Ontologising Relational Triples into a Portuguese Thesaurus

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Information extraction from text

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  - *dogs*
- Binary relations, between *terms*
  - $t_2 = animal, hypernym\_of, cat$
  - $t_2 = animal, hypernym\_of, dog$

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- Kind of word-sense **disambiguation**
- Associate terms with their **meanings** in an ontology

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- In this work: **two methods for ontologising tb-triples**

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Methods

- Strategies for selecting the most suitable synsets from:
  - $A : \forall(A_i \in A) w_a \in A_i$
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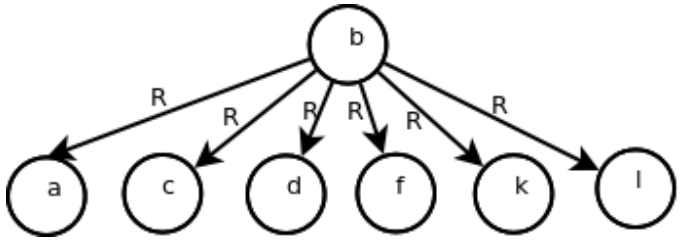
  - **Average frequency** (AF)
    - ★ compute the average frequency of the terms of each synset in Google
    - ★ attach w_a to the *most frequent* synset of A
    - ★ attach w_b to the *most frequent* synset of B

Related proportion (RP)

- For attaching w_a ($\theta = 0.5$)
  1. Fix w_b



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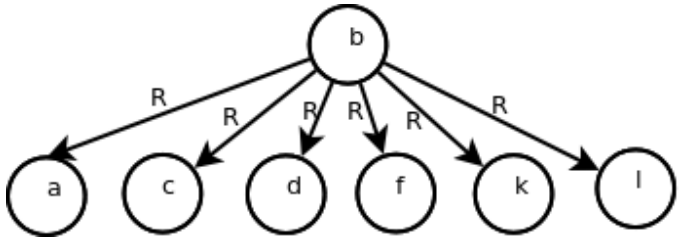

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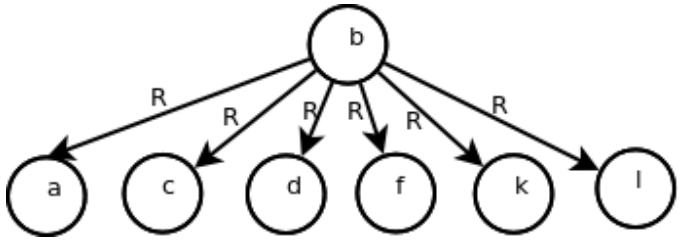

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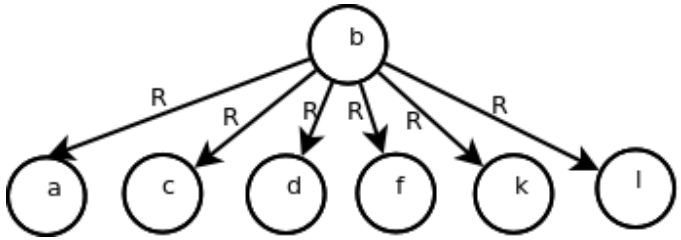

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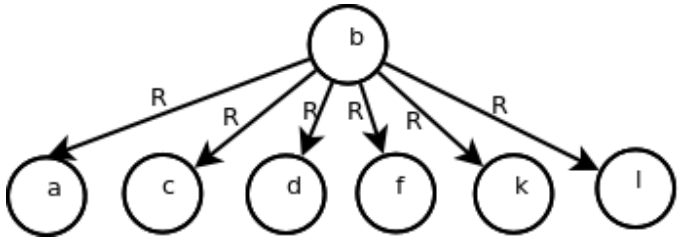

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$$sim(A_i, B_j) = \frac{\sum_{k=1}^{|A_i|} \sum_{l=1}^{|B_j|} \cos([M_{Aik}], [M_{Bjl}])}{|A_i||B_j|}$$

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3. Select the most similar pair

Thesaurus: TePOT

- Noun **synsets** from TeP 2.0[2] + OpenThesaurus.PT[3]
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$$Freq(S) = \frac{\sum_{i=1}^{|S|} Hits(w_i)}{|S|}, w_i \in S$$

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    - ★ 500 hypernymy tb-triples
    - ★ 199 part-of tb-triples
    - ★ 436 member-of tb-triples
    - ★ 125 purpose-of tb-triples

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Coverage

Table: Hypernym-of triples

Method	Ontologised triples	Coverage (%) Total	TS
Random	499/500	**99.80**	**69.00**
AF	496/500	99.60	68.80
RP 0.5	315/500	63.00	39.00
RP 0.2	382/500	76.40	49.00
AC	458/500	91.60	61.20

Table: Part-of triples

Method	Ontologised triples	Coverage (%) Total	TS
Random	199/199	**100.00**	**54.27**
AF	199/199	**100.00**	**54.27**
RP 0.5	87/199	17.40	6.60
RP 0.2	129/199	64.82	31.16
AC	188/199	94.47	49.75

Table: Member-of triples

Method	Ontologised triples	Coverage (%) Total	TS
Random	436/436	**100.00**	**74.77**
AF	427/436	97.94	72.71
RP 0.5	156/436	35.78	22.48
RP 0.2	266/436	61.01	54.59
AC	400/436	91.74	67.20

Table: Purpose-of triples

Method	Ontologised triples	Coverage (%) Total	TS
Random	125/125	**100.00**	**69.60**
AF	125/125	**100.00**	**69.60**
RP 0.5	44/125	35.20	20.80
RP 0.2	73/125	58.40	37.60
AC	121/125	96.80	66.40

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$$Recall = \frac{Precision \times |OntologisedTriples|}{|TriplesInSample|} \qquad F_1 = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

Scores of ontologised triples

Tb-triples	Sb-triples	Score
aparelho **Hypernym-of** *televisor*	*apresto,utensílio,petrechos,instrumento,apetrechos,aparelho* **Hypernym-of** *tv,televisão,televisor,têvê*	1.0
ângulo **Part-of** *triângulo*	*ângulo,face,lado* **Part-of** *triângulo,trilateral*	1.0
técnica **Member-of** *marketing*	*arte,técnica* **Member-of** *marketing*	1.0
edição **Purpose-of** *programa*	*edição,lançamento* **Purpose-of** *programa,aplicativo*	1.0
arte **Hypernym-of** *escultura*	*arte,obra* **Hypernym-of** *escultura,vulto,imagem,estátua*	0.75
província **Part-of** *país*	*província,distrito,circunscrição,região* **Part-of** *território,pátria,região,nação*	0.55
pessoa **Member-of** *raça*	*ser,pessoa,criatura,indivíduo* **Member-of** *raça,gente*	0.5
calor **Purpose-of** *combustível*	*calor,aquecimento,animação,entusiasmo* **Purpose-of** *combustível*	0.5

Supporting sentences

- *...as máquinas fotográficas digitais, os* **televisores**, *os videogravadores e outros* **aparelhos** *da electrónica de consumo...*
- *...também não consigo reparar* **televisões** *e outros* **aparelhos**.
- *O* **ângulo** *externo do* **triângulo** *($n = 3$) se obtém dividindo 360 por 3.*
- *E não estão suficientemente precavidos contras as* **técnicas** *de* **marketing**.
- *A guerra entre* **seres** *da mesma* **raça** *tornou-se no maior cataclismo jamais conhecido da história do Universo.*
- *...é um disparate queimar* **combustível** *para produzir* **calor**.

Validation results

Table: Hypernym-of triples

Method	Precision (%)		F_1 (%)	
	Total	TS	Total	TS
Random	33.46	27.37	33.43	22.35
AF	35.76	29.88	35.69	**24.36**
RP 0.5	**43.22**	**33.10**	33.41	18.58
RP 0.2	41.50	31.90	**35.95**	20.98
AC	36.45	29.16	34.85	22.14

Table: Part-of triples

Method	Precision (%)		F_1 (%)	
	Total	TS	Total	TS
Random	36.54	24.05	36.54	16.92
AF	37.30	25.05	37.30	17.63
RP 0.5	**52.99**	**28.55**	15.71	3.54
RP 0.2	47.71	28.43	37.53	13.51
AC	42.03	29.36	**40.83**	**19.51**

Table: Member-of triples

Method	Precision (%)		F_1 (%)	
	Total	TS	Total	TS
Random	32.17	27.35	32.17	23.41
AF	36.50	29.76	**36.12**	**25.06**
RP 0.5	**43.64**	**33.04**	23.00	12.13
RP 0.2	41.98	32.66	31.82	23.06
AC	37.05	30.69	35.45	24.67

Table: Purpose-of triples

Method	Precision (%)		F_1 (%)	
	Total	TS	Total	TS
Random	29.40	18.30	29.40	**15.02**
AF	29.14	17.54	29.14	14.40
RP 0.5	**49.73**	**23.63**	25.90	8.14
RP 0.2	40.69	21.62	30.01	11.81
AC	31.98	18.21	**31.36**	14.53

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Relation	$\overline{Possibilities}$	$\overline{Correct}$	$\overline{Correct\%}$
Hypernym-of	14.09	3.92	42.05%
Part-of	9.54	2.72	45.49%
Member-of	12.61	4.58	52.40%
Purpose-of	12.53	4.95	52.47%

Table: Matching possibilities in the gold resource.

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Purpose-of	12.53	4.95	52.47%

Table: Matching possibilities in the gold resource.

Method	**Hypernym-of** (135 tb-triples)		**Part-of** (72 tb-triples)		**Member-of** (105 tb-triples)		**Purpose-of** (60 tb-triples)	
	P (%)	F_1(%)	P (%)	F_1 (%)	P (%)	F_1 (%)	P (%)	F_1 (%)
Random	42.54	17.19	49.30	26.22	56.19	20.14	52.54	17.42
AF	43.18	17.25	45.83	24.63	52.48	18.21	46.55	15.21
RP 0.5	60.81	14.93	**66.67**	14.54	53.13	6.63	**68.75**	7.03
RP 0.2	57.45	17.34	58.70	22.31	56.25	13.21	59.38	11.55
AC	**61.16**	**22.77**	62.50	**30.77**	**70.00**	**22.07**	59.26	**18.23**

Table: Gold resource evaluation results.

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  - Soon freely available!

Thank you!

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