Two years of transducers at HSE

I dedicate this talk to Nick Howell

George Moroz
Linguistic Convergence Laboratory, HSE University, Moscow

18 October 2022

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)
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- In 2021 I started five projects on my own (here some lectures):
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  - Botlikh (Igor Philatov)
  - Andi (Lera Buntyakova)
  - Agul (Nastya Burakova)
  - Rutul (Hanna Cupery)
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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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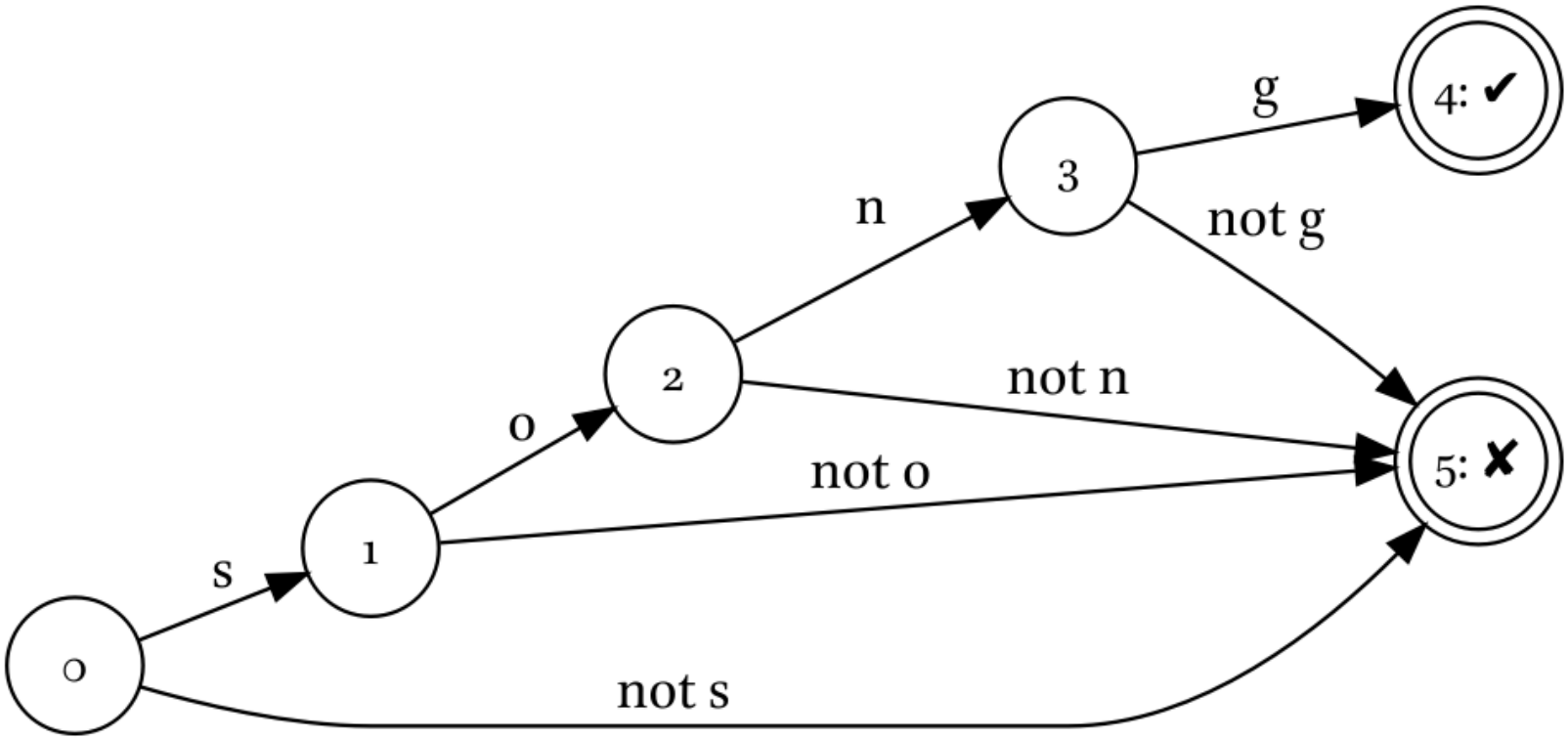
Trasducers are finite-state networks with two memory tapes of memory that can perform morphological analysis and related tasks. However, it easier to understand via the examples.

- Here is an example of finite-state automaton with one memory tape. It checks whether input string is a word *song*:



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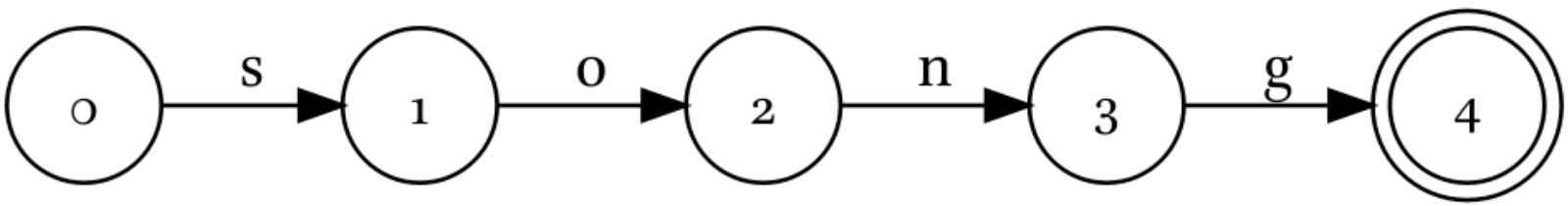

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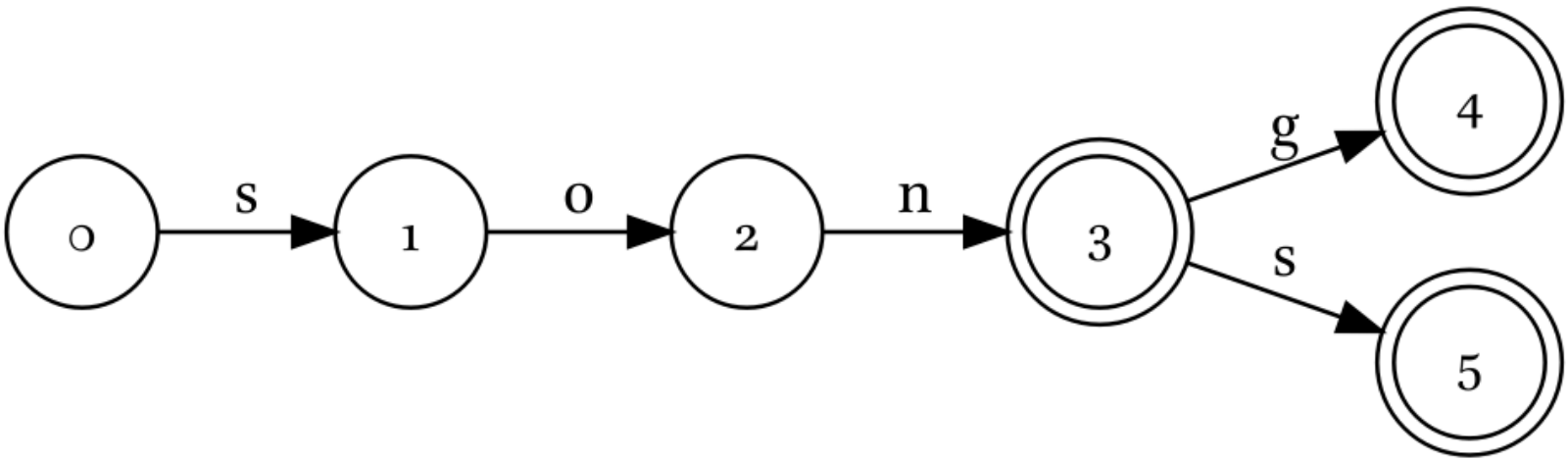
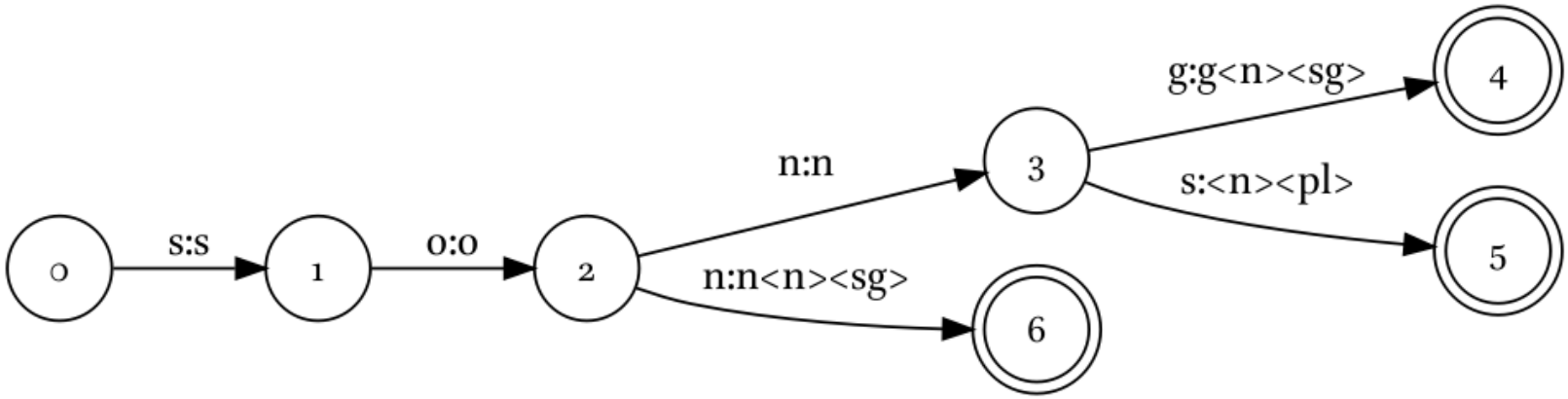
- Usually this “not X” arrow is not written
- It is possible to code multiple words (*son*, *sons*, *song*):



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 (`sons` → `son<n><pl>`) and generation (`son<n><pl>` → `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
иʰшду                  # пять; five
ойлIи                  # шесть; six
гьокьу                 # семь; seven
бейкьи                 # восемь; eight
гьочIо                 # девять; nine

LEXICON NumearalMarker
<num>:гу
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Pipeline for developing morphological transducer

- describe morphology and (mor)phonology using available sources

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- compile lexicon with inflectional type annotation
- compile test forms and their analysis based on available data (optional)
  - `чIe<NUM><num><obl.m><epent.m><an.sg><aff>` `чIегушубо` (Zilo Andi)
- test your transducer against some annotated (or not annotated) corpus (optional)

Main problems during morphological transducer development

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- traditions of Apertium people
  - there is a straightforward, but not the shortest way
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This September I have been in Zilo (Andi) 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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