CS 412 Intro. to Data Mining

Chapter 2. Getting to Know Your Data

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มิติของ Data

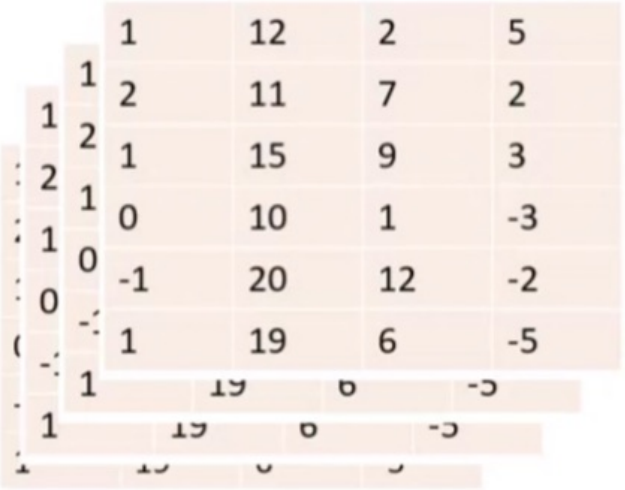
Data

1
2
1
0
-1
1

1D

1	12	2	5
2	11	7	2
1	15	9	3
0	10	1	-3
-1	20	12	-2
1	19	6	-5

2D



3D

4D

Data

	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Record 1	1	12	2	5
Record 2	2	11	7	2
Record 3	1	15	9	3
Record 4	0	10	1	-3
Record 5	-1	20	12	-2
Record 6	1	19	6	-5

แถวนอน คือ Data แต่ละจุด

แนวตั้ง คือ คุณสมบัติที่ใช้อธิบาย Data แต่ละจุด

Chapter 2. Getting to Know Your Data

- Data Objects and Attribute Types
- Basic Statistical Descriptions of Data
- Data Visualization
- Measuring Data Similarity and Dissimilarity
- Summary

Types of Data Sets: (1) Record Data

การบันทึกข้อมูล

- Relational records เชิงสัมพันธ์
  - Relational tables, highly structured
- Data matrix, e.g., numerical matrix, crosstabs

เมทริกซ์ข้อมูล เช่น เมทริกซ์ตัวเลข

	China	England	France	Japan	USA	Total
Active Outdoors Crochet Glove		12.00	4.00	1.00	240.00	257.00
Active Outdoors Lycra Glove		10.00	6.00		323.00	339.00
InFlux Crochet Glove	3.00	6.00	8.00		132.00	149.00
InFlux Lycra Glove		2.00			143.00	145.00
Triumph Pro Helmet	3.00	1.00	7.00		333.00	344.00
Triumph Vertigo Helmet		3.00	22.00		474.00	499.00
Xtreme Adult Helmet	8.00	8.00	7.00	2.00	251.00	276.00
Xtreme Youth Helmet		1.00			76.00	77.00
Total	14.00	43.00	54.00	3.00	1,972.00	2,086.00

Person:

Pers_ID	Surname	First_Name	City
0	Miller	Paul	London
1	Ortega	Alvaro	Valencia
2	Huber	Urs	Zurich
3	Blanc	Gaston	Paris
4	Bertolini	Fabrizio	Rom

no relation

Car:

Car_ID	Model	Year	Value	Pers_ID
101	Bentley	1973	100000	0
102	Rolls Royce	1965	330000	0
103	Peugeot	1993	500	3
104	Ferrari	2005	150000	4
105	Renault	1998	2000	3
106	Renault	2001	7000	3
107	Smart	1999	2000	2

- Transaction data ข้อมูลธุรกรรม

TID	Items
1	Bread, Coke, Milk
2	Beer, Bread
3	Beer, Coke, Diaper, Milk
4	Beer, Bread, Diaper, Milk
5	Coke, Diaper, Milk

	team	coach	play	ball	score	game	win	lost	timeout	season
Document 1	3	0	5	0	2	6	0	2	0	2
Document 2	0	7	0	2	1	0	0	3	0	0
Document 3	0	1	0	0	1	2	2	0	3	0

- Document data: Term-frequency vector (matrix) of text documents

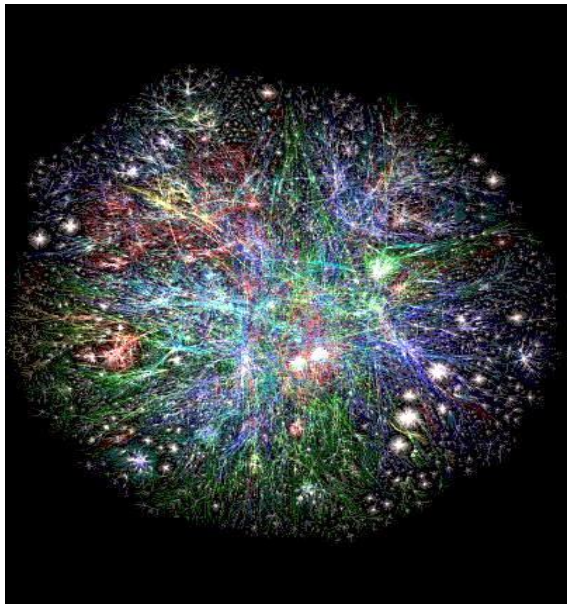
เมทริกซ์ของเอกสารข้อความ

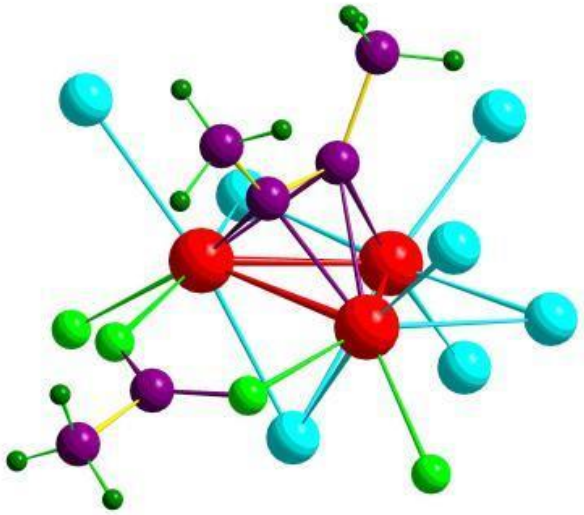
เช่น บทความ

Types of Data Sets: (2) Graphs and Networks

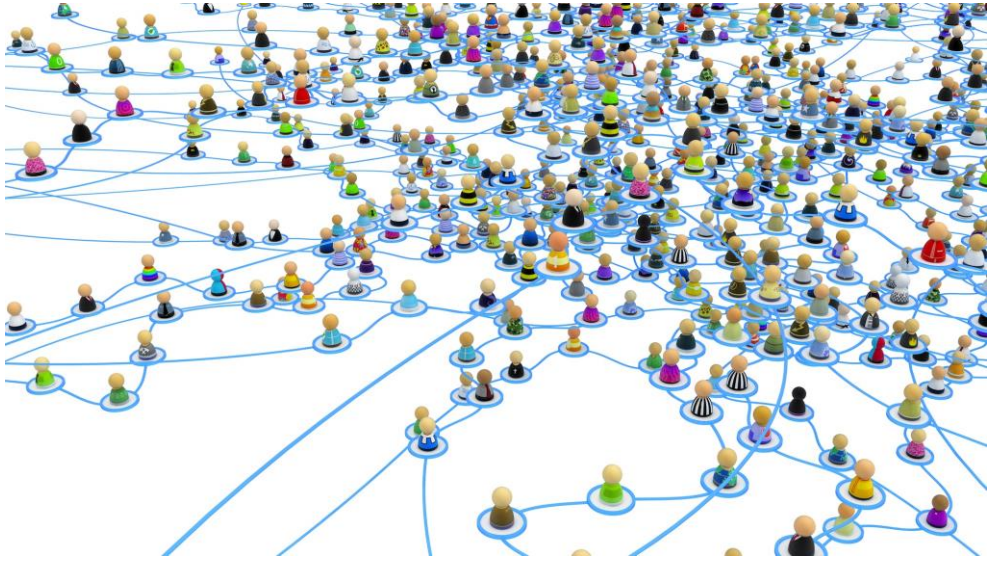
กราฟ เครือข่าย

- เครือข่ายขนส่ง Transportation network
- World Wide Web





- Molecular Structures โครงสร้างโมเลกุล



- Social or information networks

เครือข่ายสังคม หรือข้อมูล

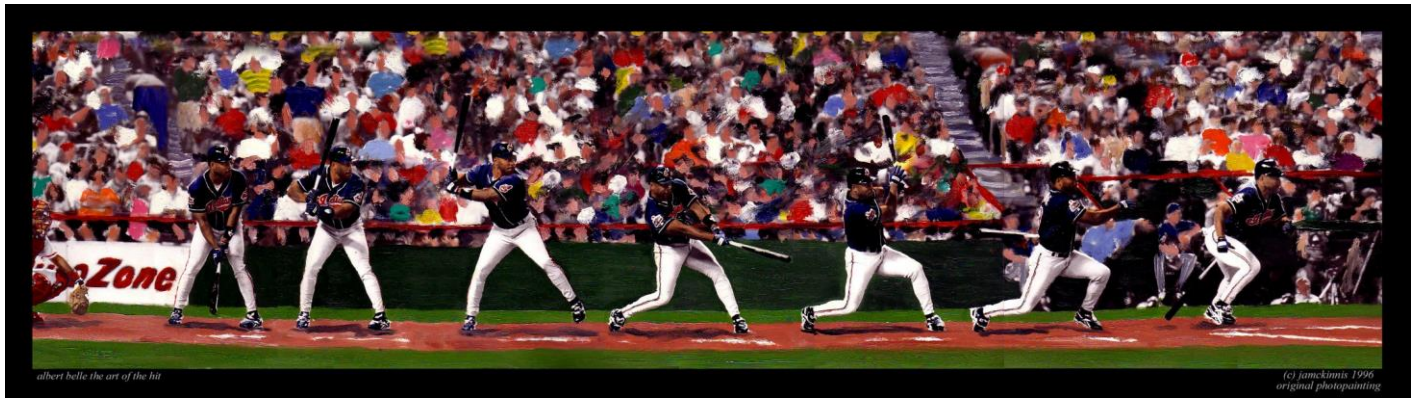
Types of Data Sets: (3) Ordered Data

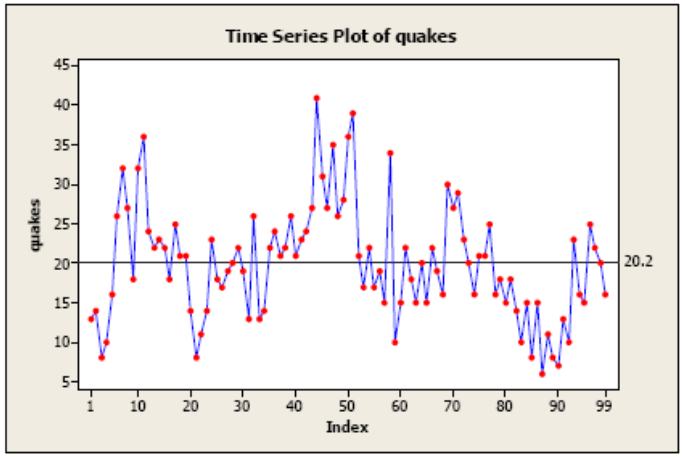
- Video data: sequence of images

รูป หลายๆ รูปมาต่อกัน

- Temporal data: time-series

อันกรมมา





สี่เหลี่ยม

- Sequential Data: transaction sequences

ลำดับการธุรกรรม

สลับตำแหน่งไม่ได้

- Genetic sequence data

ข้อมูลลำดับ ยีนธุรกรรม

Types of Data Sets: (4) Spatial, image and multimedia Data

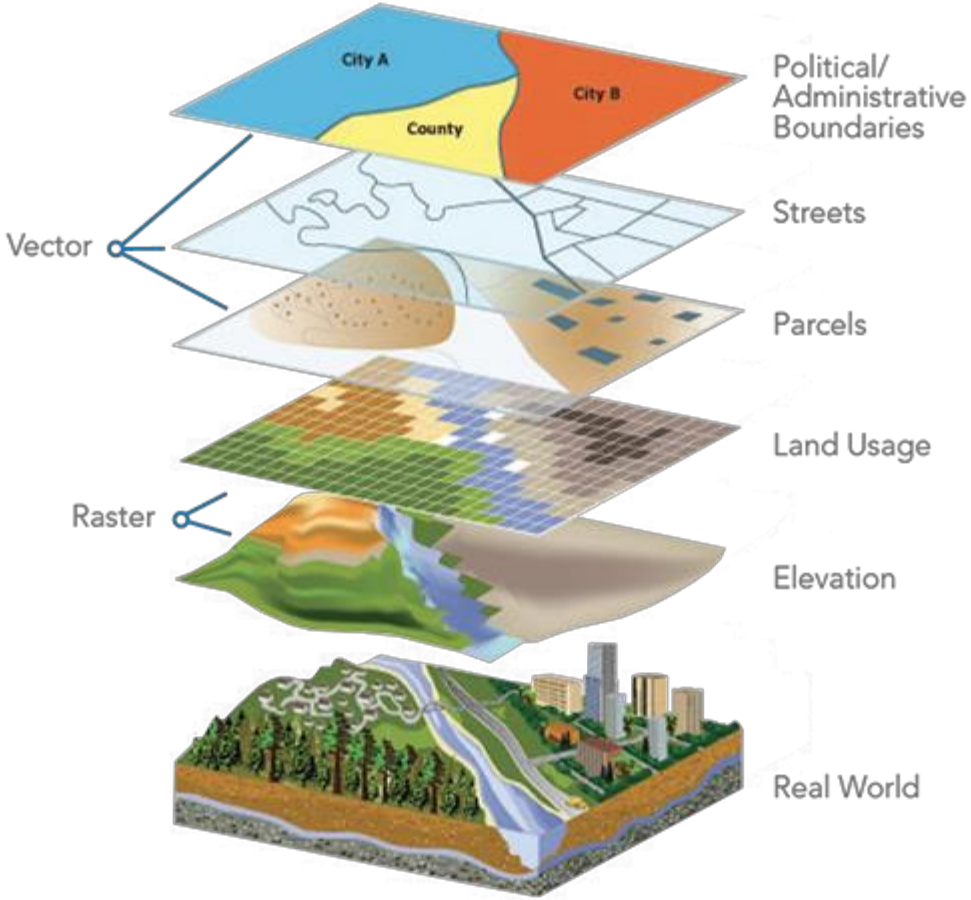
เชิงพื้นที่

- Spatial data: maps

แผนที่ → แต่ละจุดคือ มีหรือไร

จุดนี้ใช้สีฟ้า

จุดนี้สีส้ม



- Image data:

รูป

- Video data: spatio-temporal

เชิงพื้นที่ เชิงเวลา

Important Characteristics of Structured Data

- Dimensionality

  Data พวก Dimension เป็นอย่างไรบ้าง

  - Curse of dimensionality
- Sparsity

  สนใจแต่ตรงที่มีข้อมูล

  - Only presence counts
- Resolution
  - Patterns depend on the scale
- Distribution
  - Centrality and dispersion

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Data Objects

กลุ่มของข้อมูล

- Data sets are made up of data objects
- A **data object** represents an entity
- Examples:
  - sales database: customers, store items, sales ผลิตปีไหน ราคาเท่าไหร่
  - medical database: patients, treatments
  - university database: students, professors, courses
- สำคัญ Also called *samples , examples, instances, data points, objects, tuples* เรียก Data ทุก (หมดตัว)
- Data objects are described by **attributes** ข้อมูลจะถูกอธิบายด้วย attributes
- Database rows → data objects; columns → attributes

แถว → object คอลัม. → attributes

Attributes

- **Attribute** (or **dimensions, features, variables**)
  - A data field, representing a characteristic or feature of a data object.
  - *E.g., customer _ID, name, address*
- Types:
  - Nominal (e.g., red, blue)
  - Binary (e.g., {true, false})
  - Ordinal (e.g., {freshman, sophomore, junior, senior})
  - Numeric: quantitative
    - Interval-scaled: 100°C is interval scales
    - Ratio-scaled: 100°K is ratio scaled since it is twice as high as 50 °K
- Q1: Is student ID a nominal, ordinal, or interval-scaled data?
- Q2: What about eye color? Or color in the color spectrum of physics?

Attribute Types

ชื่อของสิ่งของ

- **Nominal:** categories, states, or "names of things"
  - *Hair_color* = {*auburn, black, blond, brown, grey, red, white*}
  - marital status, occupation, ID numbers, zip codes
- **Binary**
  - Nominal attribute with only 2 states (0 and 1)
  - <u>Symmetric binary</u>: both outcomes equally important
    - e.g., gender
  - <u>Asymmetric binary</u>: outcomes not equally important.
    - e.g., medical test (positive vs. negative)
    - Convention: assign 1 to most important outcome (e.g., HIV positive)
- **Ordinal**
  - Values have a meaningful order (ranking) but magnitude between successive values is not known
  - *Size* = {*small, medium, large*}, grades, army rankings

Numeric Attribute Types

- Quantity (integer or real-valued)
- **Interval** ไม่ร้อยแท้
  - Measured on a scale of **equal-sized units**
  - Values have order
    - E.g., *temperature in C˚or F˚, calendar dates*
  - No true zero-point
- **Ratio** ร้อยแท้
  - Inherent **zero-point**
  - We can speak of values as being an order of magnitude larger than the unit of measurement (10 K˚ is twice as high as 5 K˚).
    - e.g., *temperature in Kelvin, length, counts, monetary quantities*

Discrete vs. Continuous Attributes

- **Discrete Attribute** ไม่มีค่าระหว่าง 2 ค่า เช่น 1, 2 จะไม่มีค่าระหว่างกับ 2
  - Has only a finite or countably infinite set of values
    - E.g., zip codes, profession, or the set of words in a collection of documents
  - Sometimes, represented as integer variables
  - Note: Binary attributes are a special case of discrete attributes
- **Continuous Attribute** มีค่าอยู่ตรงกลางระหว่าง 2 ค่า
  - Has real numbers as attribute values
    - E.g., temperature, height, or weight
  - Practically, real values can only be measured and represented using a finite number of digits
  - Continuous attributes are typically represented as floating-point variables