Bringing The Output of Open Information Extraction to The RDF/XML Format: A Case Study

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Open Information Extraction

- Introduced by Michele Banko et al. in 2007
- Strategy for Information Discovery in arbitrary texts
- Arbitrary relations are numerous. It is not possible to make an exhaustive list of all relations and their arguments
- Traditional Information Extraction (IE) methods focus on particular relations
- OIE methods extract arbitrary relations based on specific NLP patterns without requiring a pre-specified vocabulary or large manually tagged training corpora
- Relations are extracted in the form of tuples

Example:

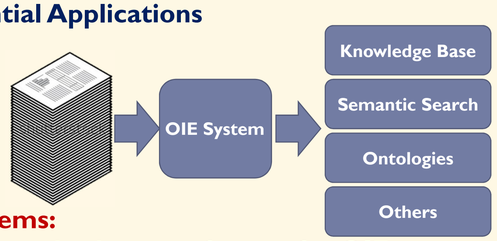
"Correspondent Steve Roizner works for the BBC"

Arg1, Subj: *Steve Roizner*^Person

Rel,VP: *works* — Rel : hasJobTitle

Arg2, FOR: *the BBC* — Arg2: *correspondent*

Potential Applications



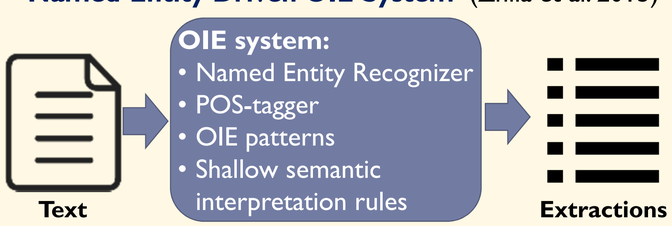
Problems:

- **No standard output format for OIE systems**
- **No general approaches on how to represent complex language phenomena, e.g., reported speech**

Case-study OIE system

We chose an OIE system with the most extended semantic interpretation of extracted relations

Named-Entity Driven OIE System (Zhila et al. 2015)



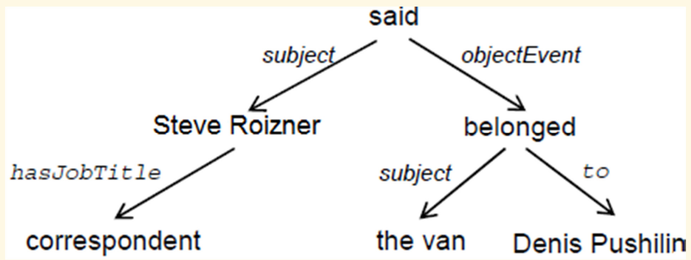
Example:

Correspondent Steve Roizner said the van belonged to Denis Pushilin.

1. **Part-of-speech tagging**
   Correspondent^NN *Steve*^NNP *Roizner*^NNP *said*^VBD *the*^DT *van*^NN *belonged*^VBD *to*^TO *Denis*^NNP *Pushilin*^NNP
2. **Named entity recognition**
   Correspondent [*Steve Roizner*]^Person *said the van belonged to* [*Denis Pushilin*]^Person
3. **Syntactic chunking**
   [*Correspondent Steve Roizner*]^NounPhrase *said*^VerbPhrase [*the van*]^NounPhrase *belonged*^VerbPhrase [*to Denis Pushilin*]^PrepositionalPhrase
4. **Information extraction**
   <*Correspondent Steve Roizner*><*said*><*the van*><*belonged to*> <*Denis Pushilin*>
5. **Post-processing rules**
   <*Steve Roizner*><*said*><*the van*><*belonged*> <to: *Denis Pushilin*>
   <*Steve Roizner*>< hasJobTitle: *correspondent*>

Steps 1-3 are performed with GATE NLP Toolkit
Steps 4, 5 are the proper OIE system

Output represented as a semantic graph



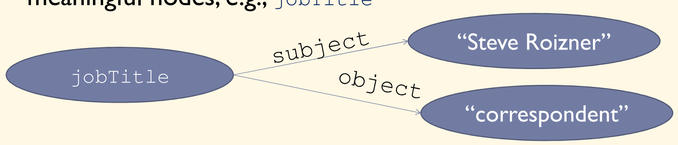
Conversion to RDF

I. RDF Vocabulary: Properties

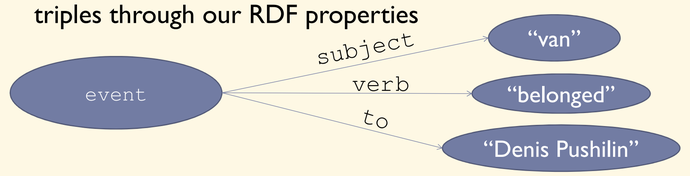
We use a syntax based vocabulary:
verb, subject, object, objectEvent, prepositions.

II. Correspondences with RDF model

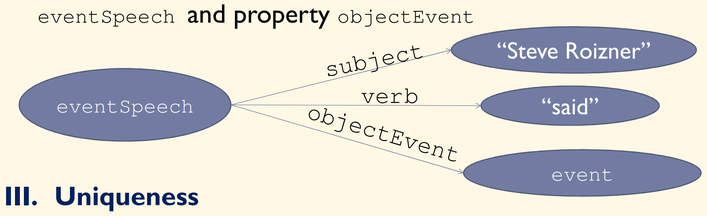
1) Extracted tuple components ↔ RDF literals ,
   e.g., <*belonged*> ↔ "*belonged*", <*the van*> ↔ "*van*"
2) Non-verb based relations are represented as semantically meaningful nodes, e.g., jobTitle



3) A verb-based relation as a whole is represented as a special event node with which components form RDF triples through our RDF properties



4) Reported speech act is represented as a special node eventSpeech and property objectEvent



III. Uniqueness

To make the event, eventSpeech and jobTitle nodes unique, we enumerate them throughout the document

IV. RDF/XML representation

We chose this format for convenience in a particular task.
All RDF formats are equivalent.

```
<rdf:Description rdf:about="doc:eventSpeech1">
<dpp:verb>docTerm:says</dpp:verb>
<dpp:subject>docTerm:SteveRoizner</dpp:subject>
<dpp:objectEvent>event1</dpp:objectEvent> </rdf:Description>
<rdf:Description rdf:about="doc:event1">
<dpp:verb>docTerm:belonged</dpp:verb>
<dpp:subject>docTerm:van</dpp:subject>
<dpp:to>DenisPushilin</dpp:to> </rdf:Description>
<rdf:Description rdf:about="doc:jobTitle1">
<dpp:subject>docTerm:SteveRoizner</dpp:subject>
<dpp:object>docTerm:correspondent</dpp:object> </rdf:Description>
```

V. Validation

We successfully validated the output with the official W3C RDF/XML validator at http://www.w3.org/RDF/Validator/

Conclusions

- Conversion procedure for OIE output to RDF model
- Universal syntax-based property vocabulary
- Arbitrary verb-based relations represented in RDF through abstract event nodes
- Reported speech representation via eventSpeech – event
- Uniqueness throughout the document

*We **acknowledge Saint Petersburg State University** for research grant 30.38.305.2014.*