Link Correlated Military Data for Better Decision Support
Problem: Locate required data from a “data sea”
—— To win the information superiority

• What a decider requires:
  – Data directly useful to solve decision problem
  – Data of interest or highly related to decision problem

• What a decider usually gets:
  – Huge amount of data while few have relevancy

• So the decider needs to:
  – Check each data’s relevancy till required data are found
  – Guess the location of required data by experience

Better solution?
One answer: Data navigation

• Data navigation:
  – Meaning: Lead the path to the required data step by step, based on some kind of guidance

• Three basic kinds of guidance:
  – Classification: guide through data taxonomy
  – Keyword: guide through keyword-based search results
  – Correlation: guide through correlations among data

Any difference?
Example decision problem – Who are robbers?

• “A bank was robbed last night. A man named Tom was arrested inside the bank, with a QSZ92 5.8mm gun found in his hand, made in company KGE. He refused to provide other robbers’ names.”

• To find other robbers, a possible way:
  1. Investigate company KGE, list its customers
  2. Gather intelligence, analyze each customer’s recent activities
  3. Check features of each activity (time, place, weapons, etc.), compare with the bank robbery event, so as to find suspects

How to support this decision through data navigation?
Data navigation method - Classification-based

Customers of company KGE

- Users need to know exactly under which branch of the tree he can or may find the required data.
Data navigation method - Keyword-based

- Users need to master precise keywords to both extract required data, and filter out irrelevant ones.
Data navigation method - Correlation-based

- Users just follow links of interest
- No restriction on content of links – by all possible data correlations
Merits of correlation-based method

• By links, one can jump from data to data directly.
• Navigation by links is as easy as surfing on Internet.
• Link construction is based on data correlations. Link selection is upon user interest.
• What user may associate, there is a link to support him, given links rich enough.

A method suited to human association habit?
Method: Unified correlation description

- RDF (Resource Description Framework)
  - `<Subject, Predicate, Object>`
- Example:
Method: Unified correlation description

Linked Data
- Use URIs as names for things;
- Use HTTP URIs so that people can look up those names;
- When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL);
- Include links to other URIs, so that they can discover more things.

09: 6,700,000,000

Domain
- Place
- People
- Company
- Book
- Thesis
- Music
- Movie
- TV
- Military?
Method: Automatic link construction

(a) Data in relational database

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KGE</td>
<td>QSZ92</td>
</tr>
<tr>
<td>2</td>
<td>KGE</td>
<td>QSS05</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>QSZ92</td>
<td>500m</td>
</tr>
<tr>
<td>2</td>
<td>QSS05</td>
<td>300m</td>
</tr>
</tbody>
</table>

(b) Table structure

Company Info
- Name VARCHAR(200) <pk>
- Product VARCHAR(200) <fk>

Weapon Info
- Type VARCHAR(200) <pk>
- Range DOUBLE

(c) Correlated data network

KGE
- ProductOf
  - QSZ92
    - Range
      - 500m
  - QSS05
    - Range
      - 300m

(d) Hyperlinks on user interfaces
Method: Automatic link construction

- D2R tool
Implementation

• Correlations generated from relational database
Implementation

- Description script of data correlations

```xml
.rdf:RDF
    xmlns:dc="http://dc.org/#"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:military="http://military.org/#" >
    <rdf:Description rdf:about="http://dc.org/#tom">
        <dc:hasWeapon rdf:resource="http://military.org/#gun"/>
        <dc:hasIdentity rdf:resource="http://dc.org/#police"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://dc.org/#terrorist">
    </rdf:Description>
    <rdf:Description rdf:about="http://dc.org/#USA">
        <dc:producerOf rdf:resource="http://military.org/#gun"/>
    </rdf:Description>
    <rdf:Description rdf:about="http://military.org/#missile">
        <dc:hasproducer rdf:resource="http://dc.org/#iraq"/>
    </rdf:Description>
    <dc:hasType rdf:resource="http://military.org/#heavyWeapon"/>
    <dc:is rdf:resource="http://military.org/#weapon"/>
</rdf:Description>
```
Methods comparison

• **User’s view on operation mode**

(a) Classification-based  
(b) Keyword-based  
(c) Correlation-based

• **Method performance**

<table>
<thead>
<tr>
<th></th>
<th>Problem Relativity</th>
<th>Operation Efficiency</th>
<th>Navigation Convergence</th>
<th>User Skill Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification-based</td>
<td>Low</td>
<td>Dependent</td>
<td>Assured</td>
<td>High</td>
</tr>
<tr>
<td>Keyword-based</td>
<td>Medium</td>
<td>Dependent</td>
<td>Not assured</td>
<td>High</td>
</tr>
<tr>
<td>Correlation-based</td>
<td>High</td>
<td>Dependent</td>
<td>Not assured</td>
<td>Low</td>
</tr>
</tbody>
</table>
Navigation within correlated data network
Summary

- Correlation-based method is a good complement to traditional methods, not a substitute.
- A method is suited to human association habit.
- With more data networked through correlations, and statistical-analytic tools to support network mining, existing data will be more interesting.
Discussion

• Is it possible to link all military data by correlations?
• How to link data in different formats, text, media…?
• How to make better use of data correlations?