

Onto.PT: integrating lexical-semantic knowledge to build a public lexical ontology for Portuguese

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Lexical Ontologies

- Knowledge bases for natural language processing (NLP)



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- Cover the whole language, not a specific domain
- Essential in the development of NLP tools for a language
- See Princeton WordNet [Fellbaum, 1998] for English!
 - ▶ Public, widely used, created manually...



- 1 Introduction
- 2 Related resources
- 3 Goal
- 4 Approach
- 5 Onto.PT v.0.3.4
- 6 Concluding remarks



Portuguese Lexical Knowledge Bases

- Wordnets
 - ▶ WordNet.PT² [Marrafa, 2002]
 - ▶ MultiWordNet.PT³

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- Public term-based lexical-semantic network
 - ▶ PAPEL⁸ [Gonçalo Oliveira et al., 2010]

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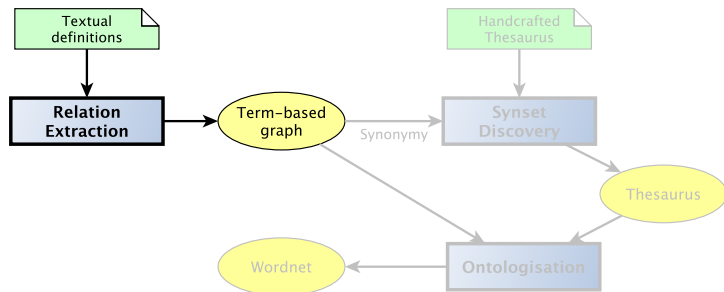


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- New lexical ontology for Portuguese
- **Wordnet** model
 - ▶ Synsets: groups of synonym words → concepts
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- Constructed **automatically**
- Exploitation and integration of **public** resources
 - ▶ Thesauri
 - ▶ Dictionaries/encyclopedias
 - ▶ Corpora
- Three independent construction steps

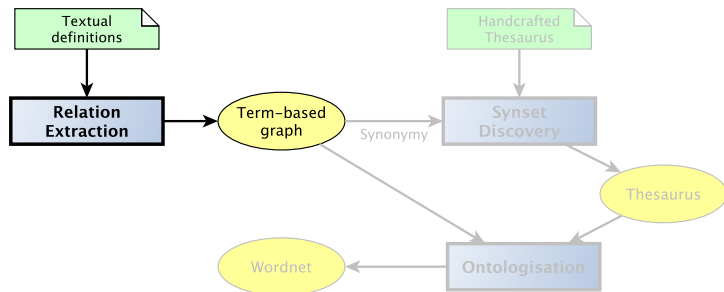


From textual definitions to a wordnet in three steps



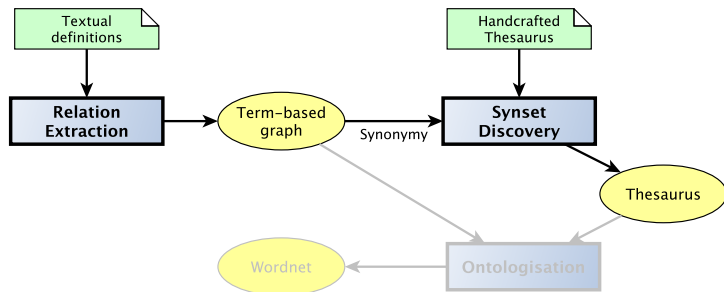
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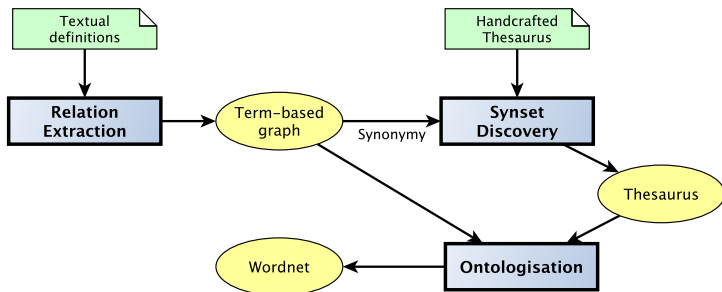
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- 3 $synset_2 = (\text{bicho, animal, alimal, béstia, minante})$
 - ▶ $sb_triple_1 = \text{synset}_2 \text{ MEMBRO_DE } synset_1$

Relation extraction from dictionaries – CARTÃO [Gonçalo Oliveira et al., 2011]

- Large lexical-semantic network for Portuguese



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- Arguments are **lexical items** identified by orthographical form
 - ▶ Ambiguity arises as a problem!



Take advantage of public handcrafted thesauri [Gonçalo Oliveira and Gomes, 2011b]

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 - ▶ CARTÃO synonymy as a network N , with synonymy pairs $p = (v_x, v_y)$
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Synonymy pair	Synset
<i>(alimentação, manutenção)</i>	→ { <i>sustento, alimento, mantimento, alimentação, manutenção</i> }
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- ▶ Evaluation
 - ★ Random baseline: Precision = 60-68%, $F_{0.5} = 61-70\%$
 - ★ Best ($\cos(\vec{p}, \vec{S}) \geq 0.15$): Precision = 74%-82%, $F_{0.5} = 73-83\%$



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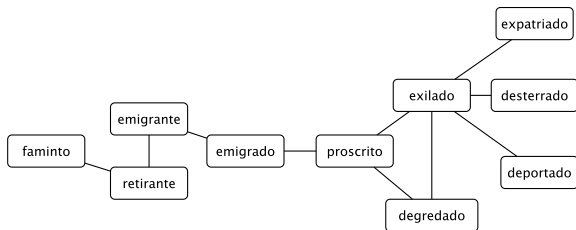
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- Discover clusters in remaining synonymy pairs
 - Remaining pairs as a synonymy network N'



Clustering for new synsets

[Gonçalo Oliveira and Gomes, 2011a]

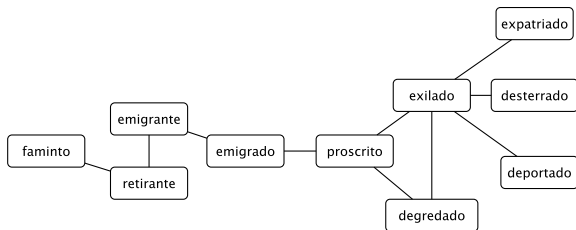
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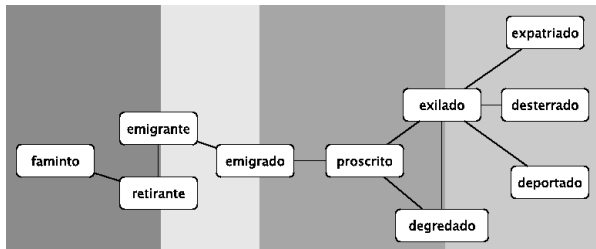


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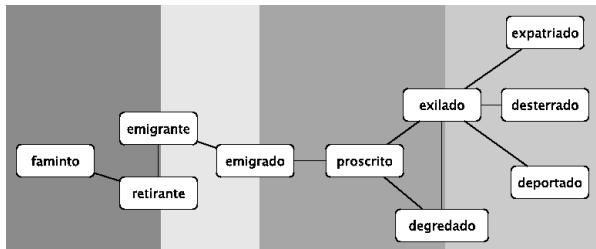
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- Cluster estimated precision:
 - ▶ Whole network: 75% (nouns)
 - ▶ After pair assignment:
 - ★ 89% (nouns), 83-92% (verbs), 94-95% (adjectives)



From term to synset relations

- Find suitable synsets for term arguments:
 - ▶ *porta* part-of *carro* → {*porta*, *entrada*, *portão*} part-of {*carro*, *automóvel*}



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- Several algorithms implemented [Gonçalo Oliveira and Gomes, 2012]
 - ▶ Random baseline:
 - ★ Precision = 42.1% (hypernymy), 47.4% (part-of), 44.8% (purpose-of)
 - ★ $F_{0.5}$ = 25.5% (hypernymy), 30.6% (part-of), 25.0% (purpose-of)
 - ▶ Best results:
 - ★ Precision = 60.1% (hypernymy), 63.3% (part-of), 63.4% (purpose-of)
 - ★ $F_{0.5}$ = 38.4% (hypernymy), 40.1% (part-of), 36.5% (purpose-of)



Onto.PT v.0.3.4

- About 150,000 lexical items
 - ▶ Only items in term triples with at least one argument occurring in AC/DC [Santos and Bick, 2000] are used



Onto.PT v.0.3.4

- About 150,000 lexical items
 - ▶ Only items in term triples with at least one argument occurring in AC/DC [Santos and Bick, 2000] are used
- Organised in about 110,000 synsets
 - ▶ Synsets are ordered according to AC/DC frequency of their words

POS	Synsets		
	size > 1	size = 1	Total
Nouns	16.962	44.924	61.886
Verbs	4.391	21.502	25.893
Adjectives	11.005	7.941	18.946
Adverbs	819	1.293	2.112



Relations (excluding inverse)

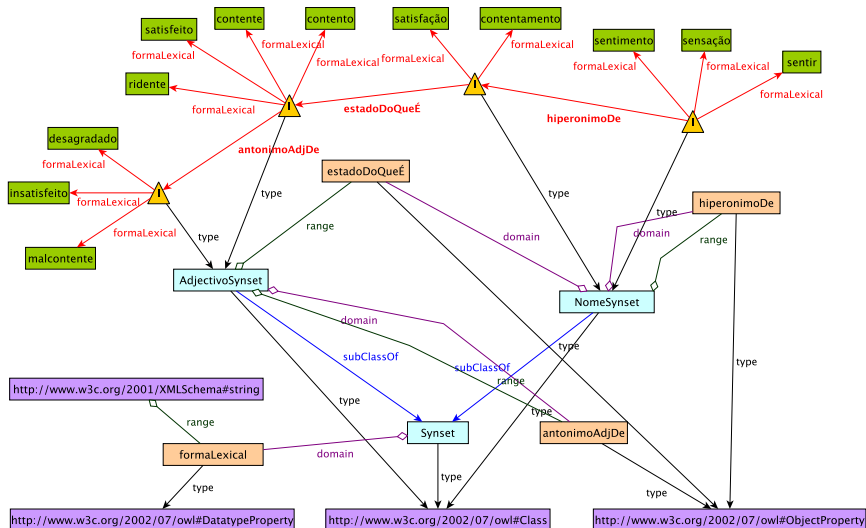
- About 170,000 synset-based relational triples
- Same relations as in PAPEL/CARTÃO

Relations	Predicates	Instances	Relations	Predicates	Instances
Hypernym	<i>n hiperonimoDe n</i>	80,533	Purpose	<i>n fazSeCom n</i>	6,601
Part	<i>n parteDe n</i>	3,679		<i>n fazSeComAlgoComProp adj</i>	82
	<i>n parteDeAlgoComProp adj</i>	4,920		<i>v finalidadeDe n</i>	7,129
Member	<i>n membroDe n</i>	5,841	<i>v finalidadeDeAlgoComProp adj</i>	328	
	<i>n membroDeAlgoComProp adj</i>	109	Antonym	<i>n antonimoNDe n</i>	1,915
	<i>adj propDeAlgoMembroDe n</i>	910		<i>v antonimoVDe v</i>	1,828
Contains	<i>n contidoEm n</i>	351		<i>adj antonimoAdjDe adj</i>	2,131
	<i>n contidoEmAlgoComProp adj</i>	261	<i>adv antonimoAdvDe adv</i>	110	
Material	<i>n materialDe n</i>	827	Quality	<i>n temQualidade n</i>	959
Causation	<i>n causadorDe n</i>	1,346		<i>n devidoAQualidade adj</i>	1,083
	<i>n causadorDeAlgoComProp adj</i>	25	State	<i>n temEstado n</i>	326
	<i>adj propDeAlgoQueCausa n</i>	627		<i>n devidoAEstado adj</i>	197
	<i>n causadorDaAccao v</i>	57	Manner	<i>adv maneiraPorMeioDe n</i>	1,859
<i>v accaoQueCausa n</i>	7,731	<i>adv maneiraComProp adj</i>		1,595	
Producer	<i>n produtorDe n</i>	1,556	Manner without	<i>adv maneiraSem n</i>	224
	<i>n produtorDeAlgoComProp adj</i>	74		<i>adv maneiraSemAccao v</i>	17
	<i>adj propDeAlgoProdutorDe n</i>	444	Property	<i>adj dizSeSobre n</i>	9,743
Place	<i>n localOrigemDe n</i>	1,290		<i>adj dizSeDoQue v</i>	25,070



Onto.PT as a Semantic Web model

- Adaptation of W3C WordNet RDF/OWL [van Assem et al., 2006]



OntoBusca interface

OntoBusca

Onto.PT v.0.3.1

Introduza a sua pesquisa:

Busca: *hospital*



lentamente palavra termo teste confusão **casa** pasta investigar
 massa **dinheiro** ontologia borracheira **cão** zabumbar planta ciência
 fado bebedeira envolvente **hospital**

- **S: (n) hospital**, [nosocômio](#), [nosocómio](#), [espiritual](#)
 - [hiperonimoDe](#)
 - **S: (n) manicómio**, [rilhafoles](#)
 - **S: (n) lazareto**
 - **S: (n) leprosaría**, [gafaria](#)
 - **S: (n) leprocómio**
 - [hiponimoDe](#)
 - **S: (n) empresa**, [casa](#), [estabelecimento](#), [firma](#)
 - **S: (n) obra**, [casa](#), [edifício](#), [prédio](#), [bloco](#), [edificação](#), [herdade](#), [edifícamento](#), [imóvel](#)
 - **S: (n) edifício**, [prédio](#), [aranha-céu](#)
 - [referidoPeloQueÉ](#)
 - **S: (adj) hospitalário**, [hospitalar](#), [nosocómico](#), [nosocomial](#), [nosocômico](#)
 - [temParte](#)
 - **S: (n) enfermaria**
 - [parteDe](#)
 - [hiperonimoDe](#)
 - **S: (n) ambulatório**
 - [servePara](#)
 - **S: (n) paciente**, [enfermo](#), [doente](#)
 - [hiponimoDe](#)
- **S: (adj) hospital**, [benfeitor](#), [virtuoso](#), [humano](#), [santo](#), [bom](#), [favorável](#), [bendito](#), [piedoso](#), [misericordioso](#), [propenso](#), [benévolo](#), [patriarcal](#), [indulgente](#), [clemente](#), [benigno](#), [benéfico](#), [benevolente](#), [generoso](#), [bondoso](#), [obsequioso](#), [caridoso](#), [almo](#), [caritativo](#), [bondadoso](#), [benfazente](#), [agatoide](#), [bondoso](#)
- **S: (adj) hospital**, [esmolar](#), [esmolador](#), [caridoso](#), [caritativo](#)

Concluding remarks

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 - ★ Updates and other resources in <http://ontopt.dei.uc.pt>
 - ▶ In constant development, future directions:
 - ★ More evaluation (quality, coverage, utility)
 - ★ Augmentation by exploiting other resources (e.g. Wikipedia)
 - ★ Associate definitions/example sentences with synsets



References I

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