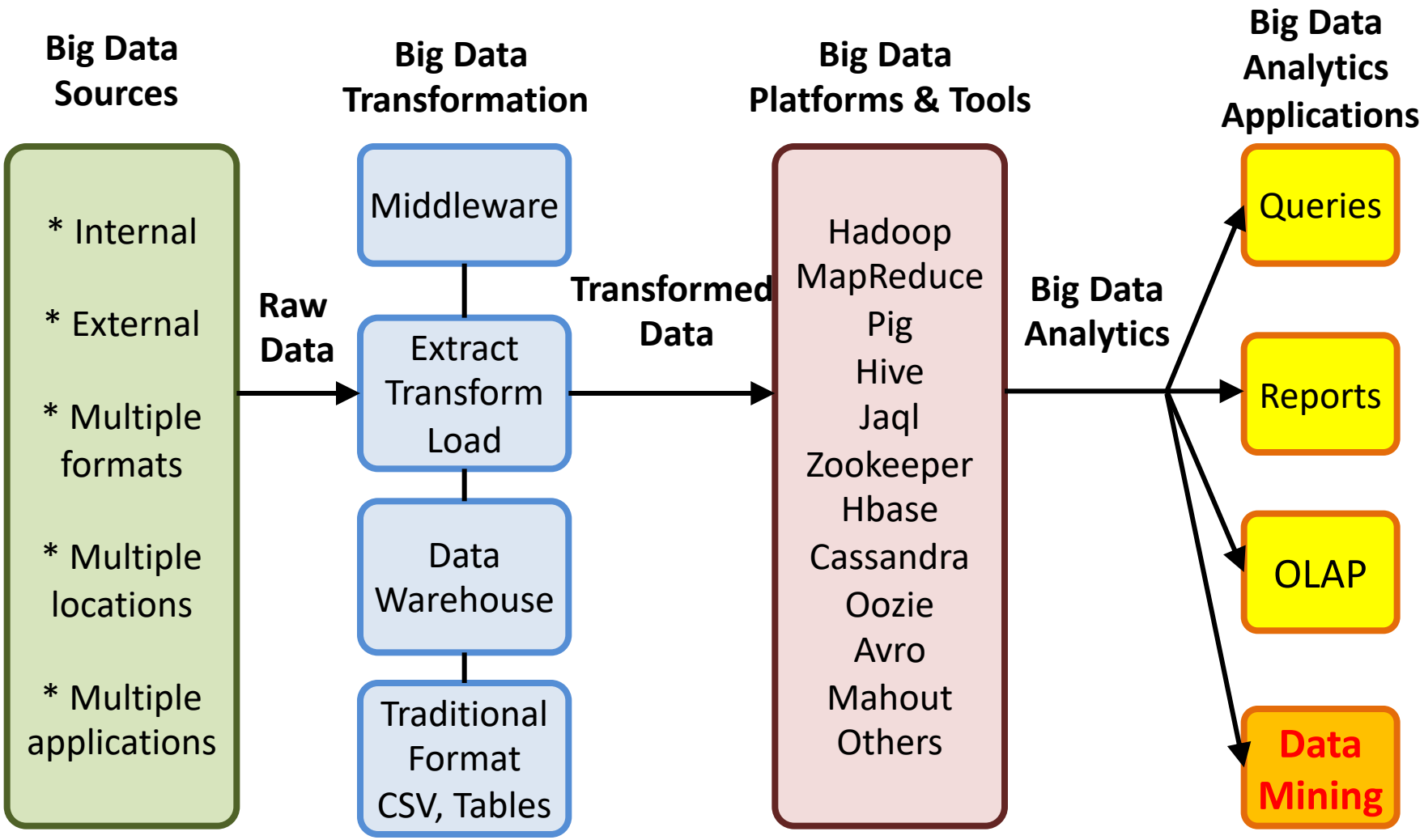
Stephan Kudyba (2014),

Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications



Source: http://www.amazon.com/gp/product/1466568704

Architecture of Big Data Analytics



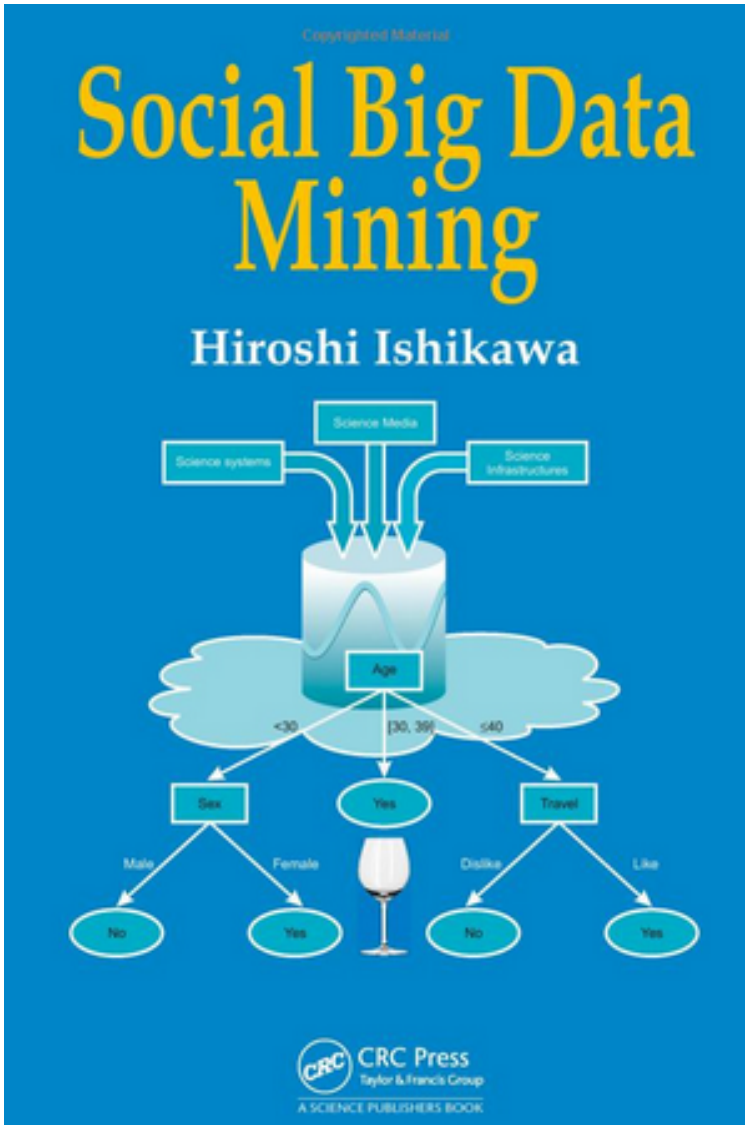
Source: Stephan Kudyba (2014), Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications

Architecture of Big Data Analytics

Source: Stephan Kudyba (2014), Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications

Social Big Data Mining

(Hiroshi Ishikawa, 2015)



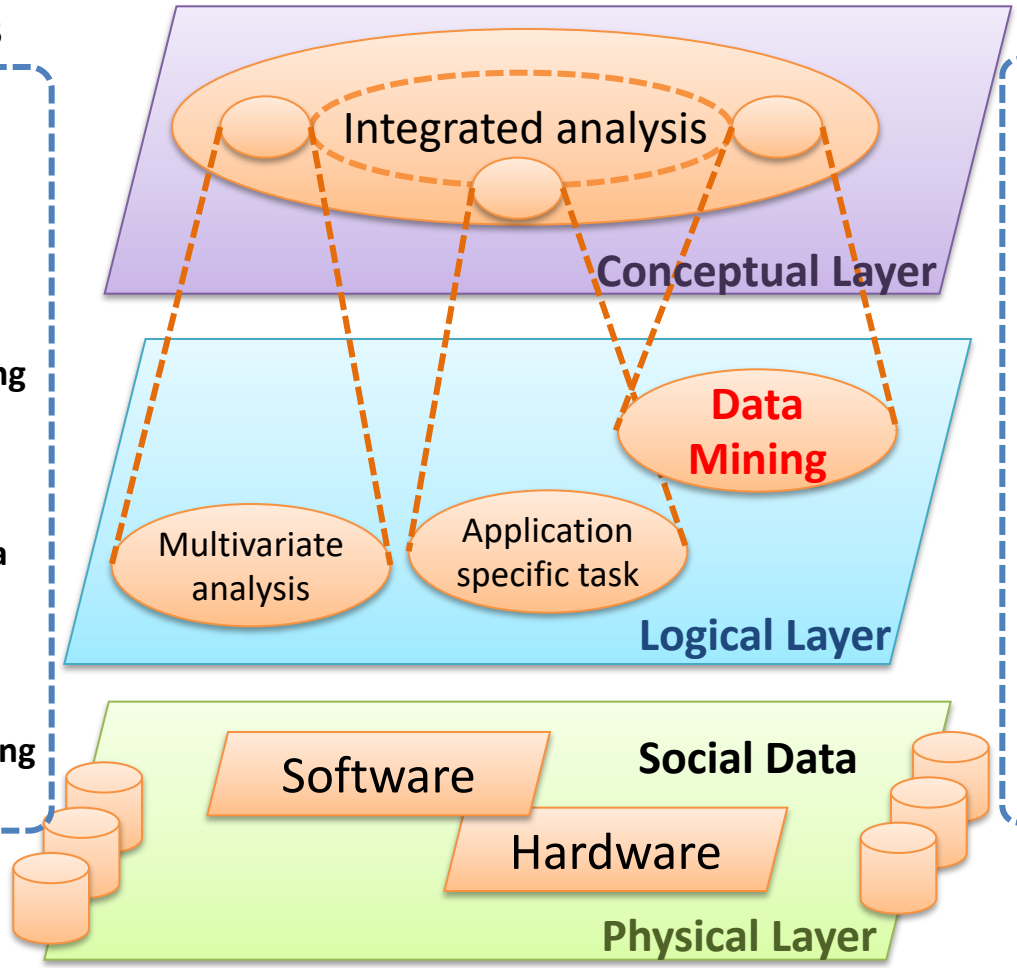
Source: http://www.amazon.com/Social-Data-Mining-Hiroshi-Ishikawa/dp/149871093X

Architecture for Social Big Data Mining

(Hiroshi Ishikawa, 2015)

Enabling Technologies

- Integrated analysis model
- Natural Language Processing
- Information Extraction
- Anomaly Detection
- Discovery of relationships among heterogeneous data
- Large-scale visualization
- Parallel distrusted processing

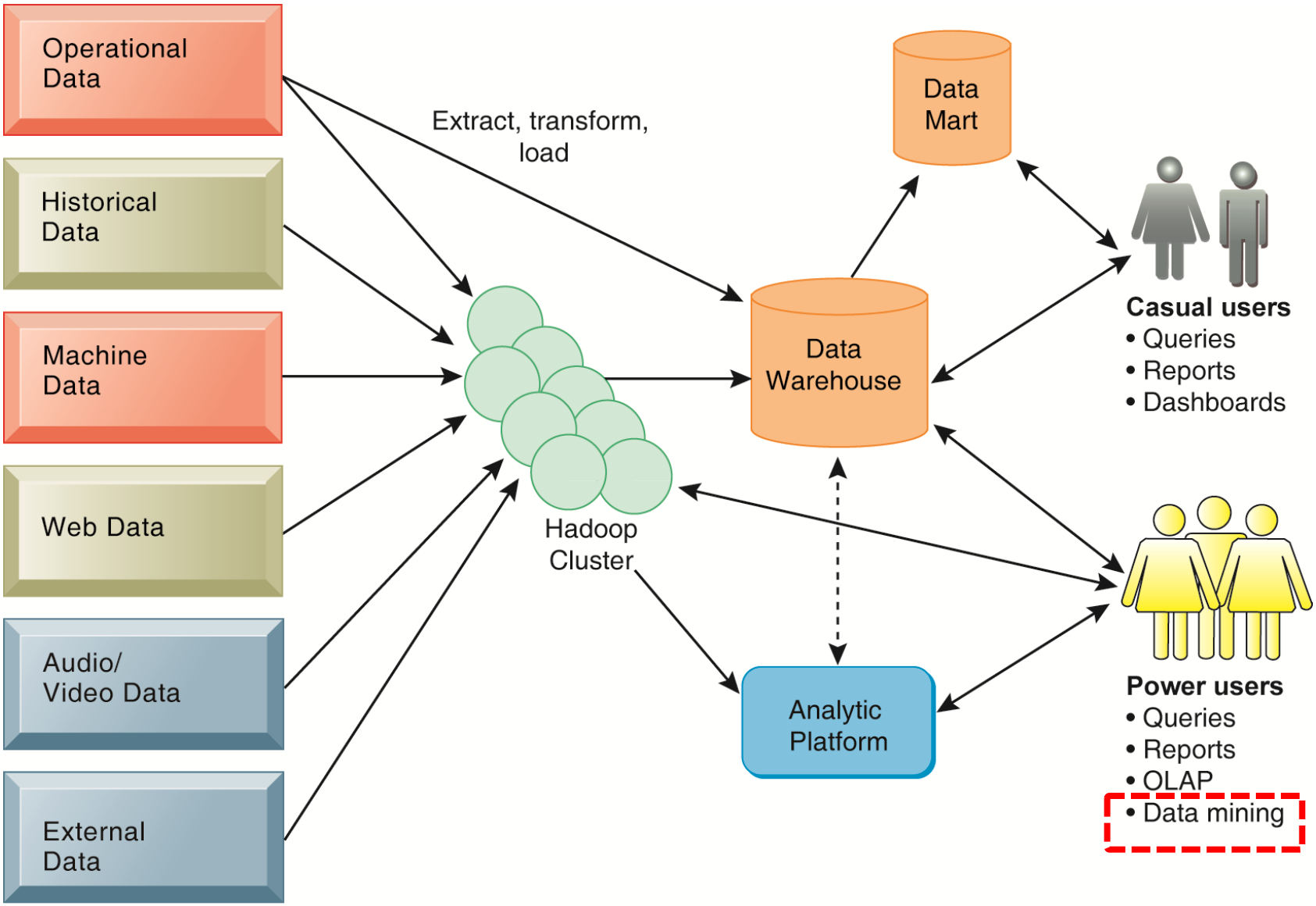


Analysts

- Model Construction
- Explanation by Model
- Construction and confirmation of individual hypothesis
- Description and execution of application-specific task

Source: Hiroshi Ishikawa (2015), Social Big Data Mining, CRC Press

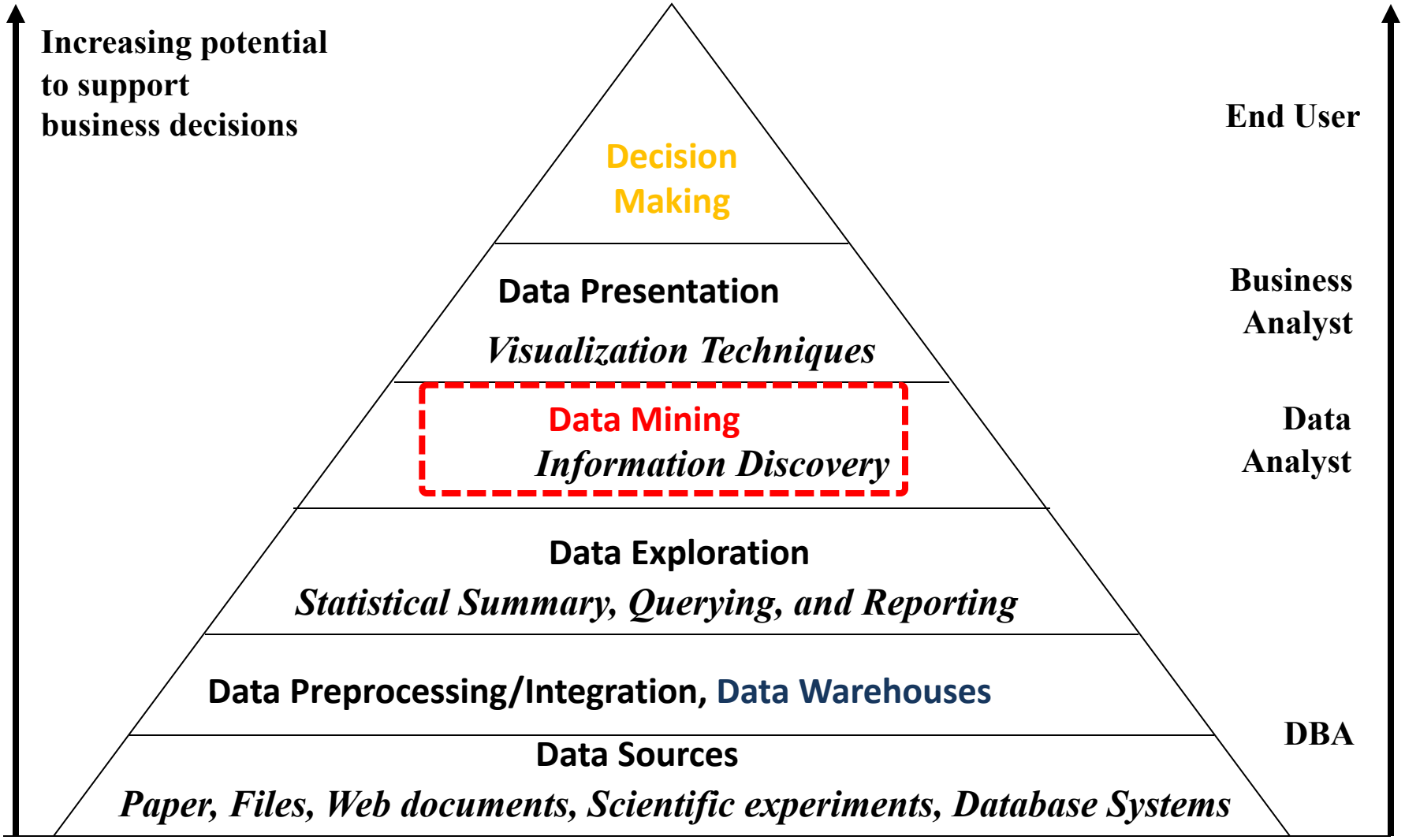
Business Intelligence (BI) Infrastructure



Source: Kenneth C. Laudon & Jane P. Laudon (2014), Management Information Systems: Managing the Digital Firm, Thirteenth Edition, Pearson.

Data Warehouse

Data Mining and Business Intelligence

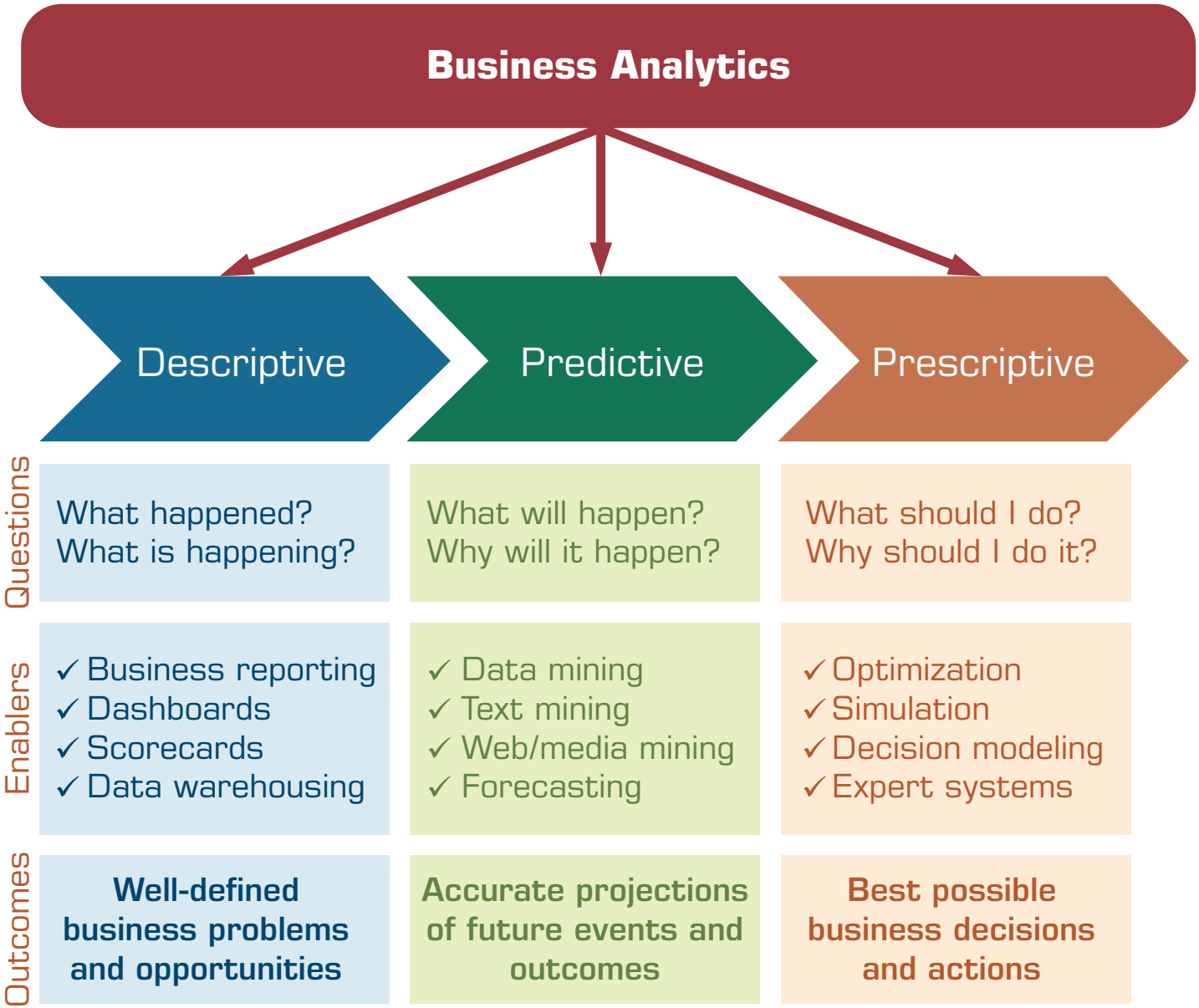


Source: Jiawei Han and Micheline Kamber (2006), Data Mining: Concepts and Techniques, Second Edition, Elsevier

The Evolution of BI Capabilities

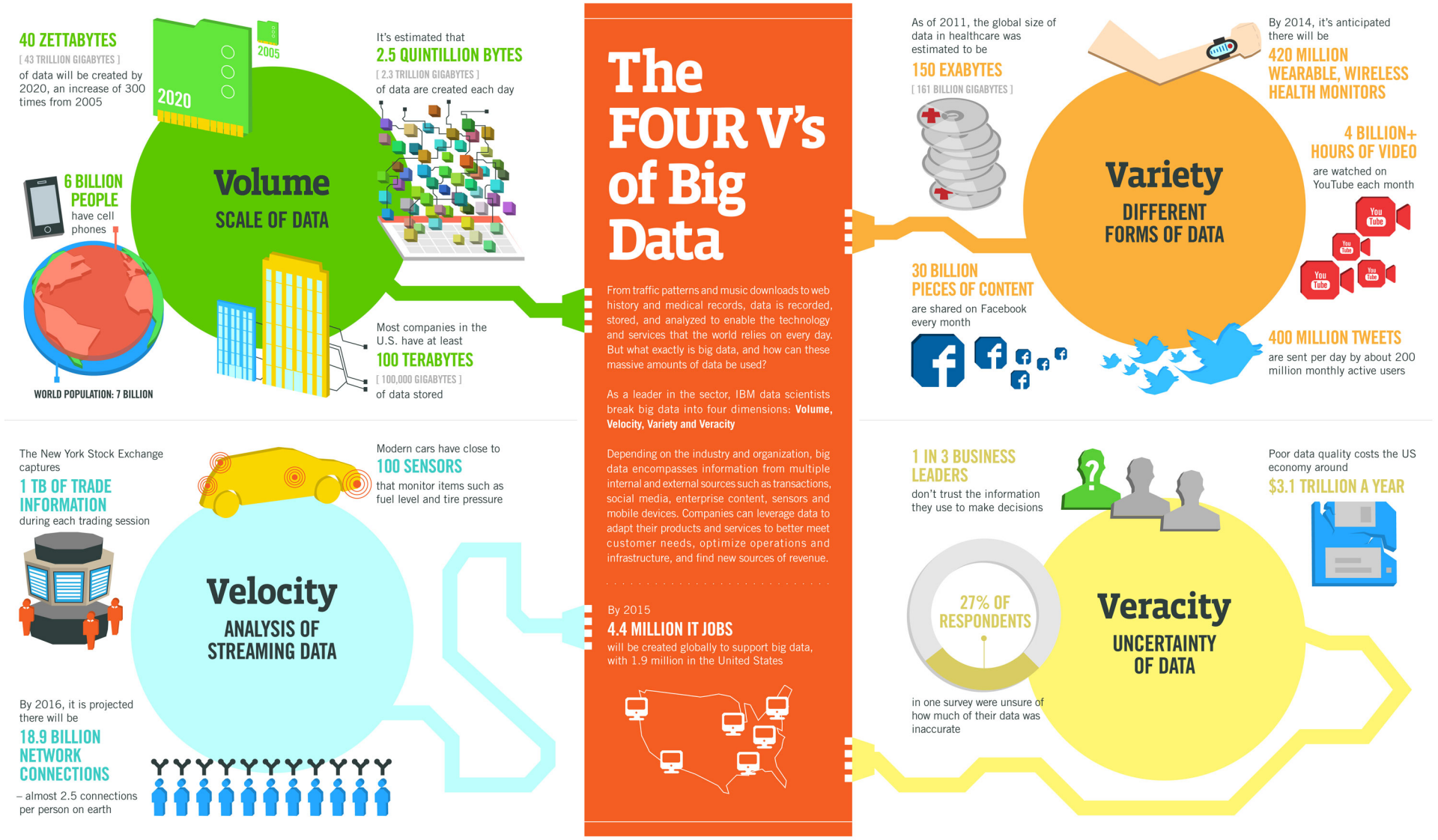
Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Three Types of Analytics



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017),
Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Big Data 4 V



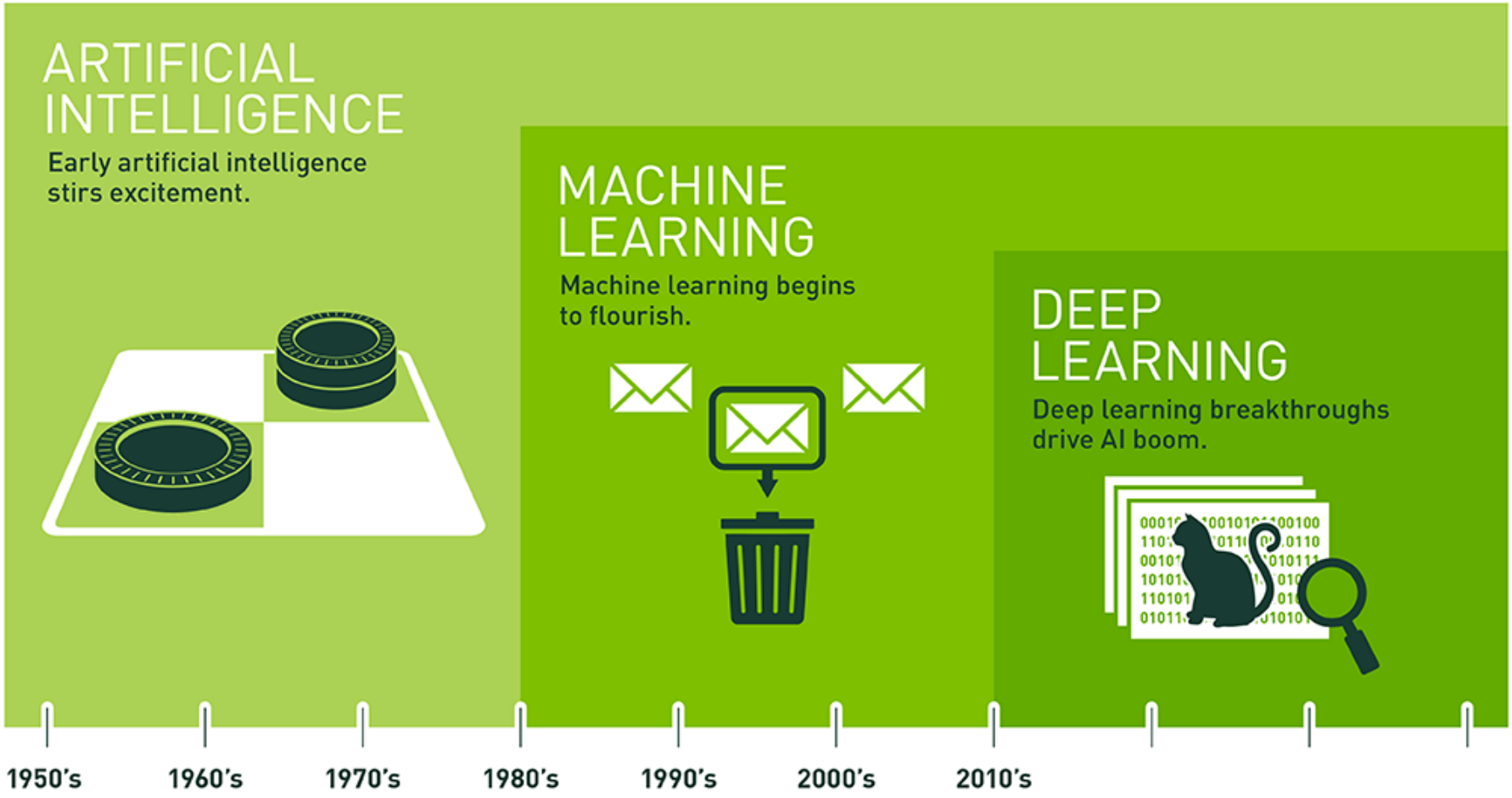
Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTEC, QAS

IBM

Source: https://www-01.ibm.com/software/data/bigdata/

Value

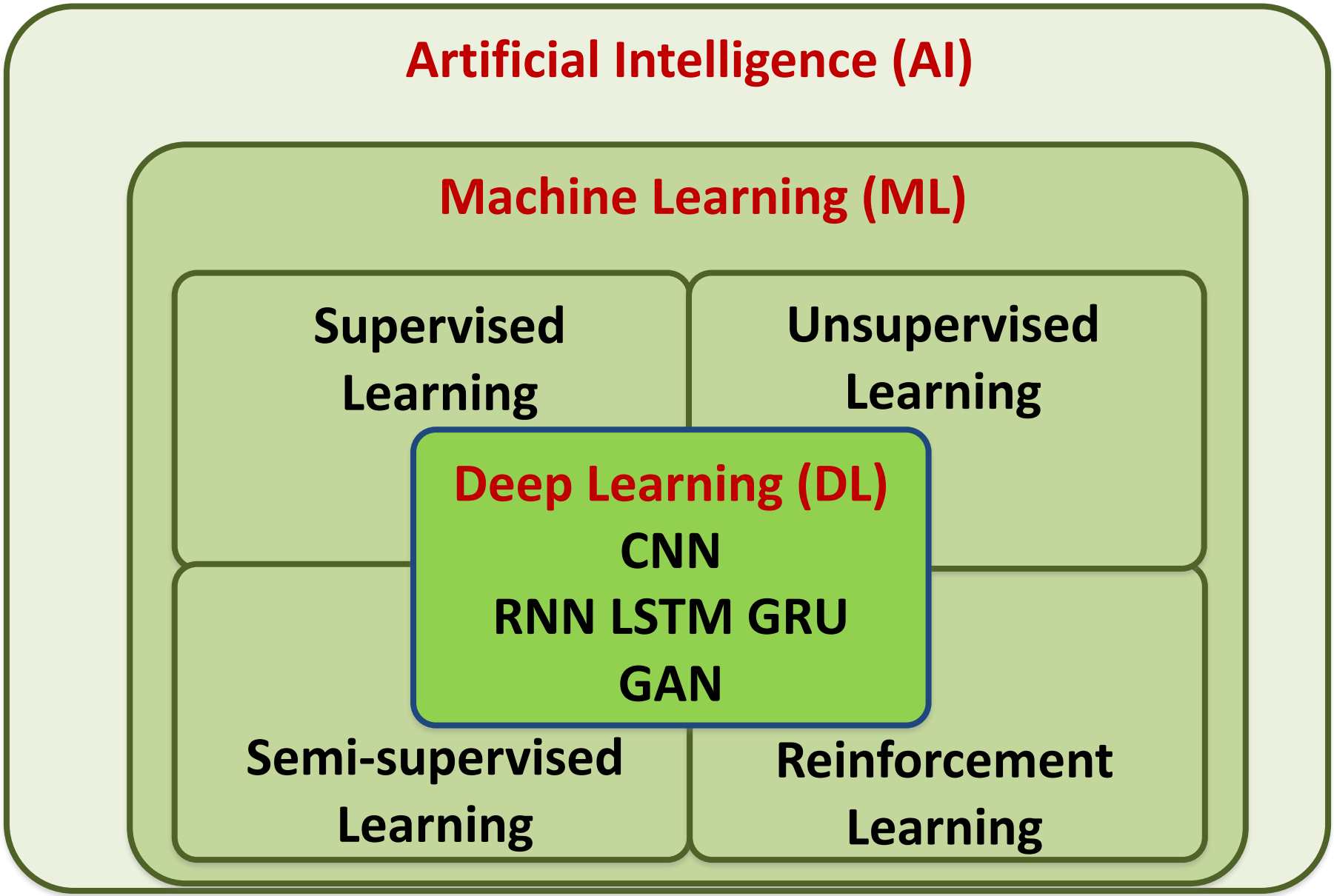
Artificial Intelligence
Machine Learning & Deep Learning



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

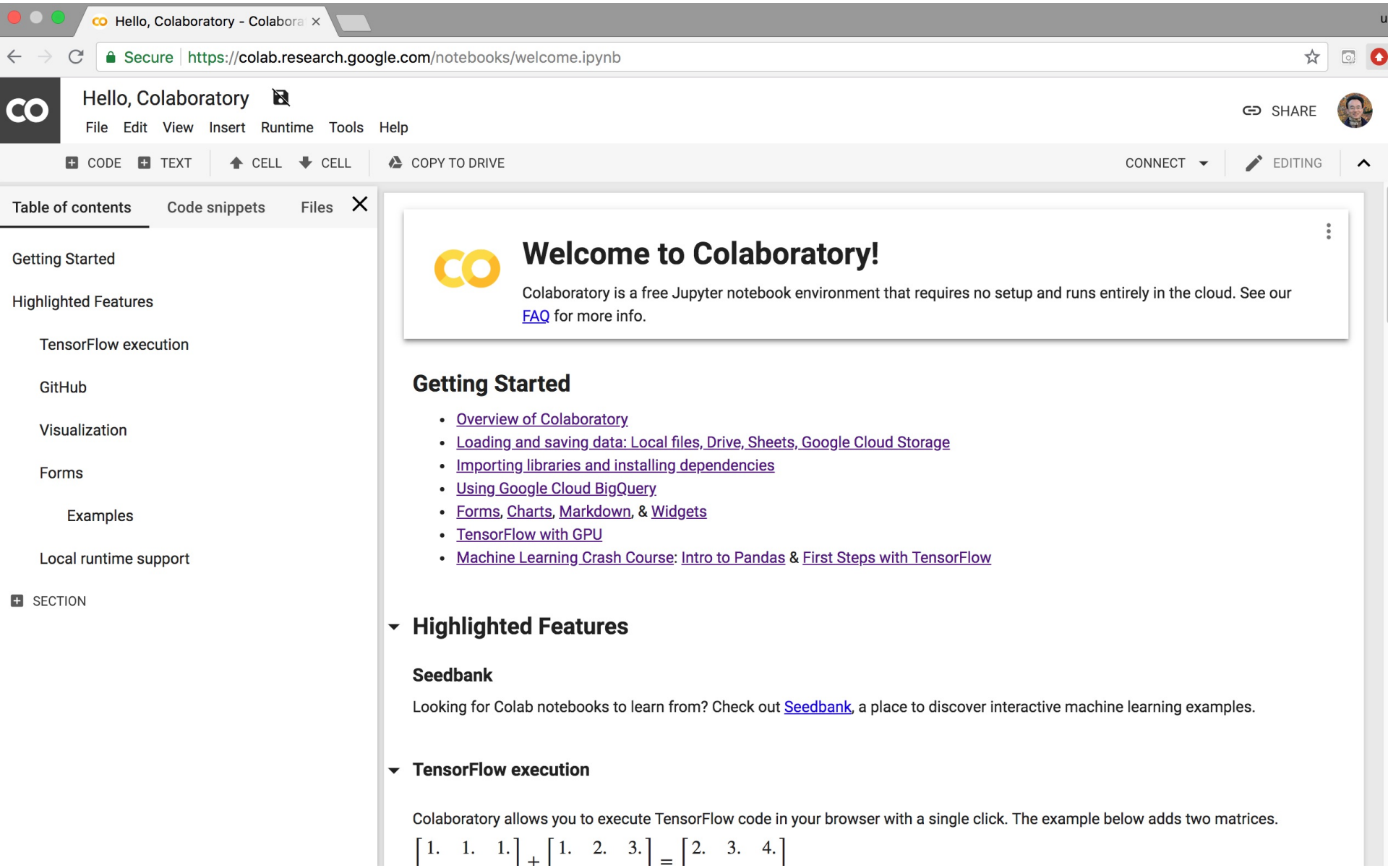
Source: https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

AI, ML, DL



Source: https://leonardoaraujosantos.gitbooks.io/artificial-inteligence/content/deep_learning.html

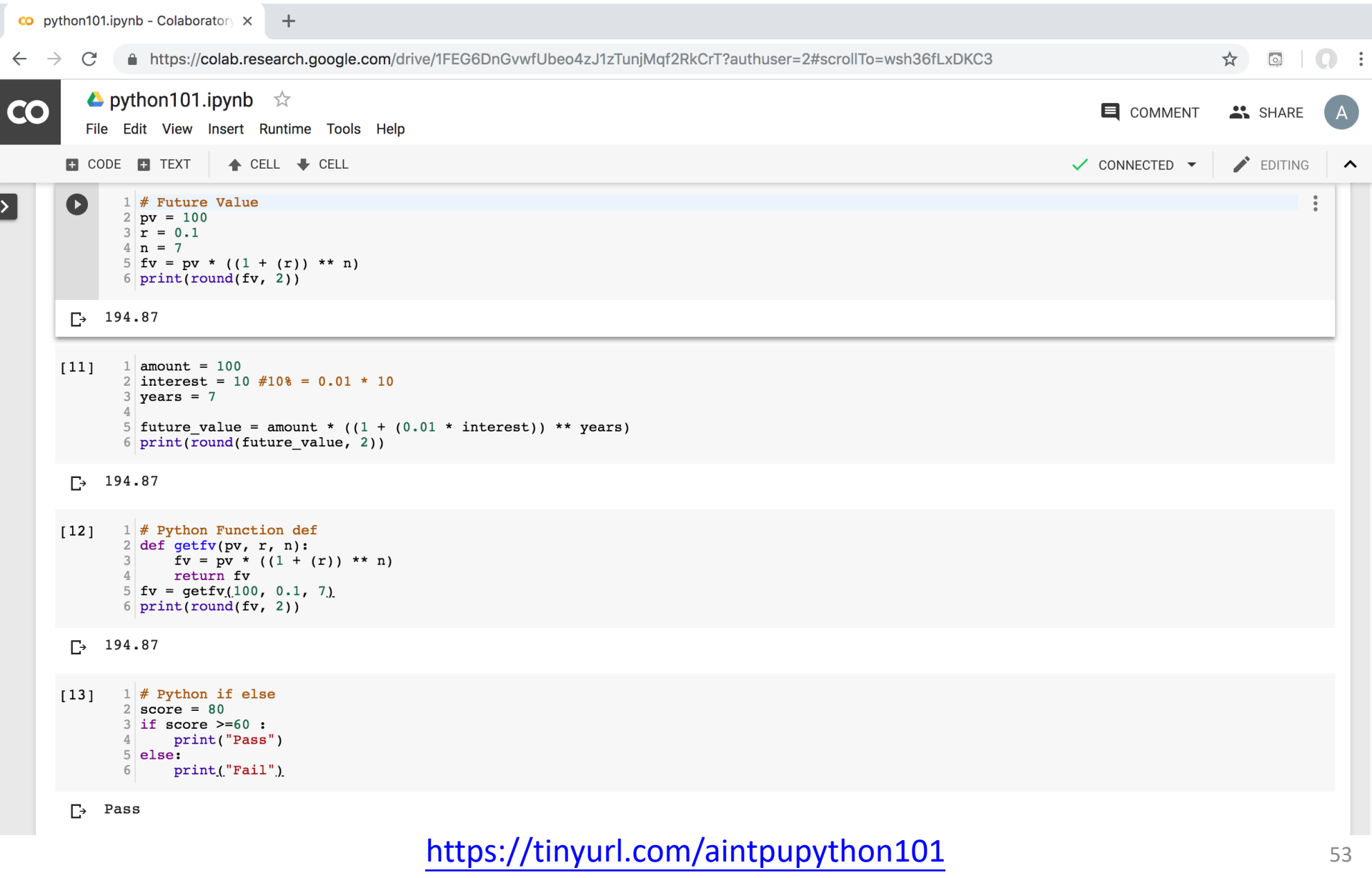
Google Colab



https://colab.research.google.com/notebooks/welcome.ipynb

Python in Google Colab (Python101)

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT



https://tinyurl.com/aintpupython101

Summary

- This course introduces the fundamental concepts, research issues, and hands-on practices of data mining.
- Topics include
  1. Introduction to data mining
  2. ABC: AI, Big Data, Cloud Computing
  3. Foundations of Data Mining in Python
  4. Data Science and Data Mining: Discovering, Analyzing, Visualizing and Presenting Data
  5. Unsupervised Learning: Association Analysis, Market Basket Analysis
  6. Unsupervised Learning: Cluster Analysis, Market Segmentation
  7. Supervised Learning: Classification and Prediction
  8. Machine Learning and Deep Learning
  9. Convolutional Neural Networks, Recurrent Neural Networks, Reinforcement Learning
  10. Social Network Analysis
  11. Case Study on Data Mining

資料探勘
(Data Mining)
Contact Information

戴敏育 博士 (Min-Yuh Day, Ph.D.)

副教授 (Associate Professor)

國立臺北大學 資訊管理研究所

Institute of Information Management, National Taipei University

電話： 02-86741111 ext. 66873

研究室： 商8F12

地址： 23741 新北市三峽區大學路 151 號

Email：myday@gm.ntpu.edu.tw

網址：http://web.ntpu.edu.tw/~myday/