Chapter I: Introduction

Knowledge Discovery in Databases

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Chapter I: Introduction

This is our agenda for this lecture:

- **Why data mining?**
- What is data mining?
- A multi-dimensional view of data mining.
- What kinds of data can be mined?
- What kinds of patterns can be mined?
- What technologies are used?
- What kinds of applications are targeted?
- Major issues in data mining.
- A brief history of data mining.
- Summary.

Why data mining?

The explosive growth of data: from terabytes to petabytes and more.

- Data collection and availability:
  - Automated data collection tools.
  - Database systems.
  - World wide web.
  - Computerized society.
  - Digitization.
- Major sources of abundant data:
  - Business: web, e-commerce, transactions, stocks ...
  - Science: remote sensing, bioinformatics, scientific simulation ...
  - Society: news, digital cameras, social media ...
- The era of **big data** (as inflationary used buzzword).

We are drowning in data, but starving for knowledge. Necessity is the mother of invention.
For data mining it is the automated analysis of massive data sets.

Evolution of sciences I

- Before 1600, era of **empirical science**.
- 1600 — 1950s, rise of **theoretical science**.
  - Each discipline has grown a theoretical component.
  - Theoretical models often motivate experiments and generalize our understanding.
- 1950 — 1990s, rise of **computational science**.
  - Over the last 50 years most disciplines have grown a third, computational branch.
    - E.g. empirical, theoretical and computational ecology.
    - E.g. physics, linguistics or biology.
- Computational science traditionally meant simulation.
- It grew out of our inability to describe reality by closed-form mathematical models.

Evolution of sciences II

- 1990—now, rise of **data science**.
  - The flood of data from new instruments and modern simulations.
  - The ability to economically store and manage petabytes of data.
  - The internet makes all these archives world wide accessible.
  - Scientific *information management*,
    acquisition,
    organization,
    query and
    visualization scale almost linearly with amount of data.
  - **Data mining** is a major new challenge!
- For further reading:
  Jim Gray and Alex Szaly: *The World Wide Telescope: An Archetype for Online Science*,
  Communications of the ACM 45(11): 50-54, 2002.

Evolution of sciences III

- 1960s: Data collection,
  database creation,
  integrated management systems (IMS) and
  network database management systems (DBMS).
- 1970s: Relational data model, relational DBMS implementation (RDBMS).
- 1980s: RDBMS products,
  database creation,
  advanced data models (extended-relational, object oriented, deductive etc.),
  application-oriented DBMS (spatial, scientific, engineering etc.).
- 1990s: Data mining,
  data warehousing,
  multimedia databases,
  web databases.
- 2000s: Stream data management and mining,
  data mining and applications,
  web technology (XML, data integration) and global information systems.

Chapter I: What is data mining?

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What is data mining?

Data mining or knowledge discovery from data:

- Extraction of interesting (**non-trivial, implicit, previously unknown and potentially useful**) patterns from huge amounts of data.
- Is **data mining** a misnomer?

Alternative names:

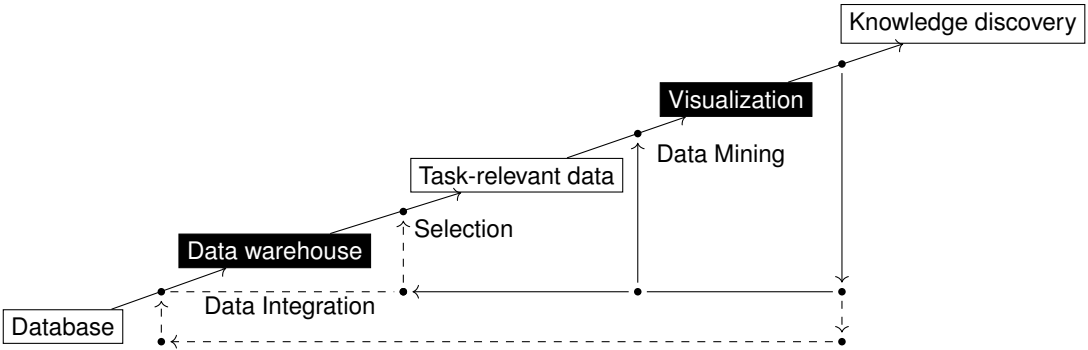
- Knowledge discovery/mining in databases (KDD).
- Knowledge extraction.
- Data/pattern analysis.
- Data archeology.
- Data dredging.
- Information harvesting.
- Business intelligence.

Watch out: Is everything **data mining**?

- Simple search and query processing is considered not to be.
- Neither are deductive expert systems.

Knowledge discovery pipeline

- This is a typical view from a typical database-systems and data-warehousing community.
- Data mining plays an essential role in the knowledge-discovery process.



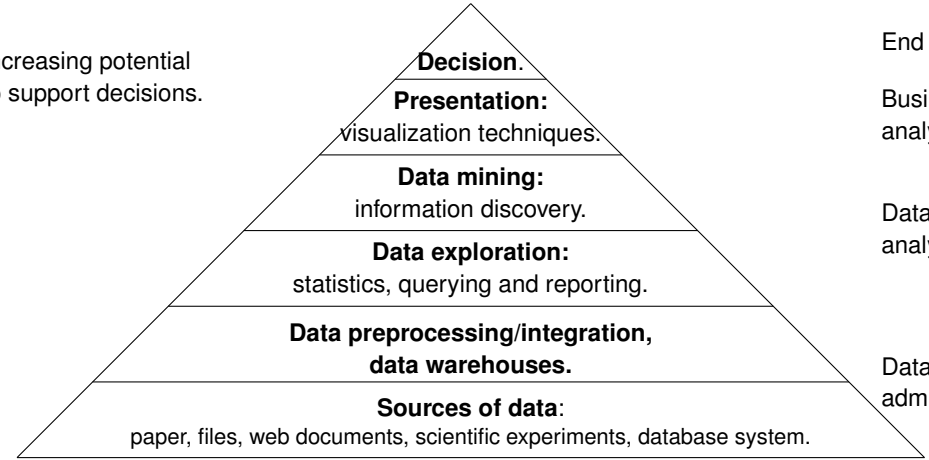
Example: a web-mining framework

Web mining usually involves:

- Data cleaning.
- Data integration from multiple sources.
- Warehousing the data.
- Data-cube construction.
- Data selection for data mining.
- Data mining.
- Presentation of the mining results.
- Patterns and knowledge to be used or stored in a knowledge base.

Data mining in business

Increasing potential
to support decisions.



End user.

Business
analyst.

Data
analyst.

Database
administration.

Thank you for your attention.
Any questions about the introduction?

Ask them now, or again, drop me a line:
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