Agenda

- Housekeeping
- Lecture 1 :
    - Intro to data Mining
- R down loads

Definitions

- Data
  - Representations of Facts
- Information
  - Data with “Relevance and Importance”
  - Any datum (and/or data) that changes the probability distribution (chances) of a relevant outcome.

Example: Information

Voluntary Termination	Employee Count	Employee Count Percent
No	60	60.00%
Yes	40	40.00%
Grand Total	100	100.00%

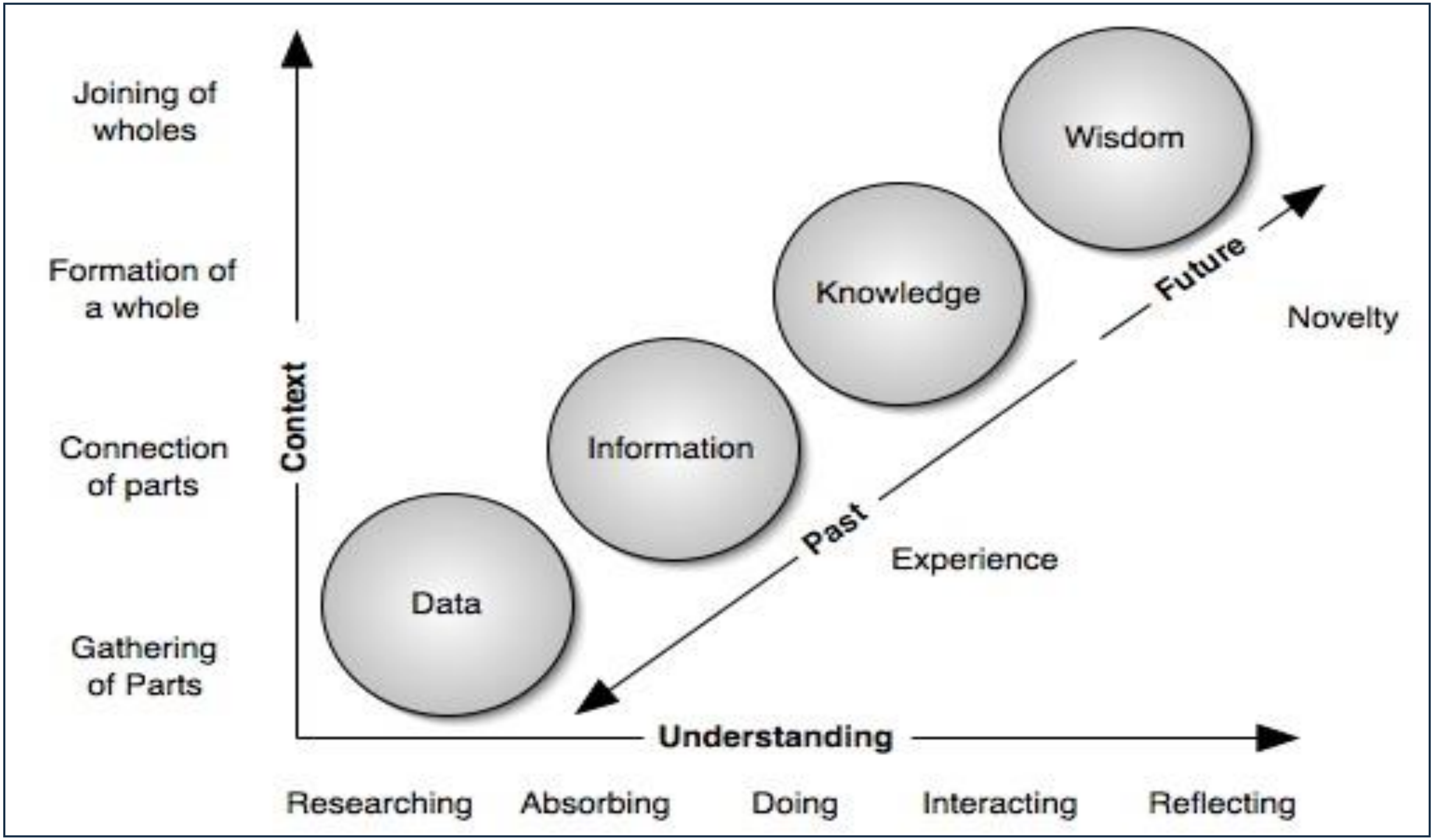
Voluntary Termination	No travel required		Travel required		Total	
	Employee Count	Column Percent	Employee Count	Column Percent	Employee Count	Column Percent
No	45	88.24%	15	30.61%	60	60.00%
Yes	6	11.76%	34	69.39%	40	40.00%
Grand Total	51	100.00%	49	100.00%	100	100.00%

Voluntary Termination	Female		Male		Total	
	Employee Count	Column Percent	Employee Count	Column Percent	Employee Count	Column Percent
No	30	60.00%	30	60.00%	60	60.00%
Yes	20	40.00%	20	40.00%	40	40.00%
Grand Total	50	100.00%	50	100.00%	100	100.00%

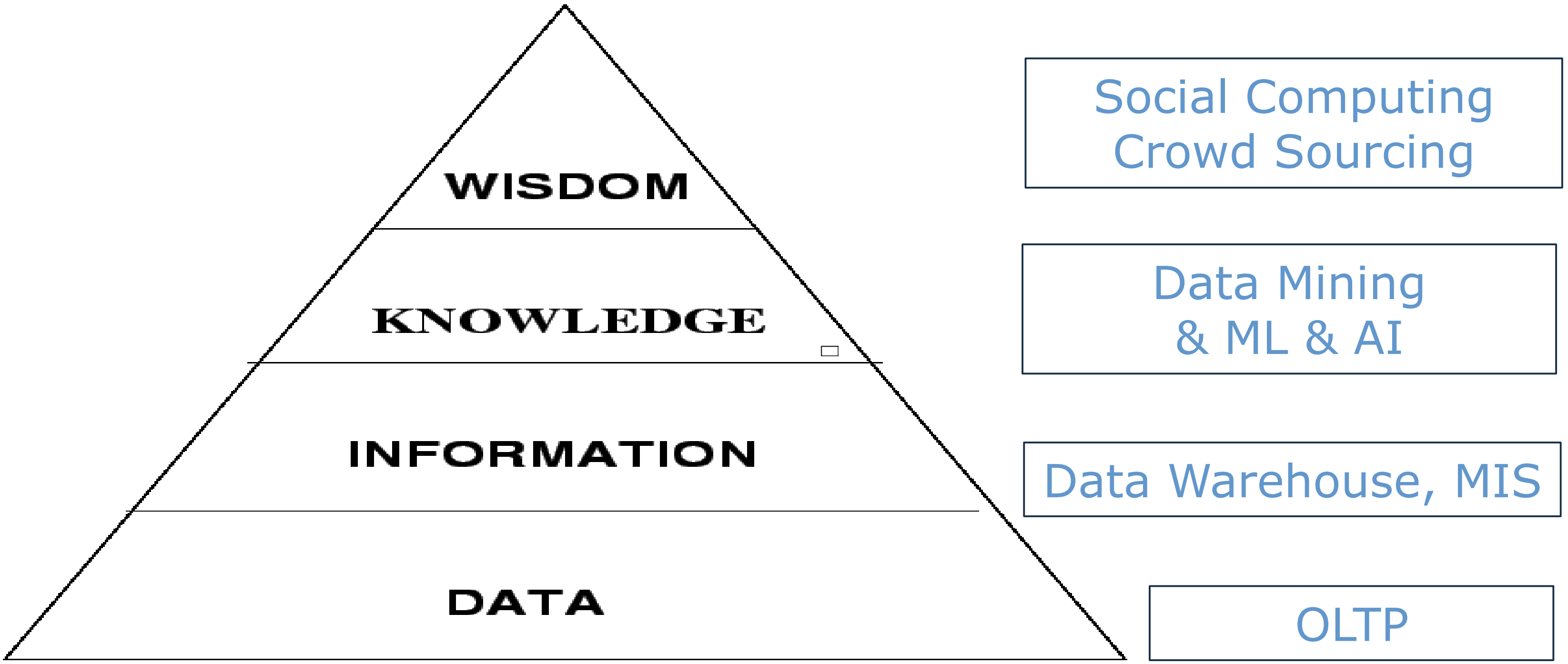
Definitions

- Knowledge
  - Ability to use information to act (or not), in order to achieve objectives.
  - The ability to understand and explain, relationship between different phenomena (usually as a rule)
- Wisdom
  - Ability to synthesize information and knowledge, to create a framework for optimal actions.
- Intelligence
  - The ability to apply knowledge

What are Data, Information, Knowledge, & Wisdom?



Support Systems In a Typical Organization



WISDOM

KNOWLEDGE

INFORMATION

DATA

Social Computing
Crowd Sourcing

Data Mining
& ML & AI

Data Warehouse, MIS

OLTP

Necessity is the mother of invention

Evolution of Technology

- 1960s
  - Data collection, database creation, IMS and network DBMS
- 1970s:
  - Relational data model, relational DBMS implementation
- 1980s:
  - RDBMS, advanced data models (extended-relational, OO, deductive, etc.)
  - Application-oriented DBMS (spatial, scientific, engineering, etc.)
- 1990s:
  - Data mining, data warehousing, multimedia databases, and Web databases
- 2000s
  - Stream data management and mining
  - Data mining and ML with a variety of applications
  - Web technology and global information systems

Data Explosion Problem ("Big" Data)

- Snapchat users share 527,760 photos
- More than 120 professionals join LinkedIn
- Users watch 4,146,600 YouTube videos
- 456,000 tweets are sent on Twitter
- Instagram users post 46,740 photos

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Source:https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#6cc1dc7d60ba

Data Explosion:Facebook

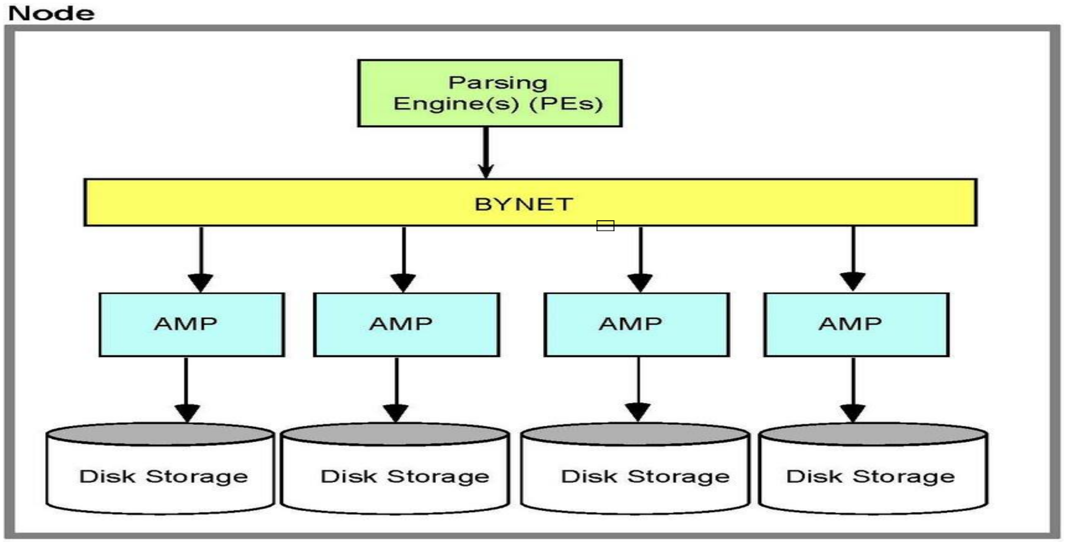
- 1.5 billion people are active on Facebook daily
- Europe has more than 307 million people on Facebook
- There are five new Facebook profiles created every second!
- More than 300 million photos get uploaded per day
- Every minute there are 510,000 comments posted and 293,000 statuses updated

https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#6cc1dc7d60ba

How to Get Information Out of “Big” Data

New Data Warehouse Architectures

Major Components of a Teradata System



How to Get Knowledge Out of “Big” Data

There is a need for a new generation of techniques with the ability to *intelligently and automatically* assist humans in analyzing ‘mountains’ of data for nuggets of useful knowledge (and not just information).

This has led to an emerging field:

Data Mining, ML & Knowledge Discovery (DM & KD)

What is Data Mining & Knowledge Discovery ?

DM & KD Mean Different Things to Different Professionals

- Management: Potentially money making tools
- Computer Scientists: A new Knowledge Discovery breakthrough - NOT STATISTICS
- Statisticians: Not statistically, significantly, new - A computerized statistician
- Electrical Engineers: Another application of Information Theory and Entropy
- Neuroscientists: Neurocomputer - a computer model of the human brain
- Mathematicians: Some weighted average of a bunch of numbers

Data Mining & Knowledge Discovery

- Underlying Disciplines

  Biology, Neurology, Psychology, Statistics, Computer Science, Engineering

- Artificial Intelligence (AI)

  Integrates the “Underlying Disciplines” for solving various types of problems

- Techniques

  – Symbolic: *Rules Based Systems (RBS), Case-Based Reasoning (CBR), Fuzzy Logic (FL)*
  – Connectionist: *Artificial Neural Networks (ANN)*
  – Inductive (ML): *C4.5, CART*
  – Evolutionary: *Genetic Algorithms (GA)*

What is Data Mining & Knowledge Discovery?

The non-trivial ***process*** of identifying ***valid***, ***novel***, potentially ***useful***, and ultimately ***understandable*** patterns in data.

-- ***Fayad, Shapiro, Smyth (1996)***

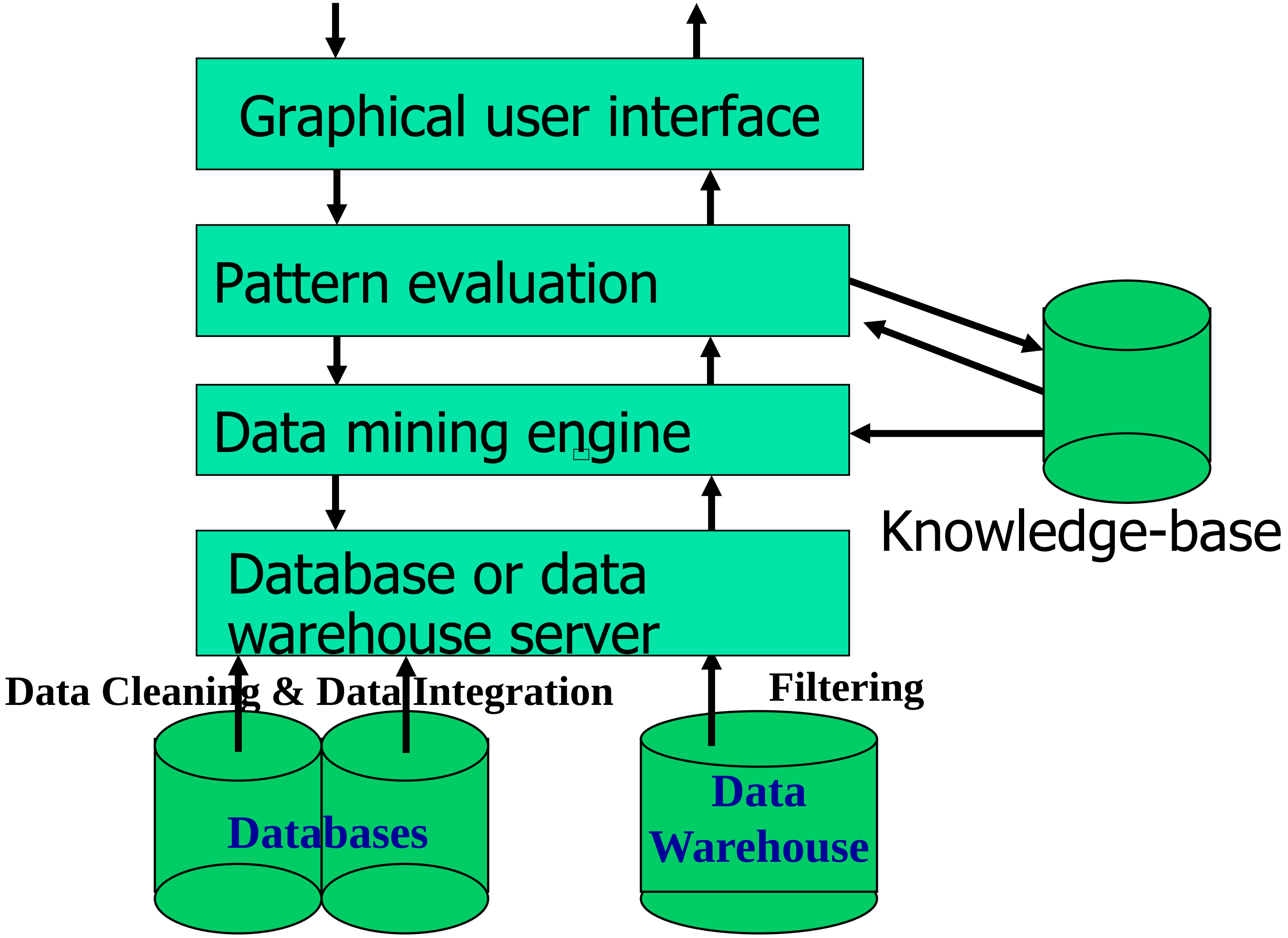
- ***process:*** knowledge discovery is iterative, as you uncover "nuggets" in the data, you learn to ask better questions
- ***valid:*** generalize to the future
- ***novel:*** not something we already know
- ***useful:*** actionable, can be used for a task
- ***understandable:*** process leads to human insight

What is Data Mining & Knowledge Discovery ?

The New York Times:

Data mining has entered a golden age, whether being used to set ad prices, find new drugs more quickly or fine-tune financial models. Companies as diverse as Google, Pfizer, Merck, Bank of America, the InterContinental Hotels Group and Shell use it.

Architecture: Typical Data Mining System



DM & KD Process: End-to-End Solution

- Pose a Profound Question
- Identify Relevant Data
- Access the Data
- Clean the Data
- Transform & Integrate the Data
- Mine/Discover Knowledge
- Make Intelligent Decisions

Intelligence Chiefs Testify At Senate Hearing

- https://www.youtube.com/watch?v=7OVVbrTP18g **40 minute**