

Investigating the Impact of Syntactic Features for Semantic Dependency Parsing

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January 15, 2020

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Table of contents

1. Introduction

2. Overview

3. Objectives

4. Results

5. Outlook

Introduction

- Syntactic and Semantic Dependency Parsing (SDP)
- Acyclic Graphs
- Research Question: To which extent does predicted syntax help for semantic dependency parsing?

Introduction | SDP

```
displacy.render(doc, style="dep", jupyter =True)
```

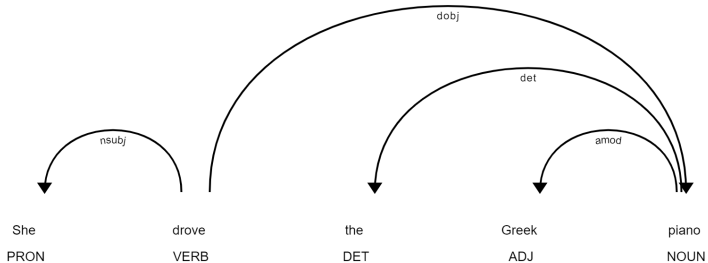


Figure 1: Syntactic tree from SpaCy.

Source: <https://towardsdatascience.com/getting-to-grips-with-parse-trees-6e19e7cd3c3c>

- Theoretical baseline model by Dozat and Manning [Zeman et al., 2017]
- Implementation by Daniel Roxbo [Roxbo, 2019]
- Extension to learn syntactic graphs

Semantic Only	Gold Syntax	Predicted Syntax
87.40%	90.90%	89.30%

Table 1: Semantic F_1 scores for test, out-of-domain.

Source: [Kurtz et al., 2019]

Introduction - Multitask Learning

- Multitask Learning
- Presumption by [Kurtz et al., 2019] shows that there might be an information overlap
- Other research shows, that multitask learning might help [Peng et al., 2017]

Overview

- Allow to import the data from the `.conllu` format
- Increase the performance during the pre-processing by using caching to save computation time
- Implement multitask learning to simultaneously learn syntactic and semantic graphs and investigate the results

Objectives

- Separate files for syntax (.cnpn) and semantic (.sdp)
- Combined file format CoNLL-U from [Buchholz and Marsi, 2006]

- Preprocessing is conducted every time the source code is being invoked
- Main functions:
 - `parse_conllu_labels`
 - `parse_conllu_sentences`
 - `parse_conllu_targets`

Objectives | Multitask Learning

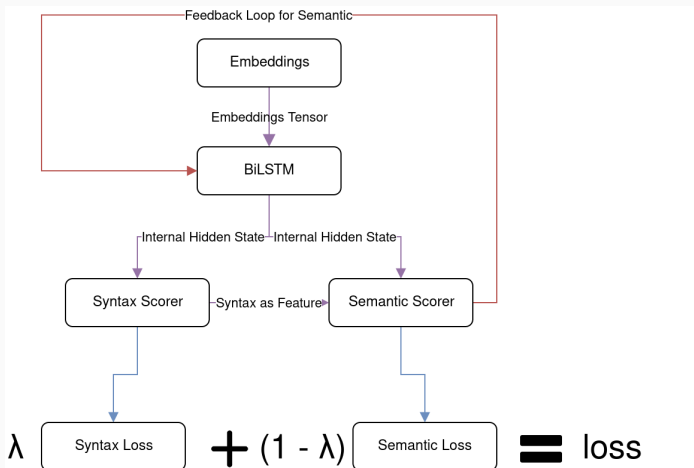
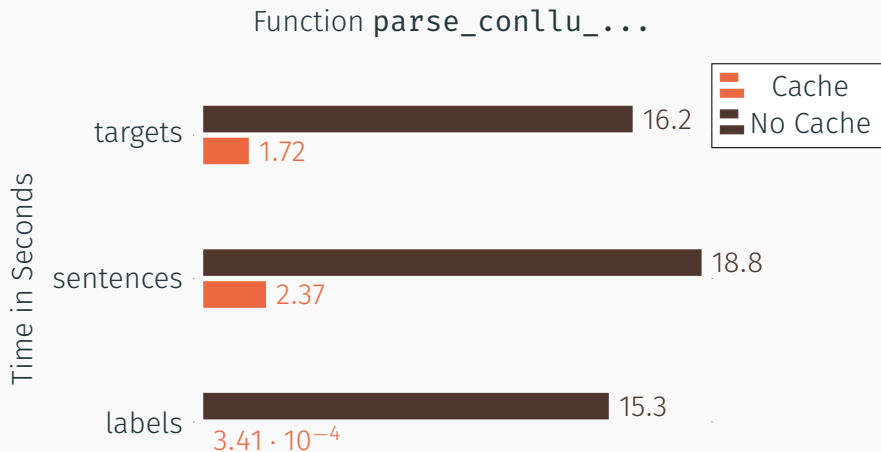


Figure 2: Flowchart, with red representing the feedback loop.

Results

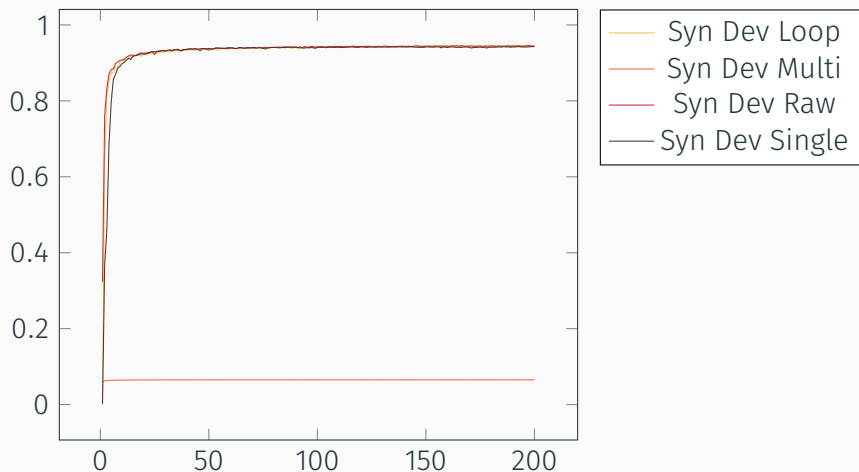
- Open-Source library CoNNL-U Parser
 - <https://github.com/EmilStenstrom/conllu>
- Now supports capitalised labels
- Fallback parser for meta information
 - .conllu files have been adjusted
 - #12345 → # sent-id = 12345

Results | Performance Improvement

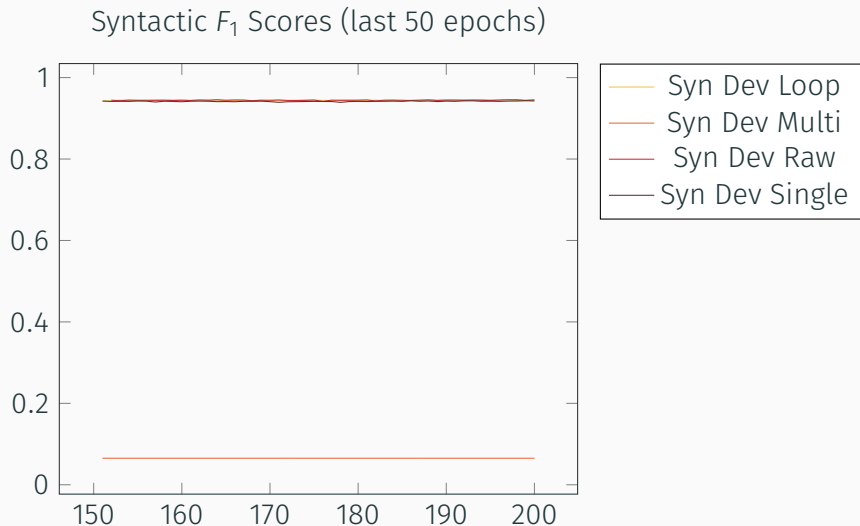


Results | Multitask Learning

Syntactic F_1 Scores

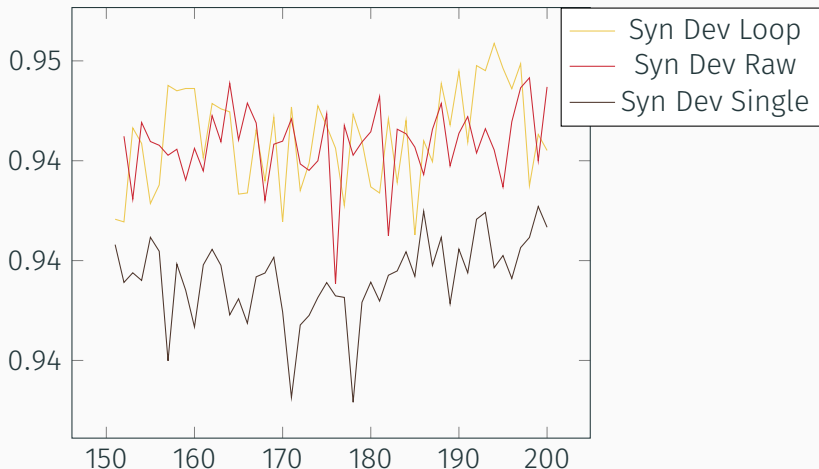


Results | Multitask Learning



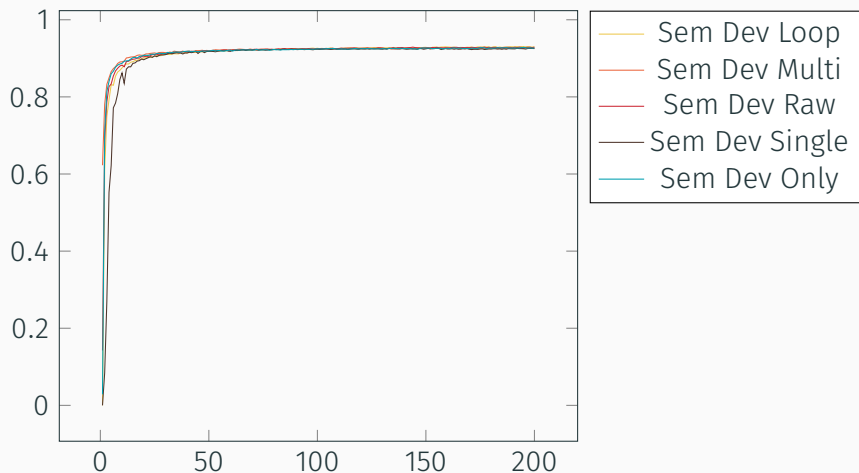
Results | Multitask Learning

Syntactic F_1 Scores (last 50 epochs without Syn Dev Multi)

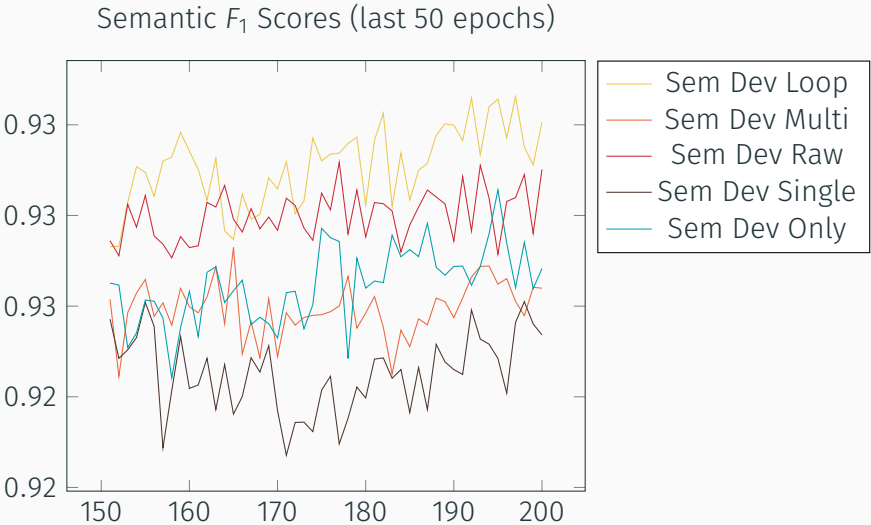


Results | Multitask Learning

Semantic F_1 Scores



Results | Multitask Learning



Results | Multitask Learning - Research Projects

Setting	In-Domain				Out-Of-Domain	
	Syn Dev	Sem Dev	Syn Test	Sem Test	Syn Test	Sem Test
Sem Only	o	92.68%	o	92.39%	o	87.50%
Multitask Raw	94.54%	92.90%	-	-	90.92%	87.80%
Multitask Single	94.27%	92.54%	94.64%	92.60%	90.81%	87.41%
Multitask Multi	6.52%	92.64%	-	-	7.39%	87.71%
Multitask Loop	94.42%	93.01%	94.29%	92.51%	90.96%	87.87%

Table 2: F_1 scores for the different setups.

Results | Multitask Learning - Comparison

Source	Sem Test	
	In-Domain	Out-Of-Domain
Research Project	92.60%	87.87%
[Kurtz et al., 2019]	92.20%	89.30%
[Lindemann et al., 2019] GloVe	90.40%	84.30%
[Lindemann et al., 2019] BERT & GloVe	93.90%	90.30%
[Lindemann et al., 2019] MTL	94.10%	90.50%

Table 3: Semantic test F_1 scores from different authors.

Outlook

- Presumption by [Kurtz et al., 2019] mostly confirmed, at least for this data set
- Bidirectional Encoder Representations from Transformers (BERT)
- Combine BERT and multitask learning

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