Practices of Business Intelligence

(Future Trends, Privacy and Managerial Considerations in Analytics)

Min-Yuh Day
Assistant Professor

Dept. of Information Management, Tamkang University

http://mail.tku.edu.tw/myday/

2018-12-26
<table>
<thead>
<tr>
<th>頻次 (Week)</th>
<th>日期 (Date)</th>
<th>內容 (Subject/Topics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2018/09/12</td>
<td>商業智慧實務課程介紹 (Course Orientation for Practices of Business Intelligence)</td>
<td></td>
</tr>
<tr>
<td>2 2018/09/19</td>
<td>商業智慧、分析與資料科學 (Business Intelligence, Analytics, and Data Science)</td>
<td></td>
</tr>
<tr>
<td>3 2018/09/26</td>
<td>人工智慧、大數據與雲端運算 (ABC: AI, Big Data, and Cloud Computing)</td>
<td></td>
</tr>
<tr>
<td>4 2018/10/03</td>
<td>描述性分析I：數據的性質、統計模型與可視化 (Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization)</td>
<td></td>
</tr>
<tr>
<td>5 2018/10/10</td>
<td>國慶紀念日 (放假一天) (National Day) (Day off)</td>
<td></td>
</tr>
<tr>
<td>6 2018/10/17</td>
<td>描述性分析II：商業智慧與資料倉儲 (Descriptive Analytics II: Business Intelligence and Data Warehousing)</td>
<td></td>
</tr>
</tbody>
</table>
課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)
7 2018/10/24 預測性分析 I：資料探勘流程、方法與演算法
(Predictive Analytics I: Data Mining Process, Methods, and Algorithms)

8 2018/10/31 預測性分析 II：文本、網路與社群媒體分析
(Predictive Analytics II: Text, Web, and Social Media Analytics)

9 2018/11/07 期中報告 (Midterm Project Report)

10 2018/11/14 期中考試 (Midterm Exam)

11 2018/11/21 處方性分析：最佳化與模擬
(Prescriptive Analytics: Optimization and Simulation)

12 2018/11/28 社會網絡分析
(Social Network Analysis)
課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)
13 2018/12/05 機器學習與深度學習  
(Machine Learning and Deep Learning)
14 2018/12/12 自然語言處理  
(Natural Language Processing)
15 2018/12/19 AI交談機器人與對話式商務  
(AI Chatbots and Conversational Commerce)
16 2018/12/26 商業分析的未來趨勢、隱私與管理考量  
(Future Trends, Privacy and  
Managerial Considerations in Analytics)
17 2019/01/02 期末報告 (Final Project Presentation)
18 2019/01/09 期末考試 (Final Exam)
Business Intelligence (BI)

1. Introduction to BI and Data Science
2. Descriptive Analytics
3. Predictive Analytics
4. Prescriptive Analytics
5. Big Data Analytics
6. Future Trends
Future Trends, Privacy and Managerial Considerations in Analytics
Outline

• Internet of Things (IoT)
• Cloud Computing and Business Analytics
• Location-Based Analytics for Organizations
• Issues of Legality, Privacy, and Ethics
• Impacts of Analytics in Organizations
• Data Scientist as a Profession
Evolution of Computerized Decision Support to Analytics/Data Science

The timeline in Figure 1.8 shows the terminology used to describe analytics since the 1970s. During the 1970s, the primary focus of information systems support for decision making focused on providing structured, periodic reports that a manager could use for decision making (or ignore them). Businesses began to create routine reports to inform decision makers (managers) about what had happened in the previous period (e.g., day, week, month, quarter). Although it was useful to know what had happened in the past, managers needed more than this: They needed a variety of reports at different levels of granularity to better understand and address changing needs and challenges of the business. These were usually called management information systems (MIS). In the early 1970s, Scott-Morton first articulated the major concepts of DSS. He defined DSSs as “interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems” (Gorry and Scott-Morton, 1971). The following is another classic DSS definition, provided by Keen and Scott-Morton (1978):

Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semistructured problems.

Note that the term decision support system, like management information system and several other terms in the field of IT, is a content-free expression (i.e., it means different things to different people). Therefore, there is no universally accepted definition of DSS.

During the early days of analytics, data was often obtained from the domain experts using manual processes (i.e., interviews and surveys) to build mathematical or knowledge-based models to solve constrained optimization problems. The idea was to do the best with limited resources. Such decision support models were typically called operations research (OR). The problems that were too complex to solve optimally (using linear or nonlinear mathematical programming techniques) were tackled using heuristic methods such as simulation models. (We will introduce these as prescriptive analytics later in this chapter and in a bit more detail in Chapter 6.)

In the late 1970s and early 1980s, in addition to the mature OR models that were being used in many industries and government systems, a new and exciting line of models had emerged: rule-based expert systems. These systems promised to capture experts’ knowledge in a format that computers could process (via a collection of if–then–else rules or heuristics) so that these could be used for consultation much the same way that one

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

Business Analytics

Descriptive
- What happened?
- What is happening?
- Business reporting
- Dashboards
- Scorecards
- Data warehousing
- Well-defined business problems and opportunities

Predictive
- What will happen?
- Why will it happen?
- Data mining
- Text mining
- Web/media mining
- Forecasting
- Accurate projections of future events and outcomes

Prescriptive
- What should I do?
- Why should I do it?
- Optimization
- Simulation
- Decision modeling
- Expert systems
- Best possible business decisions and actions

Business Intelligence

Advanced Analytics

Building Blocks of IoT Technology

Infrastructure

RFID Data Tag

**Binary:**

```
001100000111010000000001011100111110000101001101
1100110101000000001110110011010110010100011000
```

**Decimal:**

(SGTIN)

```
0023800 . 341813 . 500000024
```

**UCC-14**

(UPC for cases)

```
3   0023800   41813   3
```

Check Digit (not needed for RFID)

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson
## Difference between Fog Nodes and a Cloud Platform

<table>
<thead>
<tr>
<th>Fog Nodes</th>
<th>Cloud Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive data from IoT devices</td>
<td>Receives and aggregates data from fog nodes</td>
</tr>
<tr>
<td>Run IoT real-time analytics in millisecond</td>
<td>Analysis is performed on huge amounts of business data and can take hours or weeks</td>
</tr>
<tr>
<td>response time</td>
<td></td>
</tr>
</tbody>
</table>

### Diagram:

```
Physical device / Sensors | Fog device generating data | Data Center / Cloud
```

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

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson
# Internet of Things Landscape 2018

## Applications (Verticals)

### Personal
- Microsoft
- Fitbit
- Apple
- Google
- Amazon
- IBM
- Samsung
- Bosch
- Motiv
- Nest
- GE
- LG
- Sony
- Panasonic

### Home
- I.D. Gobio
- Honeywell
- Samsung
- LG
- Panasonic
- GE
- Whirlpool
- LG
- Bosch

### Vehicles
- Tesla
- BMW
- Ford
- GM
- Audi
- Mercedes-Benz
- Toyota
- Honda
- Nissan
- Audi

### Enterprise
- Microsoft
- Google
- IBM
- Amazon
- SAP
- Dell
- Oracle
- HP
- Salesforce
- Microsoft

### Industrial Internet
- Siemens
- Schneider Electric
- GE
- Rockwell Automation
- ABB
- Bosch
- Siemens
- Honeywell

## Platforms (Horizontal)

### Software
- AWS
- Microsoft Azure
- Google Cloud
- IBM Cloud
- Oracle Cloud
- VMware
- Red Hat
- Docker
- Kubernetes

### Security
- FireEye
- Kaspersky
- McAfee
- Symantec
- Check Point
- Trend Micro
- F5 Networks
- Faronics

### Connectivity
- AT&T
- Verizon
- T-Mobile
- Sprint
- EE
- Vodafone
- China Mobile
- China Unicom

### Analytics
- Tableau
- Qlik Technologies
- MicroStrategy
- SAS
- SAP
- IBM Analytics
- Amazon Quicksight

### Developer
- GitHub
- GitLab
- Visual Studio
- Eclipse
- Android Studio
- PyCharm
- Xcode

### Payments & Money
- PayPal
- Visa
- Mastercard
- American Express
- Stripe
- Square
- Samsung Pay
- Apple Pay

### Interests
- FirstMark Capital
- Index Ventures
- Andreessen Horowitz
- Bessemer Venture Partners
- 500 Startups

## Building Blocks

### Hardware
- Intel
- ARM
- Qualcomm
- Texas Instruments
- ARM
- IBM
- Samsung
- Huawei
- LG
- Philips

### Infrastructure
- Google Cloud
- Microsoft Azure
- IBM Cloud
- Oracle Cloud
- AWS
- VMware
- Red Hat
- Kubernetes

### Connectivity
- Bluetooth
- ZigBee
- Z-Wave
- LoRaWAN
- NB-IoT
- LTE
- 3G
- 4G
- Wi-Fi

### Partners
- IoTWorks
- ThingFirst
- Microsoft
- Google
- IBM
- Oracle
- Amazon
- Apple
- Samsung

---

© Matt Turck (@matturck), Demi Obayomi (@demi_obayomi) & FirstMark Capital (@firstmarkcap)

Final version, revised and updated as of February 7, 2018

Managerial Considerations in the Internet of Things

• Organizational Alignment
• Interoperability Challenges
• Security

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

• The National Institute of Standards and Technology (NIST) defines cloud computing as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction.”

Conceptual Architecture of a Cloud-Oriented Support System

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson
Infrastructure, Platform, Software, Data, Information, and Analytics as a Service

• Analytics as a Service (AaaS)
• Data as a Service (DaaS)
• Software as a Service (SaaS)
• Platform as a Service (PaaS)
• Infrastructure as a Service (IaaS)

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson
Technology Stack as a Service for Different Types of Cloud Offerings

<table>
<thead>
<tr>
<th>Application</th>
<th>Data</th>
<th>Runtime</th>
<th>Middleware</th>
<th>Operating System</th>
<th>Virtualization</th>
<th>Servers</th>
<th>Storage</th>
<th>Networking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IaaS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PaaS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SaaS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

• VIRTUALIZATION

  – Virtualization is the creation of a virtual version of something like an operating system or server
  – Virtualization can be in all three areas of computing:
    1. Network virtualization
    2. Storage virtualization
    3. Server virtualization

Cloud Deployment Models

• Private cloud
  – internal cloud or corporate cloud

• Public cloud
  – the subscriber uses the resources offered by service providers over the Internet
    • Microsoft Azure platform
    • Google App Engine
    • Amazon AWS

• Hybrid cloud
  – moving workloads between private and public cloud
Major Cloud Platform Providers in Analytics

• Amazon Elastic Beanstalk
• IBM Bluemix
• Microsoft Azure
• Google App Engine
• OpenShift

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

- ASTER ANALYTICS AS A SERVICE
- IBM WATSON ANALYTICS
- MINEMYTEXT.COM
- SAS VISUAL ANALYTICS AND VISUAL STATISTICS
- TABLEAU
- SNOWFLAKE
- PREDIX BY GENERAL ELECTRIC

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

LOCATION-BASED ANALYTICS

ORGANIZATION ORIENTED

GEOSPATIAL STATIC APPROACH
- Examining Geographic Site Locations

LOCATION-BASED DYNAMIC APPROACH
- Live Location Feeds; Real-Time Marketing Promotions

CONSUMER ORIENTED

GEOSPATIAL STATIC APPROACH
- GPS Navigation and Data Analysis

LOCATION-BASED DYNAMIC APPROACH
- Historic and Current Location Demand Analysis; Predictive Parking; Health-Social Networks

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

• Legal Issues
  – What is the value of an expert opinion in court when the expertise is encoded in a computer?
  – Who is liable for wrong advice (or information) provided by an intelligent application?
  – What happens if a manager enters an incorrect judgment value into an analytic application and the result is damage or a disaster?
  – Who owns the knowledge in a knowledge base?
  – Can management force experts to contribute their expertise?

Privacy Issues

• Privacy means different things to different people.

• **Privacy** is the right to be left alone and the right to be free from unreasonable personal intrusions.

• Two rules of privacy

  (1) the right of privacy is not absolute. Privacy must be balanced against the needs of society.

  (2) The public’s right to know is superior to the individual’s right to privacy.

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

- Electronic surveillance
- Ethics in DSS design
- Software piracy
- Invasion of individuals’ privacy
- Use of proprietary databases
- Use of intellectual property such as knowledge and expertise
- Exposure of employees to unsafe environments related to computers
- Computer accessibility for workers with disabilities
- Accuracy of data, information, and knowledge
- Protection of the rights of users
- Accessibility to information
- Use of corporate computers for non-work-related purposes
- How much decision making to delegate to computers

Impact of Analytics on Organizations

Organizational Impact of Analytics

Organizational Design and Management Using Analytics

Industry Impact of Automation

Impact of Analytics on Future Jobs

New Organizational Units

People Analytics

Activities Performance and Satisfaction

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

- Data scientist is a role or a job frequently associated with Big Data
- Data scientists use a combination of their business and technical skills to investigate Big Data
  - looking for ways to improve current business analytics practices (from descriptive to predictive and prescriptive) and
  - hence to improve decisions for new business opportunities.

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

Soft Skills
- Communication and Interpersonal
- Curiosity and Creativity

Technical Skills
- Domain Expertise, Problem Definition, and Decision Modeling
- Data Access and Management (both traditional and new data systems)
- Programming, Scripting, and Hacking
- Internet and Social Media/Social Networking Technologies

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

• Internet of Things (IoT)
• Cloud Computing and Business Analytics
• Location-Based Analytics for Organizations
• Issues of Legality, Privacy, and Ethics
• Impacts of Analytics in Organizations
• Data Scientist as a Profession
References

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