We Divide, You Conquer:
From Large-scale Ontology Alignment to Manageable Subtasks

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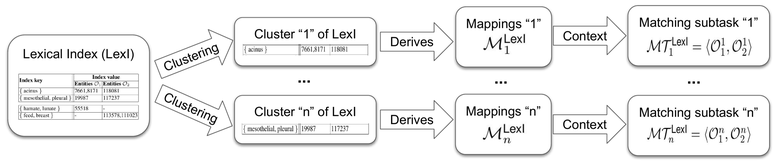
Motivation

- Large-scale ontology matching tasks still pose *serious challenges* to ontology alignment systems.
- Only 6 out of 10 (OAEI 2017) and 7 out of 12 (OAEI 2018) system were able to complete the largest tasks in the *largebio track*.

Pipeline



Lexical indexes

Index key	Index value	
	Entities $\mathcal{O}_1$	Entities $\mathcal{O}_2$
{ acinus }	7661,8171	118081
{ mesothelial, pleural }	19987	117237
{ hamate, lunate }	55518	-
{ feed, breast }	-	113578,111023

ID	URI
7661	$\mathcal{O}_1$:Serous_acinus
8171	$\mathcal{O}_1$:Hepatic_acinus
19987	$\mathcal{O}_1$:Mesothelial_cell_of_pleura
55518	$\mathcal{O}_1$:Lunate_facet_of_hamate
118081	$\mathcal{O}_2$:Liver_acinus
117237	$\mathcal{O}_2$:Pleural_Mesothelial_Cell
113578	$\mathcal{O}_2$:Breast_Feeding
111023	$\mathcal{O}_2$:Inability_To_Breast_Feed

Techniques

- **Clustering.** Two strategies: *naive* and *neural embedding*. The neural embedding relies on the StarSpace toolkit to learn vector representations for the individual words in the index keys.
- **Context as matching task.** Logic-based module extraction techniques provide the context (*i.e.*, sets of *semantically related* entities) for the entities in a given mapping or set of mappings.

OAEI datasets

OAEI track	Source of $\mathcal{M}^{RA}$	Task	Ontology	Version	Size (classes)
Anatomy	Manually created	AMA-NCIA	AMA	v.2007	2,744
			NCIA	v.2007	3,304
Largebio	UMLS-Metathesaurus	FMA-NCI	FMA	v.2.0	78,989
		FMA-SNOMED	NCI	v.08.05d	66,724
		SNOMED-NCI	SNOMED	v.2009	306,591
Phenotype	Consensus alignment (vote=2)	HPO-MP	HPO	v.2016-BP	11,786
			MP	v.2016-BP	11,721
		DOID-ORDO	DOID	v.2016-BP	9,248
			ORDO	v.2016-BP	12,936

Evaluation on OAEI systems

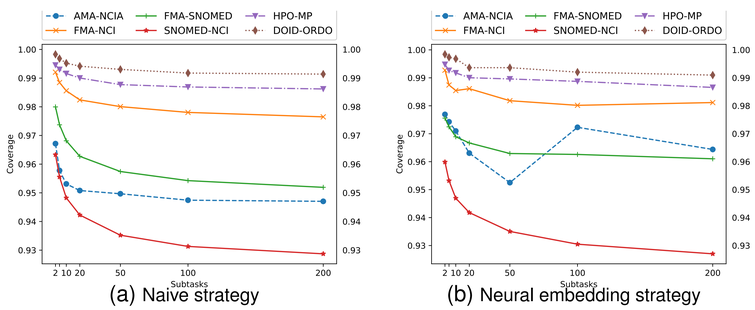
Systems failing to complete tasks in the OAEI 2015-2017 campaigns.

Tool	Task	Year	Matching subtasks	Naive strategy				Neural embedding strategy			
				P	R	F	t (h)	P	R	F	t (h)
GMap (*)	Anatomy	2015	5	0.87	0.81	0.84	1.3	0.88	0.82	0.85	0.7
			10	0.85	0.81	0.83	1.7	0.86	0.82	0.84	0.8
MAMBA	Anatomy	2015	20	0.88	0.63	0.73	2.3	0.89	0.62	0.73	1.0
			50	0.88	0.62	0.73	2.4	0.89	0.62	0.73	1.0
FCA-Map	FMA-NCI	2016	20	0.56	0.90	0.72	4.4	0.62	0.90	0.73	3.1
			50	0.58	0.90	0.70	4.1	0.60	0.90	0.72	3.0
KEPLER	FMA-NCI	2017	20	0.45	0.82	0.58	8.9	0.48	0.80	0.60	4.3
			50	0.42	0.83	0.56	6.9	0.46	0.80	0.59	3.8
POMap	FMA-NCI	2017	20	0.54	0.83	0.66	11.9	0.56	0.79	0.66	5.7
			50	0.55	0.83	0.66	8.8	0.57	0.79	0.66	4.1

(*) Executed with 8Gb.

Coverage ratio results

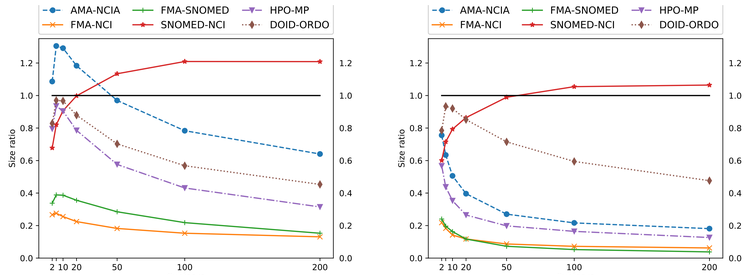
Is $m = \langle e_1, e_2 \rangle \in \mathcal{M}^{RA}$ findable in sub-tasks $\mathcal{MT}_i^{\text{LexI}}$?



(a) Naive strategy (b) Neural embedding strategy

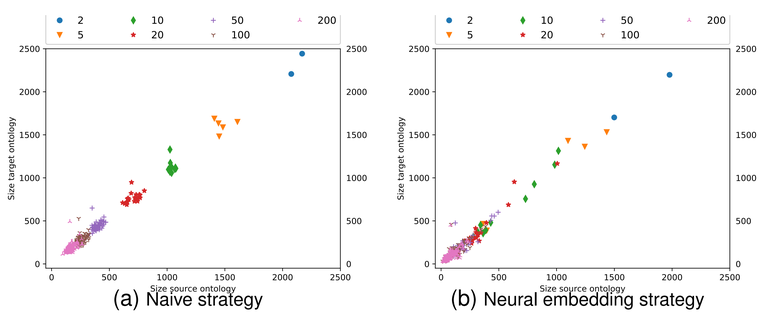
Size ratio results

Search space in the sub-tasks wrt the original task.



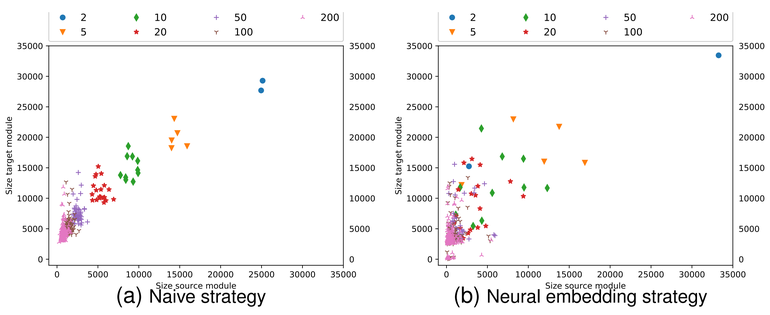
(a) Naive strategy (b) Neural embedding strategy

Source and target module sizes for AMA-NCIA



(a) Naive strategy (b) Neural embedding strategy

Source and target module sizes for FMA-NCI



(a) Naive strategy (b) Neural embedding strategy

Codes **Datasets** **Paper**