

Towards the automatic detection of syntactic differences $\mathsf{Kroon},\,\mathsf{M.S.}$

Citation

Kroon, M. S. (2022, November 10). *Towards the automatic detection of syntactic differences*. *LOT dissertation series*. LOT, Amsterdam. Retrieved from https://hdl.handle.net/1887/3485800

Version: Publisher's Version

License: License agreement concerning inclusion of doctoral thesis in the

Institutional Repository of the University of Leiden

Downloaded from: https://hdl.handle.net/1887/3485800

Note: To cite this publication please use the final published version (if applicable).

Towards the Automatic Detection of Syntactic Differences

Published by

LOT Binnengasthuisstraat 9 1012 ZA Amsterdam The Netherlands

e-mail: lot@uva.nl http://www.lotschool.nl

phone: $+31\ 20\ 525\ 2461$

Cover illustration: Kalle Wolters

ISBN: 978-94-6093-414-8

 $DOI: \quad \ \, https://dx.medra.org/10.48273/LOT0629$

NUR: 616

Copyright © 2022: Martin Kroon. All rights reserved.

Towards the Automatic Detection of Syntactic Differences

Proefschrift

ter verkrijging van de graad van doctor aan de Universiteit Leiden, op gezag van rector magnificus prof. dr. ir. H. Bijl, volgens besluit van het college voor promoties te verdedigen op donderdag 10 november 2022 klokke 10.00 uur

door

Martin Siebren Kroon

geboren 6 november 1993 te Groningen, Nederland

Promotores: Prof. dr. L.C.J. Barbiers

Prof. dr. J.E.J.M. Odijk (Universiteit Utrecht)

Co-promotor: Dr. S.L. van der Pas (Amsterdam UMC)

Promotiecommissie: Prof. dr. S.A. Raaijmakers

Prof. dr. ir. J. Nerbonne (Rijksuniversiteit Groningen)

Prof. dr. P.D. Grünwald

Prof. dr. G.J.M. van Noord (Rijksuniversiteit Groningen)

Dr. J. Prokic

The research reported in this thesis was funded by the Data Science Research Programme and the Faculty of Humanities of Leiden University.



Contents

A	ckno	wledgements	xi			
\mathbf{G}	lossa	ry of abbreviations, acronyms and notations	xiii			
1	Inti	Introduction				
	1.1	Background	2			
	1.2	Data	7			
	1.3	Outline of the dissertation	9			
2	Filt	ering for syntactic comparability	15			
	2.1	Introduction	16			
	2.2	Syntactic Comparability	17			
	2.3	Data	18			
	2.4	Filters	18			
		2.4.1 Levenshtein distance on POS-tags	19			
		2.4.2 Sentence-length ratio	20			
		2.4.3 Graph edit distance on dependency trees	21			
		2.4.4 Combination filter	22			
		2.4.5 Automatically setting a threshold	23			
	2.5	Evaluation of the filters	23			
	2.6	Results	24			
	2.7	Discussion	25			
	2.8	Conclusion	27			
3	Det	secting syntactic differences automatically using the min-				
		m description length principle	29			
	3.1	Introduction	30			
	3.2	Background	32			
	3.3	Generating hypotheses with the minimum description length				
		principle	33			
		3 3 1 Step 2a: Pattern mining with SOS	33			

	3.4	3.3.2 Step 2b: Creating a shortlist of distributional differences. Example: Europarl	36 37
		3.4.1 Step 1: data pre-processing	38
		3.4.2 Step 2a: characteristic patterns per language	39
		3.4.3 Step 2b: distributional differences	40
		3.4.4 Step 3: investigating hypotheses	41
	3.5	Discussion	51
	3.6	Conclusion	56
4		ecting syntactic differences automatically using word align-	
	mer		57
	4.1	Introduction	57
	4.2	Method	58
		4.2.1 Preprocessing	60
		4.2.2 Extracting attributes	62
	4.0	4.2.3 Discovering features	68
	4.3	Evaluation	74
		4.3.1 Data	75
	4.4	Results	77
		4.4.1 Articles and demonstratives	80
		4.4.2 Other hypotheses concerning the nominal domain	83
		4.4.3 Verbs and constituent order	86
		4.4.4 Other hypotheses	94
		4.4.5 Hypotheses on affixes	95
	4.5		100
		3 v	100
		00	101
		•	103
	4.6	Conclusion	105
5			07
	5.1	v i	107
	5.2		109
	5.3	1 0	112
	5.4	<u> </u>	115
		00 0	116
		•	117
			119
	5.5	Conclusion	120
Bi	bliogi	raphy	121
0	vervi	ew of URLs to used, referenced and developed tools and	
	data	asets 1	27
Sa	amen	$\mathbf{vatting}$	131

\boldsymbol{C}	lurriculum vitae	137

Acknowledgements

There are many people I owe thanks to, either for their direct involvement in my research endeavours during my PhD, for supporting me outside of my work, or even by simply existing. In fact, everyone that I had the pleasure of talking to ever since I moved to Leiden in 2017, I am to some extent indebted to. However, a few people I am particularly thankful to.

First and foremost I want to thank my three brilliant supervisors Sjef, Jan and Stéphanie, who have advised and guided me throughout this sometimes difficult project. You have taught me many things, and I could not have been luckier with you as my supervisors. Our collaboration was very enjoyable to me and I hope to be working together again on a new project at some point in the future.

Then, I want to thank my sweet parents, who have supported and loved me unconditionally – not only during my time in Leiden, but all my life. I count myself lucky with you as my parents and I treasure the way you have raised me. As my great-grandfather would have said in his native Bolserters: *kist op un minder like*.

I also want to thank my big brother Peter, who has often had the time to distract me with fun games as well as to stimulate and motivate me to perform research and to always stay curious. You have often been an example to me, and I am proud to be your little brother.

A great deal of thanks I owe to my Pascale. Your love and support seem unending and make me a very happy man indeed, even during the dark days of the pandemic.

A big thank you also goes out to my friends, who have proven to be fantastic people by keeping me sane during my time off. In particular Max, with whom I have learned to check whether people actually left before taking their cheese platter; Laura odB., for introducing me to Leiden and making me feel at home in a city I didn't know; Xander, Lotte, Laura D., and Vera, with whom I have developed a nearly cultist fascination with a type of Cypriot cheese; Hanjo and Froos Bommee, who have led my linguistic creativity into a wanton subversion

of reality; and Timo, Susan and Janoël, who even after all those years remain among my closest of friends.

I was also kept relatively sane during my time at work when the country wasn't in lockdown, so I am also very grateful to all of my colleagues at LUCL, my colleagues of the DSO and my colleagues of the LUCDH, chief among which are Xander and Lis (who I am also honoured and grateful to call my paranymphs), Laura odB., Manolis and all the data-science PhDs. Special thanks go out to Astrid and Anikó, who helped me analyse some of my data, and to the staff of ÚFAL of the Charles University in Prague, who have so graciously hosted me in the autumn of 2019.

Finally, I want to thank Toneel groep Imperium – especially those with whom I've worked together closely during productions. Thank you for accepting me into your theatrical family with open arms. I thoroughly enjoy spending time and sharing the spotlight with you, and hope to continue to do so for many years to come.

Glossary of abbreviations, acronyms and notations

AAA Affix-Attribute Associator

ADJ adjective (UD tag)
ADP adposition (UD tag)
ADV adverb (UD tag)

advmod adverbial modifier (UD relation)

AL list the list containing characteristic differences between Hun-

garian and English as compiled by dr. Lipták

amod adjectival modifier (UD relation)

Art article (UD feature value)
AUC area under the (ROC) curve
aux auxiliary verb (UD relation)
AUX auxiliary verb (UD tag)

cc coordinating conjunction (UD relation)

ccomp clausal complement (UD relation)
CCONJ coordinating conjunction (UD tag)

conj conjunct (UD relation)

CoNLL-U a specific annotation format; short for Conference on Compu-

tational Natural Language Learning-Universal Dependencies

CS Czech DE German

Def definite (UD feature value)
Definite definiteness (UD feature)
deprel dependency relation

DeSDA Detecting Syntactic Differences Automatically

det determiner (UD relation)
DET determiner (UD tag)

DGAE Data Grouper for Attribute Exploration

EN English

EU European Union

Fin finite (UD feature value)
GED graph-edit distance

Gen genitive (UD feature value)
GTI Generalization Tree Inducer

Hn hypothesis number n, referring to Table 4.3

HU Hungarian

Ind 1. indefinite (UD feature value);

2. indicative (UD feature value)

Inf infinite (UD feature value)

Intrans intransitive
KJB King James Bible

Lev. Levenshtein distance

MDL Minimum Description Length

Mn missed difference number n, referring to Table 4.4

N noun

n-gram a contiguous sequence of n items

NL Dutch

NLP natural language processing nmod nominal modifier (UD relation)

NP noun phrase

nsubj nominal subject (UD relation)

nsubj:pass passive nominal subject (UD relation)

Num number (UD feature) NUM numeral (UD tag) obj object (UD relation)

obl oblique nominal (UD relation)
OSV object-subject-verb order
OVS object-verb-subject order
Part participle (UD feature value)

PART particle (UD tag)

Plur plural number (UD feature value) pmi pointwise mutual information

POS part of speech PRON pronoun (UD tag)

PronType pronoun type (UD feature)
PROPN proper noun (UD tag)

Prs personal or possessive personal pronoun or determiner (UD

feature value)

PRS present tense
PST past tense

PUNCT punctuation (UD tag)

ROC curve receiver operating characteristic curve

S sentence

SCONJ subordination conjunction (UD tag)

Sent. length sentence length

Sing singular number (UD feature value)

sg. singular number

SOV subject-object-verb order

SQS 'Summarising event seQuenceS'; Tatti and Vreeken (2012)

SV subject-verb order

SVO subject-verb-object order

Trans transitive

UD Universal Dependencies; Nivre et al. (2016)

V verb

V2 verb-second word order

VB Vizsoly Bible

VBP verb, non-3rd person singular present (Penn Treebank tag)

 $egin{array}{ll} VO & ext{verb-object order} \\ VP & ext{verb phrase} \\ \end{array}$

WEB World English Bible wh question-, interrogative

X other (UD tag)

< ... > used to identify an individual grapheme or character

 $x\rangle ...\langle y$ used to mark off circumfixes