MIS 0855 Fall 2016 – Data Science

Week 2 – Data, Information, and Knowledge

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Sep. 8th, 2016
Data, Information, and Knowledge

- We tend to use data and information interchangeably.
- Can you think of a difference between data, information, and knowledge?
Data, Information, and Knowledge

- Data: Raw, unorganized facts that describe the characters of an event or an object
- Information: Data that is processed and organized with meaning and value
- Knowledge: Collection of information and data that is useful for decision makings
## Data – Example

<table>
<thead>
<tr>
<th>Student</th>
<th>Exam Score</th>
<th>Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>87</td>
<td>90%</td>
</tr>
<tr>
<td>Sue</td>
<td>98</td>
<td>100%</td>
</tr>
<tr>
<td>Jack</td>
<td>41</td>
<td>30%</td>
</tr>
<tr>
<td>Mary</td>
<td>77</td>
<td>80%</td>
</tr>
<tr>
<td>Phillip</td>
<td>65</td>
<td>60%</td>
</tr>
<tr>
<td>Steve</td>
<td>88</td>
<td>95%</td>
</tr>
<tr>
<td>Helen</td>
<td>72</td>
<td>82%</td>
</tr>
</tbody>
</table>

- What *information* can we find out from this data?
## Information – Example

<table>
<thead>
<tr>
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<tr>
<td>Helen</td>
<td>72</td>
<td>82%</td>
</tr>
</tbody>
</table>

**Exam Analysis:**
- Mean: 75.4
- Median: 77
- Lowest Score: 41 (Jack)
- Highest Score: 98 (Sue)

● What *knowledge* can we discover from this information?
The students who get lower exam scores also have lower attendance.

<table>
<thead>
<tr>
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</thead>
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<td>72</td>
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</tr>
</tbody>
</table>

**Exam Analysis:**
- Mean: 75.4
- Median: 77
- Lowest Score: 41 (Jack)
- Highest Score: 98 (Sue)
Data
– Another Example

What kind of information can we get from this data?

http://finance.yahoo.com/q/hp?s=CMCSA
Information – Another Example

Comcast Corporation (CMCSA)  
57.99  +0.77 (+1.35%)  NASDAQ - As of 10:57AM EST

- Comcast stock has risen by 12.8 for the last one year.
Knowledge – Another Example

Comcast Corporation (CMCSA) ★ Watchlist

58.14 +0.92(+1.61%) NASDAQ - As of 11:05am EST

- Comcast has outperformed the Dow-Jones Index by 3.33%-point.
MIS 0855 Fall 2016 – Week 2 – Data, Information, Knowledge

Diagram: Data, Information, Knowledge

Data: Value, Meaning
Information: Knowledge

Data:
- Cluster
- Validate

Information:
- Associate
- Relate
- Classify
- Synthesize

Knowledge:
- Interpret
### What Information, Knowledge from Philadelphia Crime Records?

<table>
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<tr>
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<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<td>-75.1570</td>
<td>39.96282</td>
<td>12043023</td>
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</tr>
</tbody>
</table>
NSA Collection of “Metadata”

- What is this report saying?
- According to this report, did the NSA listen to our actual phone conversations?
- Which information then did they collect?

http://mashable.com/2013/06/07/nsa-prism-faq/
Metadata

- Data Dictionary
- “Data for data”
- Data that explains what this data is, what it is for, and how it is structured
  - e.g. title, description, data type
The ‘Me’ in Metadata

Almost every digital file we generate carries invisible tags.

**METADATA EXAMPLES**
- Focal length
- Camera type
- Exposure
- Flash setting
- Internet provider
- Mail client
- IP address
- Preferred language
- Home location
- Place ID

**From the tweet:**
- **COORDINATES** 42.59640 -114.4012
- **LANGUAGE** EN

**From the email:**
- **DATE/TIME** 2013: 04: 22 15: 57: 33

**From the photo:**
- **CAMERA TYPE** HTC ONE X
- **FLASH SETTING** AUTO

---

1. Geoff poses by a waterfall and snaps a self-portrait, which he immediately tweets, then emails to his grandmother.

2. Geoff’s text, photo, and email ascend to a series of remote servers, each dragging their own trails of metadata.

3. Once there, the metadata may be extracted and interpreted by any interested party with access.

---

Thanks to the above metadata, without ever having met Geoff, we know he was at Shoshone Falls near Twin Falls, Idaho, at 3:57 p.m. on April 22, that he has an HTC One X smartphone, and that he is an English language speaker.

---

**Source:** staff reporting

**Note:** Actual metadata code modified for readability. Many metadata values, such as time, can be extracted from multiple sources, and values may differ slightly.

**The Wall Street Journal**

How would you describe this data?

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<tr>
<td>17</td>
<td>1 J</td>
<td>2006-01-01 17:26</td>
<td>2006-01-01 17:26</td>
<td>17:26:00</td>
<td>2.00601E+11</td>
<td>2400 BLOCK S 23RD ST</td>
<td>12079316</td>
<td>Thefts</td>
<td>-75.1877</td>
<td>39.92192</td>
<td>12033577</td>
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<tr>
<td>18</td>
<td>1 J</td>
<td>2006-01-02 10:12</td>
<td>2006-01-02 10:12</td>
<td>10:12:00</td>
<td>2.00601E+11</td>
<td>23RD ST /RITNER ST</td>
<td>12069574</td>
<td>Thefts</td>
<td>-75.1852</td>
<td>39.92258</td>
<td>120254114</td>
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<tr>
<td>19</td>
<td>1 A</td>
<td>2006-01-02 12:36</td>
<td>2006-01-02 12:36</td>
<td>12:36:00</td>
<td>2.00601E+11</td>
<td>1400 BLOCK MIFLIN ST</td>
<td>12067807</td>
<td>Thefts from Vehicle</td>
<td>-75.1693</td>
<td>39.92678</td>
<td>12022168</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1 E</td>
<td>2006-01-03 7:05</td>
<td>2006-01-03 7:05</td>
<td>7:05:00</td>
<td>2.00601E+11</td>
<td>2200 BLOCK S 20TH ST</td>
<td>12074130</td>
<td>Thefts from Vehicle</td>
<td>-75.1797</td>
<td>39.92335</td>
<td>12028491</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>2 C</td>
<td>2006-01-03 14:15</td>
<td>2006-01-03 14:15</td>
<td>14:15:00</td>
<td>2.00601E+11</td>
<td>1700 BLOCK HICKMAN</td>
<td>12006172</td>
<td>Robbery No Firearm</td>
<td>-75.1752</td>
<td>40.01526</td>
<td>12024523</td>
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</tr>
</tbody>
</table>
## Metadata for Philadelphia Crime Logs

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Alias</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC_Dist</td>
<td>District</td>
<td>A two character field that names the District boundary.</td>
<td>Text</td>
</tr>
<tr>
<td>DC_Key</td>
<td>DC Number</td>
<td>The unique identifier of the crime that consists of Year + District + Unique ID.</td>
<td>Text</td>
</tr>
<tr>
<td>Dispatch_Date_Time</td>
<td>Dispatch Date/Time</td>
<td>The date and time that the officer was dispatched to the scene.</td>
<td>Date/Time</td>
</tr>
<tr>
<td>Hour</td>
<td></td>
<td>The generalized hour of the dispatched time.</td>
<td>Date/Time</td>
</tr>
<tr>
<td>Location_Block</td>
<td>Location Block</td>
<td>The location of crime generalized by street block.</td>
<td>Text</td>
</tr>
<tr>
<td>Sector</td>
<td>PSA</td>
<td>A single character field that names the Police Service Area boundary.</td>
<td>Text</td>
</tr>
<tr>
<td>Text_General_Code</td>
<td>General Crime Category</td>
<td>The generalized text for the crime code.</td>
<td>Text</td>
</tr>
<tr>
<td>UCR_General</td>
<td>UCR Code</td>
<td>The rounded crime code, i.e., 614 to 600.</td>
<td>Numeric</td>
</tr>
</tbody>
</table>

[Link to dataset](http://metadata.phila.gov/#home/datasetdetails/5543868920583086178c4f8e/representationdetails/570e7621c03327dc14f4b68d/)
### Data Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Examples</th>
<th>What it’s called in Excel</th>
<th>What it’s called in Tableau</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integer</td>
<td>Whole numbers</td>
<td>35, 102, -40, 0</td>
<td>Number</td>
<td>Number (whole)</td>
</tr>
<tr>
<td>Floating point</td>
<td>Fractional values</td>
<td>3.56, -1.0, 10.123</td>
<td>Number</td>
<td>Number (decimal)</td>
</tr>
<tr>
<td>Boolean</td>
<td>Binary (2) values</td>
<td>True/False, Male/Female</td>
<td>N/A</td>
<td>Boolean</td>
</tr>
<tr>
<td>String</td>
<td>Numeric and non-numeric characters</td>
<td>Bob, I like cheese, hello123</td>
<td>Text</td>
<td>String</td>
</tr>
<tr>
<td>Date/Time</td>
<td>Calendar date and time</td>
<td>8/31/2014, 10:05 AM, 8/31/2014 10:05 AM</td>
<td>Date</td>
<td>Date or Date &amp; time</td>
</tr>
</tbody>
</table>
Why do we need Metadata?

- Because computers are dumb!
- It is getting there, but computers are still not able to understand what the data means and what it is for.
- So, we have to describe it for them.

Metadata is everywhere

- Kindle Store > Kindle eBooks > Business & Money > Management & Leadership > Leadership

- How Google Works [Kindle Edition]
  - Eric Schmidt (Author), Jonathan Rosenberg (Author)
  - 4 stars (162 customer reviews)
  - Print List Price: $30.00
  - Kindle Price: $10.99
  - You Save: $19.01 (63%)
  - Sold by: Hachette Book Group

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  - Word Wise: Enabled
  - Don’t have a Kindle? Get your Kindle here.
  - Whispersync for Voice: Ready

- The New York Times
  - http://nyti.ms/1sSSAQD

- Cuomo to Propose 2 New Minimum Wages, for New York City and State

- By JESSE McKINLEY     JAN. 18, 2015