Assignment 2 Report

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This report is only an introduction: more detailed explanations in the notebook (point 0. in the notebook corresponds to part1)

part 1 - Evaluating SpaCy at token & chunk level

I loaded the dataset with a function called get_data, which returns the sentences with their annotations + the sentences in string format.

```
>>> data, corpus = get_data()
>>> data[0]
[('SOCCER', 'NN', 'B-NP', 'O'), ('-', ':', 'O', 'O'), ('JAPAN', 'NNP', 'B-NP', 'B-LOC'), ...]
>>> corpus[0]
'SOCCER - JAPAN GET LUCKY WIN , CHINA IN SURPRISE DEFEAT .'
```

Then I used spacy to extract the named entities. Unfortunately spacy's tokenizer creates tokens in a different way wrt. conll2003 dataset. To solve this problem 2 solution were implemented: OPTION1 (elegant) substitutes spacy's tokenizer with a whitespace tokenizer; OPTION2 (slightly better performances) after having processed the tokens with spacy's tokenizer, a function maps spacy's tokens to conll tokens. **Figure 1** shows the results obtained with each method.
Before computing the metrics I had to convert spacy's NER annotations into CoNNL2003 annotations, so I wrote a custom function for this purpose (more info in **Appendix A** of the notebook).

The results of this part of the exercise showed that chunk level performances are a little worse wrt. token level performances.
note: most of these functions are components that can be added to spacy's pipeline and store the computations inside an attribute (of Token or Doc).

part 2 - Grouping of entities

Chunks from Doc.noun_chunks can contain multiple entities, so I wrote a function that checks if an entity is contained in one of these chunks, if it is we add that entity to group[chunk_id], else the entity will be put in a separate 'private' group.

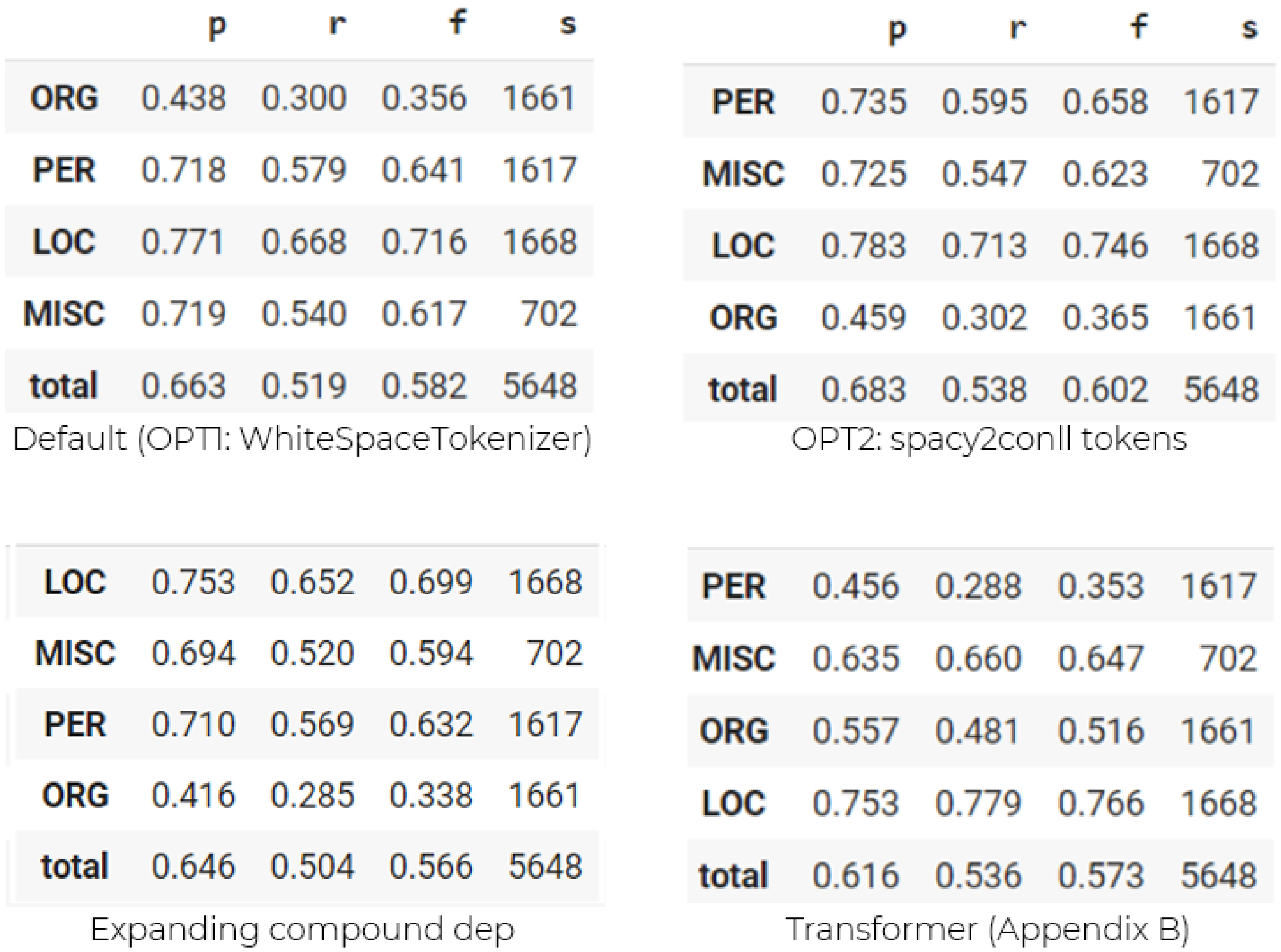
The results (**Figure 2**) showed that most of the entities are not grouped and that groups of 2+ entities often include PERSON.

part 3 - Fixing Segmentation

A possible post processing step would be to adjust the span of the entities. To do so we expand the entities through the compound dependency, if two entities overlap after the expansion, they are merged.

By default, before expanding an entity, we check if the new token that should be added to the entity is of the same ent_type_ of the current entity (if it is from another entity type eg. PER and MISC, the expansion is not performed). The postprocessing function takes a parameter named union_of_different_ent_types_allowed, if this parameter is set to True, the above behaviour is modified. **Appendix C** of the notebook analyzes the differences between setting union_of_different_ent_types_allowed to True/False and gives more insights on what changes are made in the post-processing phase.

Results show that this approach seems to lead little to no-improvement, as we can notice from **Figure 1**.
How expansion affects the token_level tags can be seen in **Appendix C** of the notebook.



	p	r	f	s
ORG	0.438	0.300	0.356	1661
PER	0.718	0.579	0.641	1617
LOC	0.771	0.668	0.716	1668
MISC	0.719	0.540	0.617	702
total	0.663	0.519	0.582	5648

Default (OPT1: WhiteSpaceTokenizer)

	p	r	f	s
PER	0.735	0.595	0.658	1617
MISC	0.725	0.547	0.623	702
LOC	0.783	0.713	0.746	1668
ORG	0.459	0.302	0.365	1661
total	0.683	0.538	0.602	5648

OPT2: spacy2conll tokens

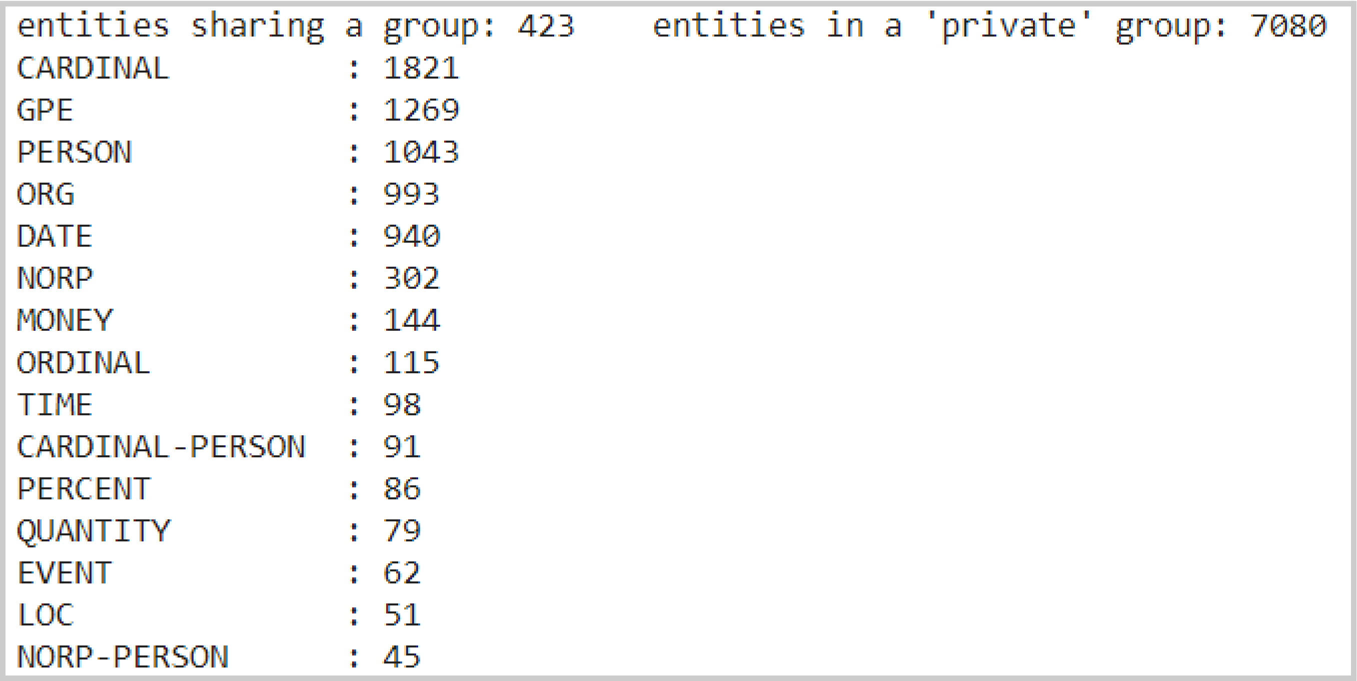
LOC	0.753	0.652	0.699	1668
MISC	0.694	0.520	0.594	702
PER	0.710	0.569	0.632	1617
ORG	0.416	0.285	0.338	1661
total	0.646	0.504	0.566	5648

Expanding compound dep

PER	0.456	0.288	0.353	1617
MISC	0.635	0.660	0.647	702
ORG	0.557	0.481	0.516	1661
LOC	0.753	0.779	0.766	1668
total	0.616	0.536	0.573	5648

Transformer (Appendix B)

Figure 1. Four different procedures to compute NER entities and evaluate them on conll2003/test.txt. OPT1 and OPT2 refers to part1; Expanding compound refers to part 3; Transformer refers to Appendix B.



```
entities sharing a group: 423    entities in a 'private' group: 7080
CARDINAL          : 1821
GPE               : 1269
PERSON            : 1043
ORG               : 993
DATE              : 940
NORP              : 302
MONEY             : 144
ORDINAL           : 115
TIME              : 98
CARDINAL-PERSON   : 91
PERCENT           : 86
QUANTITY          : 79
EVENT             : 62
LOC               : 51
NORP-PERSON       : 45
```

Figure 2. top 15 groups of entities for part 2.