Linked Metaphors

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Abstract. The poster summarizes Amnestic Forgery, an ontology for metaphor semantics, based on MetaNet and Framester factual-linguistic linked data. An example of metaphor generation based on linked metaphors is shown.

1 Introduction

A metaphor is a cognitive operation involving usage of natural language and cross-domain conceptual mapping. Its ontological interest goes beyond purely cognitive and linguistic aspects, since ontology-based extraction and representation of knowledge need to make the semantics of natural language explicit even in presence of such phenomena. More generally, metaphor detection can help in improving Natural Language Understanding which can in turn allow the machines to understand and interpret presence of Metaphors.

We have designed an OWL ontology for metaphors, compliant with the frame-based semantics of Framester[1], and populated it with data from Berkeley's MetaNet [2]. It is the reference repository of conceptual metaphors, developed as a Semantic Wiki[2], maintained through collaborative editing by multiple conceptual metaphor experts. In Conceptual Metaphor Theory (CMT) [5], a metaphor is supposed to map aspects of a target domain (e.g. *love*) to those of another domain (e.g. *travel*). MetaNet used FrameNet [1] *frames* as units of those domains, and *frame elements* as their aspects. The new ontology is called Amnestic Forgery[3] which is deployed as an extension of Framester [4]. It is a knowledge graph represented as Linked Open Data, which integrates heterogeneous linguistic resources (OntoWordNet, VerbNet, FrameNet-OWL, BabelNet, etc.), factual datasets (DBpedia, YAGO, etc.), and foundational ontologies, by providing them a unified formal semantics.

2 Amnestic Forgery: an ontology for MetaNet and beyond

Framester is a large knowledge graph containing more than 50 million triples linking millions of linguistic, conceptual, or real world entities. This ontology is based on Descriptions and Situations (D&S) [3]. The D&S formal framework is appropriate to

[1] `http://etna.istc.cnr.it/framester2/sparql`

[2] `https://metaphor.icsi.berkeley.edu/pub/en/`

[3] This is a recursive name, since FORGERY IS AMNESIA is a new metaphor generated by means of the ontology itself, cf. Sect. 2.

formalise the (informal) explanation of the FrameNet [1] core schema, which distinguished between frames and frame occurrences, or *situations*: "For example, the **Apply heat** frame describes a common situation involving a Cook, some Food, and a Heating Instrument, and is evoked by words such as bake, blanch, boil, broil, brown, simmer, steam, etc. We call these roles frame elements and the frame-evoking words are lexical units in the **Apply heat** frame".

Once formalised in D&S, the FrameNet implicit schema becomes a semiotic passepartout: a frame f, as a description, can be the reification of any relation ρ with arbitrarily variable arity, a frame element fe is a binary projection of ρ, and a lexical unit lu of f is a symbol, for which ρ (and its reified counterpart f), and its projections $fe_{1...n}$ act as intensional interpretations. A "common situation" s described by f is the extensional interpretation (aka *denotation*) of lu, whose intension is f. The *FrameProjection* class allows to integrate any predicate defined either intensionally or extensionally in ontologies, lexical resources, or other vocabularies or web formats, For example, the FrameNet frame `Activity_start` as well as the VerbNet verb class `verbclass-begin-55.1-1` are linked as intensionally equivalent to the Framester frame `ActivityStart`, while the synset `synset-newcomer-noun-1` from WordNet, which is intensionally mapped to FrameNet `Activity_start`, is extensionally represented as a class of newcoming entities, and linked as a *unary projection* of a Framester class of newcoming situations, `Newcomer.n.1`, which on its turn is represented as a subclass of `ActivityStart`.

In D&S, higher-level descriptions can also be defined, e.g. for meta-norms that describe priority between other norms. This expressive capability can be used to represent a metaphor as a mapping operation between frames, as informally represented by MetaNet and CMT. A metaphor itself is a kind of description, which incorporates roles (frame elements) for two frames (the source and target frames), as well as mapping rules between the respective roles.

The design approach taken to formalise MetaNet is to use D&S in order to extract and formalise a metaphor, then to extract data and formally represent them according to that schema, and finally to align the schema and data to elements in the Framester knowledge graph.

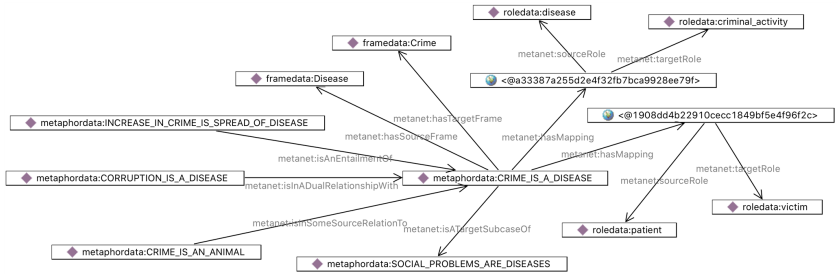

Fig. 1: The subgraph for the metaphor CRIME_IS_A _DISEASE.

We have firstly scraped tabular data from the MetaNet wiki[4], and we have designed a preliminary MetaNet schema that catches the intended meaning of the interface used to

[4] It is a SemanticMediaWiki instance, but its data querying facility is not accessible.

populate the MetaNet wiki. Secondly, we have refactored the extracted data according to this preliminary schema, and fine-tuned it against features deriving from the data entry variety in the wiki. The result is a refined schema, the Amnestic Forgery ontology, and its MetaNet data. Fig. 1 depicts a subgraph of MetaNet for the metaphor CRIME_IS_A_DISEASE. The subgraph contains examples of the core relations in MetaNet, linking metaphors to their source and target frames, their role mappings, entailments, and possibly other more vague relations contributed by the users of the wiki.

A summary diagram of the axiomatisation for Amnestic Forgery is shown in Fig. 2. The diagram uses a UML-class-diagram-oriented profile to sketch the core axioms for the `Metaphor` class, shown either as "attributes" within class boxes, or as either "associations" (restrictions), or "generalisations" (subsumptions) across class boxes. The diagram summarizes the reuse of the `Description` class from D&S, which subsumes the `Metaphor`, `Frame`, and `MetaphoricRoleMapping` classes. A hierarchy of frame and role notions exemplify Framester schema alignements, and the treatment of semantic roles as both binary projection of frames, and OWL properties (binary relations). Association-like edges derive from either domain or range restrictions in the OWL encoding of Amnestic Forgery, or from existential restrictions. Please refer to the OWL file for the full axiomatization, including imports, alignments, disjointness, and documentation axioms[5].

Generating new metaphors with MetaNet and Framester: In order to prove the advantages of having a large and formally rigorous knowledge base, we report here a query to Framester extended with Amnestic Forgery and MetaNet data. Given a MetaNet metaphor, the query is able to generate hundreds of novel intensional metaphors: an API is available online[6]. Example results include e.g. the eponymous Amnestic Forgery as a linguistic rendering of the FORGERY_IS_AMNESIA metaphor, which appears to be actually novel: no realisations can be found e.g. on the Web (based on Google searching). The query running behind the API Amnestic Forgery (see below), as announced earlier only uses adjective-noun phrase constructions, and their related senses and frames in Framester.

```
prefix metanet: <https://w3id.org/framester/metanet/schema/>
prefix framedata: <https://w3id.org/framester/metanet/frames/>
prefix metaphordata: <https://w3id.org/framester/metanet/metaphors/>
SELECT DISTINCT ?ssyn ?tsyn
WHERE {
metaphordata:CRIME_IS_A_DISEASE metanet:hasSourceFrame ?s ;
     metanet:hasTargetFrame ?t .
?s skos:closeMatch ?fns . ?fns a fn15schema:Frame .
?t skos:closeMatch ?fnt . ?fnt a fn15schema:Frame .
?fns skos:closeMatch ?ssyn .
?fnt skos:closeMatch ?tsyn .
{?ssyn a wn30schema:AdjectiveSynset}
UNION
{?ssyn a wn30schema:AdjectiveSatelliteSynset}
```

[5] https://github.com/alammehwish/AmnesticForgery

[6] https://lipn.univ-paris13.fr/framester/en/metanet/

```
?tsyn a wn30schema:NounSynset }
```

Ongoing and future work bears multiple directions: completing the alignment of MetaNet frames to FrameNet frames (currently covering only about 25% of Metanet), automatically detecting metaphorical sentences in text; automatically enriching metaphoric knowledge graphs.

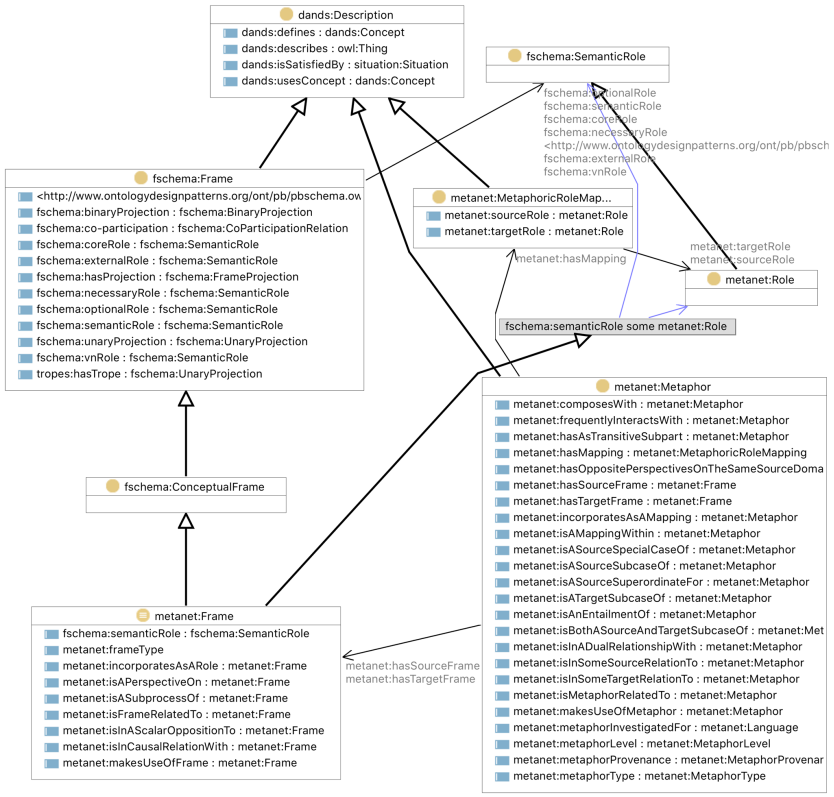

Fig. 2: A class-diagram profile for the OWL axiomatisation of Amnestic Forgery.

References

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