

Two years of transducers at HSE

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Outline of the talk

Tranducers for morphological parsing at HSE

What is transducer?

How to use transducers?

Zilo: from 0 to 40866 wordforms

Tranducers for morphological parsing at HSE

- Nick Howell gave a talk at School of Linguistics' seminar
- In 2020 we started four projects on:
 - [Abaza](#) (Daria Arakelova)
 - [Agul](#) (Roman Klimov)
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- In 2021 I started five projects on my own ([here](#) some lectures):
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- Result: ([Arakelova and Ignatiev 2021](#); [Budilova 2022](#); [Buntyakova 2022](#); [Burakova 2022](#); [Kazakova 2022](#); [Cupery and Philatov 2022](#))

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What is transducer?

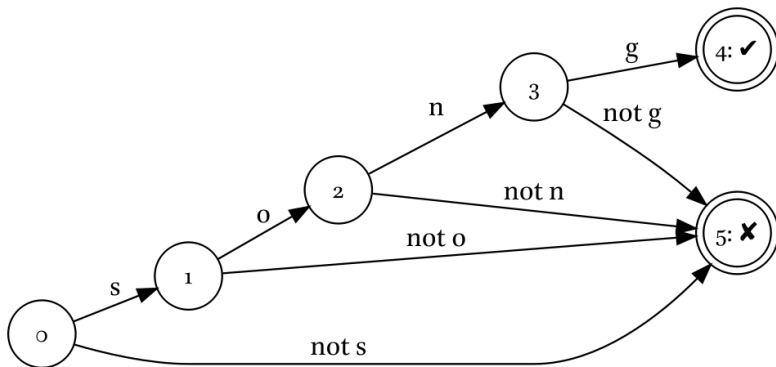
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Zilo: from 0 to 40866 wordforms

What is transducer?

Transducers are finite-state networks with two memory tapes of memory that can perform morphological analysis and related tasks. However, it easier to understand via the examples.

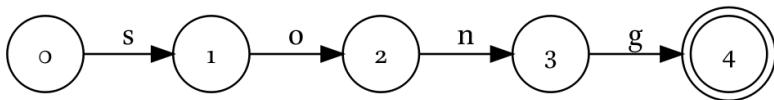
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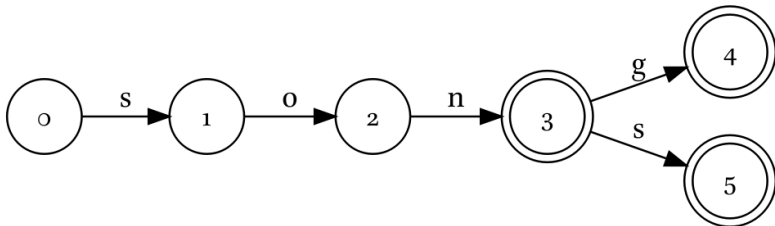
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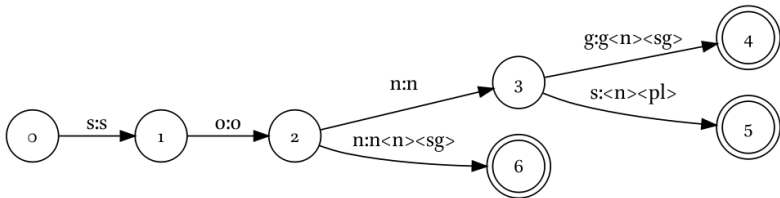
- Here is an example of finite-state automaton with one memory tape. It checks whether input string is a word *song*.
- Usually this “not X” arrow is not written
- It is possible to code multiple words (*son*, *sons*, *song*):



What is transducer?

Transducers has two memory tapes that can be treated as overwriting:

- son becomes son<n><sg>
- song becomes song<n><sg>
- sons becomes son<n><pl>
- everything else returns an error



Why use transducers?

- they are reversible, so analysis ($\text{sons} \rightarrow \text{son}\langle n \rangle \langle p1 \rangle$) and generation ($\text{son}\langle n \rangle \langle p1 \rangle \rightarrow \text{sons}$) can be done with the same transducer

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- they can be optimized for the fast search
- they can be easily combined with other transducers (e. g. transliteration or even translation)

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How to use transducers?

- read (Beesley and Karttunen 2003; Karttunen and Beesley 1992)
- lexd — a finite-state lexicon compiler (Swanson and Howell 2021)
- twol — a tool for (mor)phonology

lexd example (Zilo Andi numerals)

PATTERNS

Numerals NumearalMarker

LEXICON Numerals

иґшду	# пять; five
ойлґи	# шесть; six
гьокьу	# семь; seven
бейкьи	# восемь; eight
гьочґо	# девять; nine
гьоцґо	# десять; ten

LEXICON NumearalMarker

<num>:>гь

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LEXICON NumearalMarker

<num>:>гү

иґшдугү:иґшду<num>

ойлґигү:ойлґи<num>

гьокьугү:гьокьу<num>

бейкьигү:бейкьи<num>

Pipeline for developing morphological transducer

- describe morphology and (mor)phonology using available sources

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- compile lexicon with inflectional type annotation
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 - 4Ie<NUM><num><obl.m><epent.m><an.sg><aff> 4Ierywy6o (Zilo Andi)
 - 2-num-oml.m-<an.sg>aff
- test your transducer against some annotated (or not annotated) corpus (optional)

Main problems during morphological transducer development

- not usual development environment (at least for our students/not computer linguists)
- time
- lack of resources
- traditions of Apertium people
 - there is a straightforward, but not the shortest way
 - from `ҫIe<NUM><num><obl.m><epent.m><an.sg><aff>` `ҫIerywy6o` (Zilo Andi)
 - to `TWO-NUM-OBL.M-<AN.SG>AFF`
- difference in linguistic descriptions
- difference in languages

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This September I have been in Zilo for about 5 days:

- collected a dictionary with inflectional type annotation (more than 700 words)
- created a transducer that analyze/generate 40866 wordforms
 - about 400 nouns, 70 adjectives, 50 adverbs, numerals
 - just nominal and adjective inflection
 - future work: pronouns, verb inflection

References

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