Knowledge Graphs for Global Events and Trade

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D2R2’23: Second International Workshop on Linked Data-driven Resilience Research 2023
Knowledge Graphs for Global Events

Events, Supply Chains & EventKG
Events & Supply Chains

1. The COVID-19 Pandemic
   - When: January 2020 to present | Where: Global

2. Computer Chip Factory Fire
   - When: March 2021 | Where: Japan

3. Brexit
   - When: January 2020–present | Where: UK

4. The Ever Given Shipping Container Blockage
   - When: March 2021 | Where: Suez Canal, Egypt

5. Drought
   - When: 2021 | Where: Taiwan

6. The Big Freeze
   - When: February 2021 | Where: USA
EventKG: A Multilingual Event-Centric Temporal Knowledge Graph

- 1.7M events and more than 8M temporal relations
  - 2nd inauguration of Barack Obama
  - “The Space Shuttle Challenger is launched on its maiden voyage”
  - Jennifer Aniston, married to, Brad Pitt, [2000-07-29,2005-10-02]

- Integrated data in 15 languages with provenance information

- [https://eventkg.l3s.uni-hannover.de/](https://eventkg.l3s.uni-hannover.de/)
EventKG Sources

Cross-domain knowledge graphs

Textual knowledge bases

Wikipedia Current Events Portal

Event Ontology

Knowledge Graphs for Global Events and Trade
Example Query: Natural events that affect companies

Which pairs of natural events and companies are most related?

```sql
SELECT ?eventLabel ?companyLabel (SUM(?links) AS ?count)
WHERE {
  ?related rdf:type dbo:Company .
} GROUP BY ?eventLabel ?companyLabel
ORDER by DESC(?count)
```
Example Query Results

<table>
<thead>
<tr>
<th>eventLabel</th>
<th>companyLabel</th>
<th>count</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011 Tōhoku earthquake and tsunami</td>
<td>Toyota</td>
<td>132</td>
</tr>
<tr>
<td>1923 Great Kantō earthquake</td>
<td>Sharp Corporation</td>
<td>100</td>
</tr>
<tr>
<td>1906 San Francisco earthquake</td>
<td>Munich Re</td>
<td>98</td>
</tr>
<tr>
<td>2011 Tōhoku earthquake and tsunami</td>
<td>Tokyo Electric Power Company</td>
<td>96</td>
</tr>
<tr>
<td>2004 Chūetsu earthquake</td>
<td>Sanyo</td>
<td>90</td>
</tr>
</tbody>
</table>
Knowledge Graphs for Global Events – Conclusion

- Modelling events in knowledge graphs can help get an understanding of disruptions in the market.

- Open Questions / Challenges
  - How to get and deal with dynamic information?
  - How fine-granular does event information need to be?
  - Can we predict events? Can we predict the effect of events?
Example Applications of EventKG

Visualisation and Interaction

Question Answering

Anomaly Detection

News Analysis

Knowledge Graphs for Global Events and Trade
Knowledge Graphs for Global Trade

Trade-based Money Laundering, Company & Trade Data, Red Flags
Trade-based Money Laundering (TBML)

- TBML is the process of disguising the proceeds of crime and **moving value using trade transactions to legitimize their illicit origins**. TBML involves the **exploitation of the international trade system** for the purpose of transferring value and **obscuring the true origins of illicit wealth**. TBML schemes vary in complexity but typically involve **misrepresentation of the price, quantity, or quality of imports or exports**.

Trade Based Money Laundering – A Massive Illicit Flow

- Estimated money laundered globally is 2 - 5% of global GDP per year, or USD $715 billion - $1.87 trillion\(^1\)

- Special case: brand protection
  - Counterfeit products often deceptively resemble the original
  - The quality of plagiarism isn’t calculable

- A problem for people and institutions
  - Consumers, manufacturers, banks, law enforcement agencies

➢ There is a global lack of a scientifically based understanding of how illegal transactions can be recognized and what patterns they follow

We need to model large datasets of company and trade data to understand TBML patterns.

Trade data: Shipments, seller, provider, price, …

Company data: Address, revenue, ownership…
Company & Trade Ontology

Example Trade Data Graph
Examples of Red Flags to Detect Suspicious Patterns

- "If the entity is sanctioned"

- "If the entity is connected by trade to a sanctioned entity"
- "If the weight of a traded good mismatches the average in its product category"

➢ Next step: Inference of new patterns

```sparql
SELECT ?organisation WHERE {
  ?organisation rdf:type so:Organization;
  att:isSanctioned true .
}
```
Knowledge Graphs for Global Trade – Conclusion

- Brand protection is an important aspect of supply chain security

- Open Questions / Challenges
  - Large amounts of different datasets needed
  - Evaluation is difficult and training data is hard to get
  - Sensitive area
Example Scenario

Resilience through Unique Codes
Schaeffler: German manufacturer with
- > 200 sites in > 50 countries
- > 40,000 different products

How can Schaeffler identify fake products and follow their distribution?

OneCode: A unique code for each product
Global database of codes

If the same code is scanned twice on different packagings: Fake!
Timeline of Scans
From Codes and Trade Data to Global Networks

- Scanned codes
- Scan Locations
- Company and Trade Data
- Company and Trade Knowledge Graph
- Global Network of Companies and Suspicious Trade Transactions
Knowledge Graphs for Global Events and Trade

Thank You!

1. **Knowledge Graphs for Global Events:** Events, Supply Chains & EventKG
2. **Knowledge Graphs for Global Trade:** TBML, Company & Trade Ontology, Red Flags
3. **Example Scenario:** Resilience through Unique Codes

Tomorrow afternoon: Workshop on Semantic Methods for Events and Stories (SEMMES)

https://anr-kflow.github.io/semmes/