

# Syntactic embeddings in mOWL

Fernando Zhapa-Camacho

*<2023-02-13 Mon>*

# Introduction

- Ontologies contain axioms, not triples (as in a graph)
- Ontology syntactic information can be represented as text

# Learning objectives

- Learn about syntactic representation of ontologies as text.
- Learn how to use mOWL on this type of methods.

# Axioms as sentences

- Ontologies are constructed over a defined syntax

## Syntax

Symbols, formulas, systems, theorems, proofs, and interpretations expressed in formal languages are syntactic entities whose properties may be studied **without regard to any meaning** they may be given, and, in fact, need not be given any. (Wikipedia)

# OWL syntaxes

OWL Constructor	DL Syntax	Manchester Syntax
intersectionOf	$C \sqcap D$	$C$ and $D$
unionOf	$C \sqcup D$	$C$ or $D$
complementOf	$\neg C$	not $C$
someValuesFrom	$\exists R.C$	$R$ some $C$
allValuesFrom	$\forall R.C$	$R$ only $C$

# Axioms as sentences

Ontologies contain axioms      Representation as sentences

- *Parent*  $\sqsubseteq$  *Person*

# Axioms as sentences

Ontologies contain axioms

- $Parent \sqsubseteq Person$

Representation as sentences

- Parent SubClassOf Person

# Axioms as sentences

Ontologies contain axioms

- $Parent \sqsubseteq Person$
- $Female \sqcap Parent \sqsubseteq Mother$

Representation as sentences

- Parent SubClassOf Person



# Axioms as sentences

Ontologies contain axioms

- $Parent \sqsubseteq Person$
- $Female \sqcap Parent \sqsubseteq Mother$

Representation as sentences

- Parent SubClassOf Person
- Female and Parent SubClassOf Mother

- Syntactic information of ontologies as sentences
- Use of *reasoning* for data augmentation
- Application to protein-protein interaction

# Onto2Vec: method

Input: an OWL ontology Output: numerical representations in  $\mathbb{R}^n$  of ontology entities

- 1 Reasoning over the ontology to generate more axioms
- 2 Generation of sentences from the ontology axioms
- 3 Process the sentences using Word2Vec
- 4 Output Word2Vec representations

- Ontologies contain axioms and textual annotations

## Example

- Class: GO:0034399
- Label: rdfs:label nuclear periphery
- Comment: rdfs:comment The portion of the nuclear lumen proximal to the inner nuclear membrane

- OPA2Vec extends Onto2Vec by adding annotations to entities.
- Annotations can come from several sources
  - Annotations in the ontology
  - Text corpora from other sources