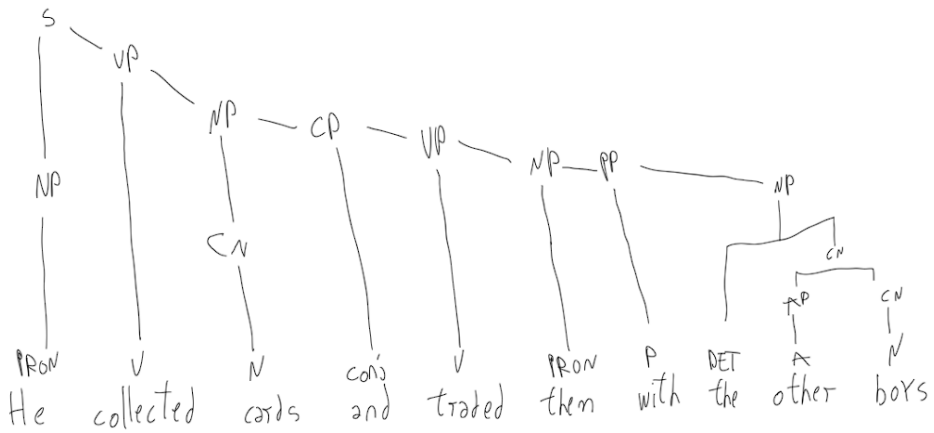
1. Phrase Structure Trees

English

Pre-annotated text: He:<PRON> collected:<VERB> cards:<NOUN> and:<CCONJ> traded:<VERB> them:<PRON> with:<ADP> the:<DET> other:<ADJ> boys:<NOUN>

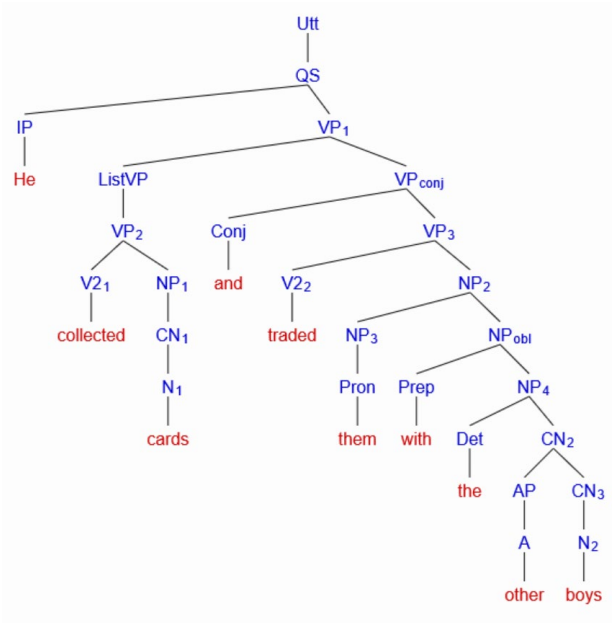
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Utt (QS (IP He) (VP (ListVP (VP (V2 collected) (NP (CN (N cards))))) (VP_conj (Conj and) (VP (V2 traded) (NP (NP (Pron them)) (NP_obl (Prep with) (NP (Det the) (CN (AP (A other)) (CN (N boys))))))))))

Graphical representation:



Comparison:

While the two phrase structure trees look mostly similar to each other at a first glance, a few differences can be easily spotted.

The main difference stems from GF's classification of the phrase, considering it a **QS (Question)** instead of an utterance, this is also seen when looking at how the word "he" is classified as an **IP (Interrogative Pronoun)** instead of a pronoun.

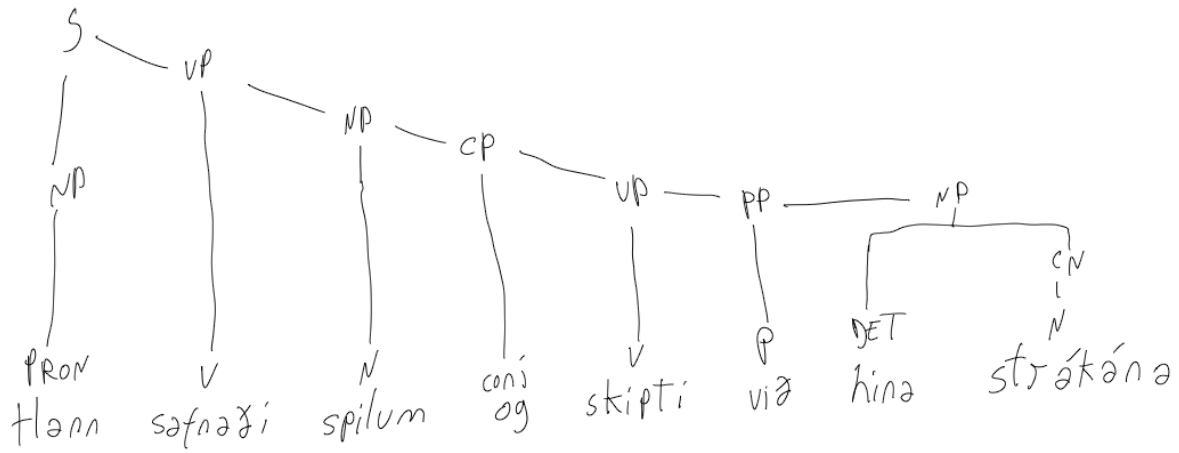
Worth mentioning is that it also classifies "collected cards" as a **ListVP (List of Verb Phrases)** instead of a single VP.

Lastly, another difference that should be pointed out is a purely superficial one, regarding the use of a different term, the GF phrase structure tree uses the terms VP conj for a Conjunction Phrase (CP) and NP obl (**Oblique Noun Phrase**) for a prepositional phrase.

Icelandic

Pre-annotated text: hann:<PRON> safnaði:<VERB> spilum:<NOUN> og:<CCONJ> skipti:<VERB> við:<ADP> hina:<DET> strákana:<NOUN>

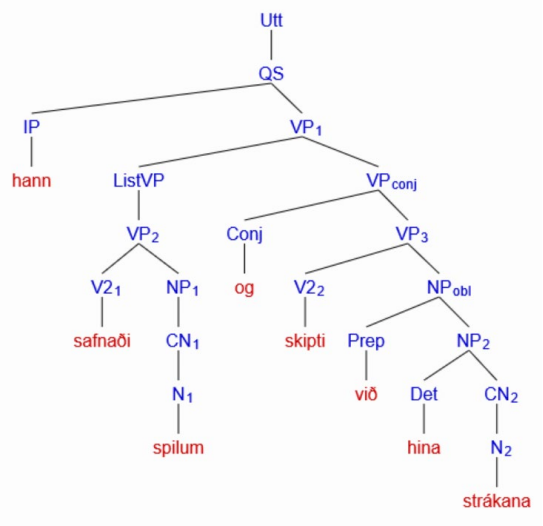
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Utt (QS (IP hann) (VP (ListVP (VP (V2 safnaði) (NP (CN (N spilum))))) (VP_conj (Conj og) (VP (V2 skipti) (NP_obl (Prep við) (NP (Det hina) (CN (N strákana)))))))))

Graphical representation:



Comparison:

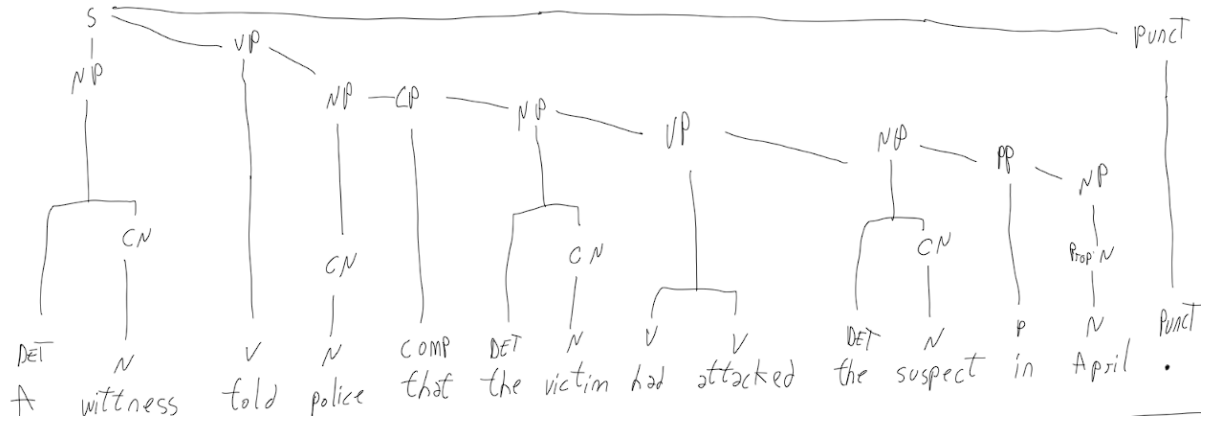
For this Icelandic sentence, it seems that GF managed parse it similarly to the English sentence, committing the same errors in the process. Most notably, GF classified the phrase as a QS (**Question**) when it was a simple utterance instead, alongside with the misclassification of the pronoun “hann” as an **I**nterrogative **P**ronoun.

English

Pre-annotated text:

A:<DET> witness:<NOUN> told:<VERB> police:<NOUN> that:<SCONJ> the:<DET> victim:<NOUN> had:<AUX> attacked:<VERB> the:<DET> suspect:<NOUN> in:<ADP> April:<PROPN> .:<PUNCT>

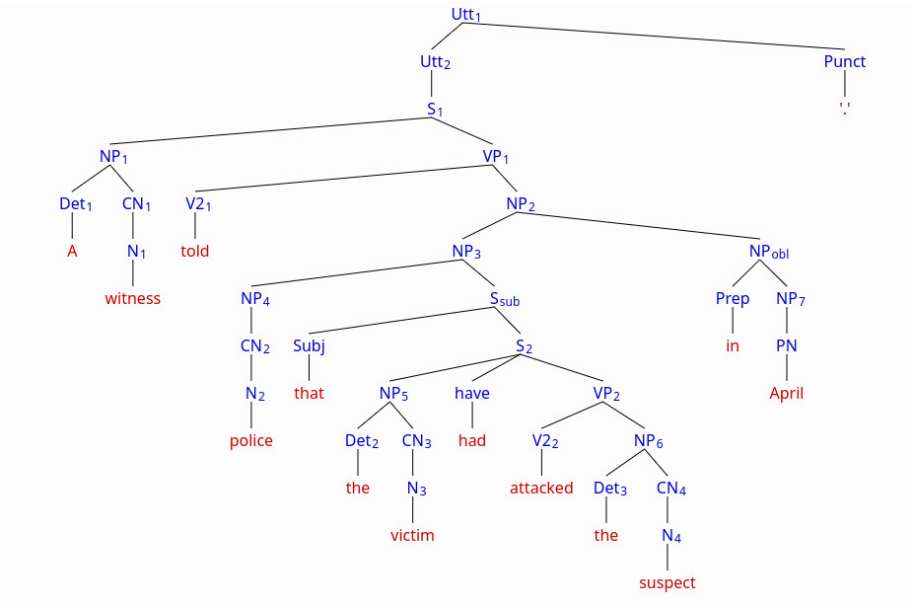
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Utt (Utt (S (NP (Det A) (CN (N witness))) (VP (V2 told) (NP (NP (NP (CN (N police))) (S_sub (Subj that) (S (NP (Det the) (CN (N victim))) (have had) (VP (V2 attacked) (NP (Det the) (CN (N suspect)))))))) (NP_obl (Prep in) (NP (PN April)))))) (Punct '.'))

Graphical representation:



Comparison:

For this sentence, the English dbnf file does a great job at providing a detailed phrase structure tree, correctly identifying the subordinate phrase (and explicitly naming it).

One significant difference from my attempt is that it did not correctly place the auxiliary verb “had” in direct relation to the verb “attacked”, classifying it incorrectly as “have” which is erroneous.

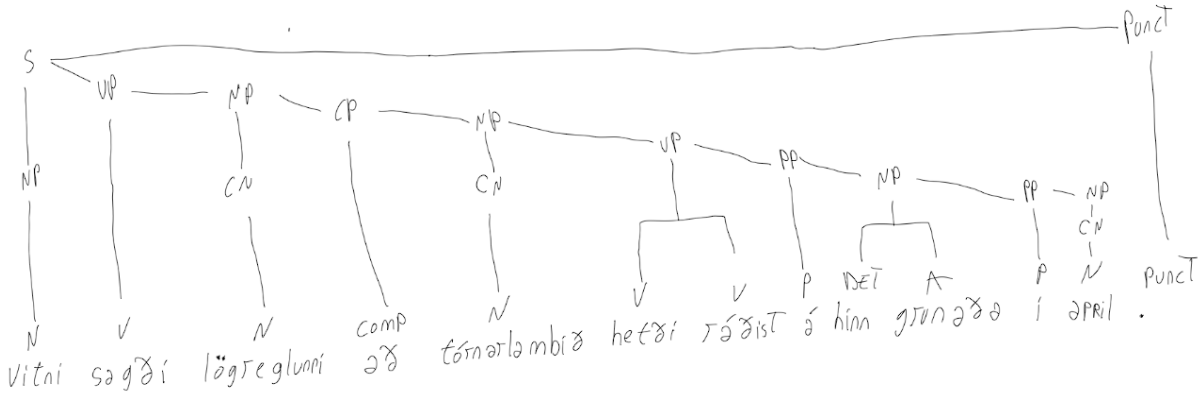
Another difference is that it classified the prepositional phrase “in April” (named NP obl due to its internal naming conventions) as being separate from the nominal phrase “the suspect”. The rest of the differences being simply cosmetic (different naming conventions) or due to its higher granularity.

Icelandic

Pre-annotated text:

Vitni:<NOUN> sagði:<VERB> lögreglunni:<NOUN> að:<ADP> fórnarlambið:<NOUN> hefði:<AUX> ráðist:<VERB> á:<ADP> hinn:<DET> grunaða:<ADJ> í:<ADP> apríl:<NOUN> .:<PUNCT>

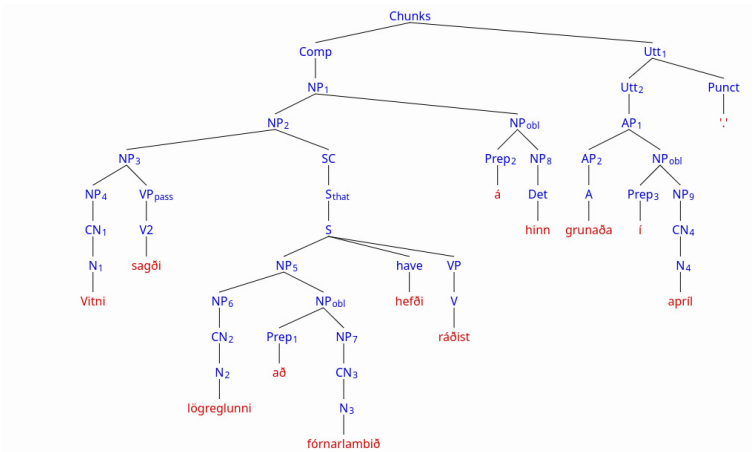
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Chunks (Comp (NP (NP (NP (NP (CN (N Vitni))) (VP_pass (V2 sagði))) (SC (S_that (S (NP (NP (CN (N lögreglunni))) (NP_obl (Prep að) (NP (CN (N fórnarlambið))))) (have hefði) (VP (V ráðist)))))) (NP_obl (Prep á) (NP (Det hinn))))) (Utt (Utt (AP (AP (A grunaða)) (NP_obl (Prep í) (NP (CN (N apríl)))))) (Punct '.')))

Graphical representation:



Comparison:

Regarding this sentence, GF's English dbnf's limits are particularly visible when it comes to creating phrase structure trees for Icelandic. It incorrectly classified "grunaða í apríl" as being the main phrase (signified by the Utt label).

This is wrong as not only does "grunaða í apríl" mean something similar to "the suspect in April" but it is also an incomplete construction, as the full meaning is only conveyed by "á hinn grunaða í apríl", which is spread between the "complement of the copula" and the Main Clause.

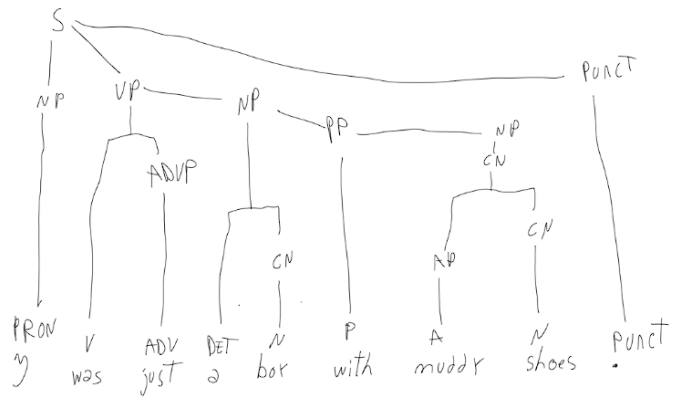
Besides this, I have to say that it also did not properly label the real Main Clause "Vitni sagði", instead classifying it as part of the "complement of copula", this way representing the entire phrase structure tree in an erroneous manner.

English

Pre-annotated text:

I:<PRON> was:<AUX> just:<ADV> a:<DET> boy:<NOUN> with:<ADP> muddy:<ADJ> shoes:<NOUN> .:<PUNCT>

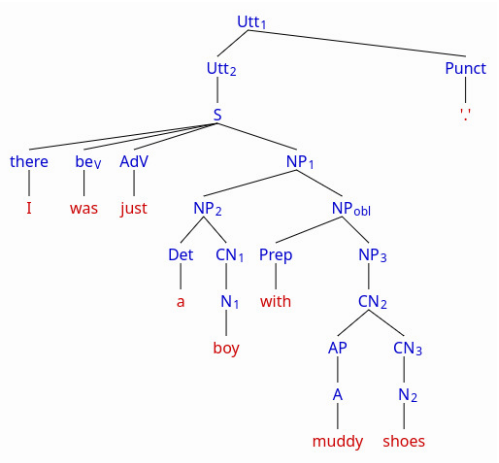
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Utt (Utt (S (there I) (be_V was) (AdV just) (NP (NP (Det a) (CN (N boy))) (NP_obl (Prep with) (NP (CN (AP (A muddy)) (CN (N shoes))))))))) (Punct '.'))

Graphical representation:



Comparison:

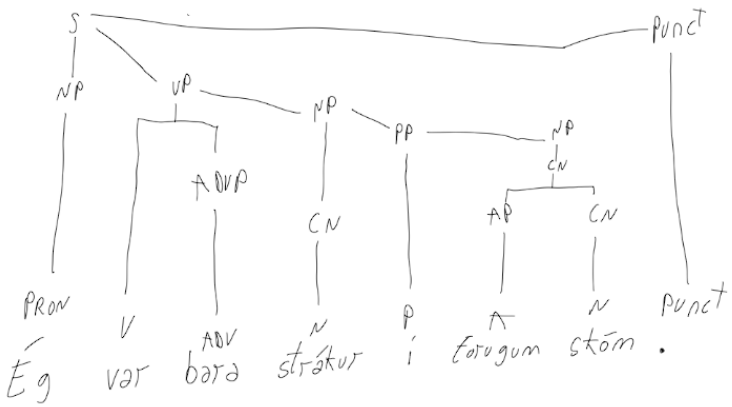
A seemingly simple phrase, which was parsed wrongly by the English dbnf rules. The problem lies with how the construction “I was just” was classified, as it is clearly an error due to the invalid “there” category for the “I” pronoun, which prevents it being classified correctly as part of a Noun Phrase.

Not only that, but the Adverbial Phrase (of which “just” should be part of) is not properly categorized either, leading to not being able to classify the Verb Phrase pertaining to the verb “was” either.

Icelandic

Pre-annotated text: Ég:<PRON> var:<VERB> bara:<ADV> strákur:<NOUN> í:<ADP> forugum:<ADJ> skóm:<NOUN> .:<PUNCT>

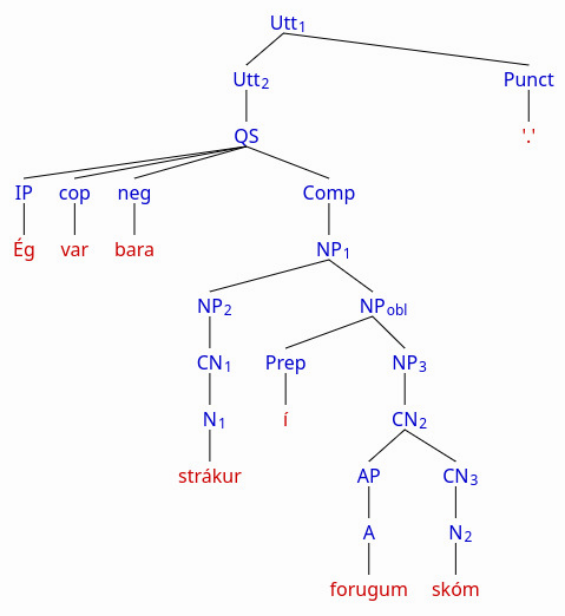
Manually created phrase structure tree:



Gf-ud automatically created tree:

(Utt (Utt (QS (IP Ég) (cop var) (neg bara) (Comp (NP (NP (CN (N strákur))) (NP_obl (Prep í) (NP (CN (AP (A forugum)) (CN (N skóm)))))))))) (Punct '.'))

Graphical representation:



Comparison:

It seems that even with the Icelandic phrase, GF had a similar problem as with the English one, having catalogued the construction “Ég var bara” wrongly. “Ég” instead of being labeled as a pronoun, is directly attributed to an Interogative Pronoun, the verb “var” (past tense form of the “to be” að vera) is classified as a copula and the adverb “bara” is labeled as a negation. Not only that, but the entire phrase is categorized as a question as well. This mistake in classifying prevents the GF phrase tree from being an accurate representation.

2. Testing the English Grammar on the Corpus

Given English Corpus’ .conll file:

Macro Evaluation

UDScore {udScore = 0.5929797255884212, udMatching = 23, udTotalLength = 328, udSamesLength = 192, udPerfectMatch = 2}

Micro Evaluation:

UDScore UDScore {udScore = 0.7388888888888889, udMatching = 15, udTotalLength = 180, udSamesLength = 133, udPerfectMatch = 2}

It can be noticed that the macro score (udScore) has the value of 0.592, which would suggest that around 59.2% of the tokens were correctly parsed by using English.dbnf grammar.

The micro score shows a significant accuracy of around 74%, this means that the most common dependency labels are identified accurately most of the time.

While parsing more than half the tokens properly, there may still be room for improvement, especially regarding the less common labels. It can also be mentioned that there are 2 sentences which have been parsed completely identically by using the grammar.

Given Icelandic Corpus’ .conll file:

Macro Evaluation

UDScore {udScore = 0.49281753946517887, udMatching = 24, udTotalLength = 302, udSamesLength = 151, udPerfectMatch = 1}

Micro Evaluation

UDScore {udScore = 0.5, udMatching = 24, udTotalLength = 302, udSamesLength = 151, udPerfectMatch = 1}

The macro score (udScore) has the value of 0.492, which would suggest that around 49.2% of the tokens were correctly parsed by using English.dbnf grammar.

The micro score has a very similar value of 0.5, suggesting that 50% of the most common labels are correctly classified.

Slightly less than half of the tokens are parsed correctly, which is understandable, as there is a significant number of differences between the English and the Icelandic grammar.

It can also be mentioned that there is 1 sentence which has been parsed completely identically by using the grammar.

3. Adjusting the Grammar According to the Icelandic Grammar

The grammar was modified largely by changing its lexicons to better suit the Icelandic language, but also, through changes in its sentences, indirect questions, adverbials, coordination, and noun phrases. The changes aren't comprehensive, partially due to Icelandic's similarities to English, but also due to my lack of in-depth knowledge of Icelandic grammar and special cases.

The results when using the new grammar are the following:

Given Icelandic Corpus' .conll file:

Macro Evaluation

UDScore {udScore = 0.5264121107435736, udMatching = 24, udTotalLength = 302, udSamesLength = 157, udPerfectMatch = 1}

Micro Evaluation

UDScore {udScore = 0.5198675496688742, udMatching = 24, udTotalLength = 302, udSamesLength = 157, udPerfectMatch = 1}

The macro score for Icelandic is now 0.526, which means that around 53% of the tokens are parsed correctly, a 3.4% increase of the previous grammar. At the same time, the micro score is just 2% better, which means that the improvements come from a better classification of the less common labels.

While still having a noticeable number of errors, this grammar is a visible improvement compared to the English one regarding the parsing of Icelandic language.

Given English Corpus' .conll file:

Macro Evaluation

UDScore {udScore = 0.5050941811811377, udMatching = 23, udTotalLength = 328, udSamesLength = 157, udPerfectMatch = 2}

Micro Evaluation

UDScore {udScore = 0.4940828402366864, udMatching = 24, udTotalLength = 338, udSamesLength = 167, udPerfectMatch = 2}

Using the modified grammar on the English corpus once more shows that its macro score performance has dropped by almost 10%, a significant amount, which showcases the significant linguistic distance between the 2 languages, despite being in the same greater (Germanic) branch.

This is even more apparent when looking at the micro score, where a drop of over 30% in regards to labelling the most frequent classes.

Italian PUD .conll file:

Macro Evaluation

UDScore {udScore = 0.22634484763190812, udMatching = 169, udTotalLength = 4790, udSamesLength = 876, udPerfectMatch = 3}

Micro Evaluation

UDScore {udScore = 0.18288100208768268, udMatching = 169, udTotalLength = 4790, udSamesLength = 876, udPerfectMatch = 3}

The macro score of Italian is 0.226, thus amounting for a correct parsing of just 22.6% of the tokens, this is to be expected as Italian is part of a completely different branch of Indo-European languages. This is also supported by its micro score of 0.18, which shows a low number of labels accurately classified.

Finnish PUD .conll file:

Macro Evaluation

UDScore {udScore = 0.2930139988935566, udMatching = 213, udTotalLength = 3530, udSamesLength = 940, udPerfectMatch = 1}

Micro Evaluation

UDScore {udScore = 0.26628895184135976, udMatching = 213, udTotalLength = 3530, udSamesLength = 940, udPerfectMatch = 1}

The overall score of Finnish is 0.293, which makes sense, as despite not being an Indo-European language, Finnish has been greatly influenced by North Germanic languages throughout its existence.

This is also supported by its micro score of 0.27, which shows that an equally low number of labels is accurately classified.

Czech PUD .conll file:

Macro Evaluation

UDScore {udScore = 0.37821145737603284, udMatching = 991, udTotalLength = 18488, udSamesLength = 6699, udPerfectMatch = 14}

Micro Evaluation

UDScore {udScore = 0.3623431414971874, udMatching = 991, udTotalLength = 18488, udSamesLength = 6699, udPerfectMatch = 14}

The overall score of Czech is 0.378, thus 37.8% of the tokens being parsed correctly. This is a surprising result, which could be explained by the potential similarities between Czech and other Germanic languages, due to their geographic proximity but also due to their cultural (and linguistic) exchange.

This is also supported by its micro score of 0.36, which shows a similar number of labels is accurately classified.