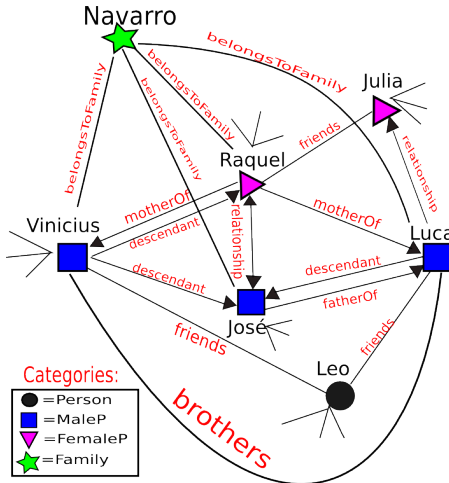

Algorithm 2 The GRL

Require: $G_i = (V, E, X)$ **Ensure:** List of Inference Rules

```
1: Find all  $\Delta(u, v, w)$  in  $G$ 
2: for all closed triangle  $\Delta(u, v, w)$  do
3:   Calculate  $\aleph(u, v)$ ,  $\aleph(v, w)$  and  $\aleph(w, u)$ 
4:   Group  $\Delta(u, v, w)$  in  $\Delta_c(c_u, c_v, c_w)$ 
5:   Group  $\Lambda(u, v)$  in  $\Lambda_c(c_u, c_v)$ ,  $\Lambda(v, w)$  in  $\Lambda_c(c_v, c_w)$  and
      $\Lambda(w, u)$  in  $\Lambda_c(c_w, c_u)$ 
6: end for
7: for all  $\Lambda_c(c_i, c_j)$  do
8:   Calculate
```

$$\aleph_c(c_i, c_j) = \sum_{\forall \Lambda(u, v) \in \Lambda_c(c_1, c_2)} (\aleph(u, v) - 1)$$

```
9: end for
10: for all  $\Delta_c(c_u, c_v, c_w)$  do
11:   Find the category pair with highest  $\aleph_c$ :
      $(c_i, c_j) = \text{MAX}(\aleph_c(c_u, c_v), \aleph_c(c_v, c_w), \aleph_c(c_w, c_u))$ 
12:   if  $\aleph_c(c_i, c_j) \geq \xi$  then
13:     Validate the rule:  $r_{c_i c_j}(c_i, c_j) \Leftarrow r_{c_i c_k}(c_i, c_k) \wedge$ 
        $r_{c_k c_j}(c_k, c_j)$ 
14:   end if
15: end for
```

**Figure 7: New Ontological Instances Graph**

knowledge base(OKB) for the execution of graph-mining algorithms to extract implicit information from it. The goal we wanted to achieve with this article(and the N° structure) is to formally define a structure to be used assisting another projects that uses ontological knowledge bases and intends to map it into graphs to apply graph-mining algorithms on it. We also wanted to present some ideas and demonstrate by using simple algorithms that graph mining techniques can be very useful to extends OKBs.

We already implemented a version of Prophet within OntExt and the Graph Rule Learner, both functional to work with NELL. We also start to work on the task of find new categories. The structure (N°) was widely used in the design and documentation of all these algorithms. This project still lack of proof of how this structure is really useful and measure it's usefulness and other characteristics of it, but we plan to work on that in a near future.

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