Splitting and Identifying Czech Compounds: A Pilot Study

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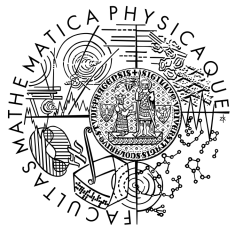

Joint work with Magda Ševčíková for DeriMo 2021

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Compounding

Definitions and terminology

"The formation of a new lexeme by adjoining two or more lexemes" (Bauer, 2003)

vždy	+ ***zelený***	→ ***vždyzelený***	
always.ADV	green.ADJ	evergreen.ADJ	

- the two or more input lexemes are "parents" or "parent words"

This paper focuses on:

- Czech, where compounding is underresearched computationally
- graphical words only:
  - strings of graphical symbols unbroken by whitespace or special characters

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The tasks at hand

Compound identification and compound splitting

Compound identification:

- Binary classification
- Input graphical word **W** (assumed to be a Czech lexeme):
  - if **W** is a Czech compound, return 1;
  - else, return 0.

Compound splitting:

- An open-ended task
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Challenges

What makes the tasks difficult?

krv-o-tok → ***krev*** ***tok***
bloodflow.NOU blood.NOU flow.NOU

modr-o-oký → ***modrý*** ***oko***
blue-eyed.NOU blue.NOU eye.NOU

ps-o-vod → ***pes*** ***vést***
dog handler.NOU dog.NOU lead.VERB

holekchtivý → ***chtivý*** ***holka*** (***holek*** = gen. pl.)
wanting girls.ADJ wanting.ADJ girl.NOU

dvaapůlletý → ***dvě*** ***a*** ***půl*** ***léto***
two-and-a-half-year-old.ADJ two.NUM and.CONJ half.NUM year.ADJ

soci-o-logie → ***-soci-*** ***-log-***
sociology.NOU -soci-.NEOCON -log-.NEOCON

tetrachlorethylen → ***-tetra-*** ***chlor*** ***ethylen***
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The ways (Czech) compounds have been handled so far

- Theoretical accounts:
  - Bozděchová (1997) uses an onomasiological approach
  - Štichauer (2003) discusses Bisetto and Scalise's (2005) approach wrt Czech
  - Ološtiak and Vojteková (2021) cover neoclassical compounding
- Static data resources:
  - DerivAnCze: contains no compounds
  - DeriNet 2.0: contained 33,923 identified and 1,252 split compounds
- Procedural tools:

Authors	Language	Task	Performance
Krotova et al. (2020)	German	Splitting	Acc: 96%
Hellwig and Nehrdich (2018)	Sanskrit	Splitting	Acc: 96%
Clouet and Daille (2014)	English	Finding split-points	F1: 80%
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Data set and evaluation

What we had to work with

Data set: Manually annotated data

- 1,447 manually annotated compounds (by us)
- extracted from DeriNet
- 80/10/10 split (1,158/145/144; training/testing/validation)

ryb-o-lov → ***ryba*** ***lov***
fishery.NOU fish.NOU hunt.NOU

Synthetic data

- 280,000 compounds synthesized using lexemes from DeriNet
- Used only for Czech Compound Splitter training

Adjective 1 + *-o-* + Adjective 2 → Compound Adjective
důležitý + ***-o-*** + ***neomylný*** → ***důležitoneomylný***
important.ADJ + -o- + infallible.ADJ → *important-infallible.ADJ

Data set and evaluation

What we had to work with

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How we evaluated performance

Metrics:

- **Accuracy**: Ratio of correct predictions vs. incorrect predictions
  - Applicable to both compound splitting and identification
  - Within splitting, a prediction is correct iff *all* parents are correct (unless stated otherwise)
- **Root accuracy**: Ratio of predicted parents within the correct derivational family
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Our solutions

Three approaches to the tasks at hand

- Baseline solution
  - Naive explicit solution contextualizing the other two
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  - Requires a lexicon
- *IML*()-based heuristic algorithm
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IML() matrix function

The phonological string similarity function

The *IML*() (*Interlexical Matrices of Likeness*) function returns the phonological similarity of two Czech graphical words using a manually defined *correspondence matrix*.

- $IML(word_1, word_2) = 0$ iff $word_1 = word_2$
- $IML(word_1, word_2)$ need not equal $IML(word_2, word_1)$

The IML()-based heuristic algorithm tests all word-pairs $((lexeme_1, lexeme_2))$ from the lexicon that satisfy a heuristic filter that discards all obviously wrong word-pairs.

- otherwise, $800,000^2 = 6.4 \times 10^{11}$ operations

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The all-in-one Czech compound handling tool

Czech Compounds Splitter (*CCS*) performs compound splitting and compound identification in one step.

It is an implementation of the *Marian* translator framework by Microsoft.

It was trained on:

- 1,164 genuine compounds, with their splittings
- 280,000 synthetic compounds, with their splittings
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zakódovat → ***kódovat***
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Czech Compounds Splitter's typical errors in compound splitting:

Compound	CCS *splitting*	**Correct splitting**
dlouhohořící	*dlouhohořící*	*dlouho hořící*
CCS returns the original string, performing no splitting.		
osmiramenný	*osm ramenný*	*osm rameno*
CCS returns a non-existing derivative of an existing word.		
bíločerný	*bílo černý*	*bílý černý*
CCS includes the interfix in one of the parents.		

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bíločerný	*bílo černý*	*bílý černý*
CCS includes the interfix in one of the parents.		

Czech Compounds Splitter's typical errors in compound splitting:

Compound	CCS *splitting*	**Correct splitting**
dlouhohořící	*dlouhohořící*	*dlouho hořící*
CCS returns the original string, performing no splitting.		
osmiramenný	*osm ramenný*	*osm rameno*
CCS returns a non-existing derivative of an existing word.		
bíločerný	*bílo černý*	*bílý černý*
CCS includes the interfix in one of the parents.		

Results

How the approaches ended up performing

Compound identification:

- Performed only by *Czech Compound Splitter*
- Evaluated on 144 compounds and 141 non-compounds (no information rate: 50.5%)
- Accuracy: 92%

Compound splitting:

Method	1st parent accuracy	2nd parent accuracy	Overall accuracy	Overall root accuracy
Baseline	22%	42%	11%	16%
IML()	42%	66%	24%	39%
CCS	61%	66%	54%	61%

Conclusion

- We have made the first attempt into the automatic splitting and identification of Czech compound words.
- We have developed three tools:
  - a naive baseline solution,
  - a heuristic algorithm based on *IML*(), a custom phonological similarity function
  - *Czech Compound Splitter*, a deep learning solution
- *Czech Compound Splitter* turns out to be the best solution, in terms of both performance and practicality.
- It has achieved an accuracy of 54% in compound splitting and an accuracy of 92% in compound splitting.
- Furthermore, it can also find the single *derivational* parent of a given Czech word, if it's not a compound.

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References


Introducing Linguistic Morphology.
Bauer L, 2nd edn. Washington, DC: Georgetown University Press, 2003.


Tvoření slov skládáním.
Bozděchová I. Nakladatelství Institut sociálních vztahů, 1994.


Je možná nová klasifikace českých kompozit?.
Štichauer P. *Časopis pro moderní filologii* 95(2), 2003.


The classification of compounds.
Bisetto K, Scalise, S. *Lingue e linguaggio* 4(2), 2005.


Kompozitnost' a kompozícia: príspevok k charakteristike zložených slov na materiáli západoslovanských jazykov.
Ološtiak M, Vojteková M. *Slovo a Slovesnost* 82(2), 2021.


Derivancze — derivational analyzer of Czech.
Pala, K, Šmerk, P. In: *International Conference on Text, Speech, and Dialogue*, 2015.


DeriNet 2.1.

Vidra, J,Žabokrtský, Z, Kyjánek, L, Ševčíková, M,Dohnalová, Š, Svoboda, E, Bodnár, J. URL:

http://hdl.handle.net/11234/1-3765.

References 2


GermaNet – a lexical-semantic net for German.
Hamp, B and Feldweg, H. In: *Automatic information extraction and building of lexical semantic resources for NLP applications*, 1997.


The CELEX lexical database.
Baayen, H, Piepenbrock, R, and Gulikers, L. Linguistic Data Consortium, 1996.


A Joint Approach to Compound Splitting and Idiomatic Compound Detection.
Krotova, I, Aksenov, S, Artemova E. In: *Proceedings of the 12th Language Resources and Evaluation Conference*, 2020.


Sanskrit word segmentation using character-level recurrent and convolutional neural networks.
Hellwig, O, Nehrdich, S. In: *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing*, 2018.


Splitting of compound terms in non-prototypical compounding languages.
Clouet, E. and Daille, B. In: *Workshop on Computational Approaches to Compound Analysis*, 2014

Thank you for your attention!

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