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ТЕЗИСТЕР ABSTRACTS

Халықаралық конференция
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in the program construction: development of the program sketch, which does not take into account the resource constraints, and mapping the sketch to a real computer. We show the advantages of this approach for the development of thinking and, in particular, when teaching parallelism. The approach develops proposed in [1] teaching methods based on challenge tasks.

References

[1] Skopin, I.N. Challenge Tasks for the Study of General Methods of Computer Science and Programming. Bulletin of the Russian Friendship University. Series: Education Informatization, Vol. 4, P. 21–33, 2011 (in Russian).

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Combinational circuits model of Kazakh and Russian languages morphology

The problem of constructing a finite transducer with one state for the two-level morphology of inflectional languages, namely, the direct transformation of word endings into grammatical characteristics is investigated. This problem is studied on the base of Kazakh and Russian languages, which are inflectional languages. For solution of this problem a trivial Mealy automaton with one state (combinational circuit) and a multi-valued mapping is used.

The question of morphological analysis is important in natural language processing. Determining of the base finite state approach in morphological analysis is a two-level morphology concept proposed by Koskenniemi (1983), implemented through the use of finite state transducers (FST). In this paper we consider the possibility of using combinational circuits for two-level morphology of inflectional languages. Combinational circuit is a trivial Mealy FST, namely, FST with one state:

(1)
$$y(t) = f_y(x(t)),$$

where x(t) – input of the machine, y(t) – output of the machine, t – current time, f_y – the output function of the machine. The advantage of combinational circuit is its high speed. Essentially, combinational circuit is a mapping of x(t) onto y(t).

The set of endings of Kazakh language is necessary for the construction of multi-valued mappings:

F_s: $X_s \mapsto Y_s$ (for source language),

F_t: $Y_t \mapsto Z_t$ (for target language),

where X_s source language endings,

Y_s - grammatical characteristics of words of source language,

Y_t - grammatical characteristics of words of target language,
Z_t - the endings of target language.

The steps of machine translation, using combinational circuits in scheme of translation are described below: 1) Input of this scheme is a sentence of source natural language. 2) Marking out words in the sentence. 3) Finding part of speech characteristic for words. 4) Split words into stem and ending. 5) Morphological analysis of words with combinational circuits: "ending" - "grammatical characteristics". 6) Translation of the stem from the source language into the target language. 7) Transfer grammatical characteristics of a source language word into grammatical characteristics of a target language word. 8) Morphological generation of endings for target language words from grammatical characteristics of source language words using combinational circuits. 9) Compounding of word stems of the target language with the endings. 10) Implementation of structural transfers from the source language sentence to the target language sentence. Output of this scheme is a sentence of target natural language.

The mappings of combinational circuits are in the steps 5 and 8 for the Kazakh and Russian languages pair. These mappings allow getting the corresponding word ending in the target language for each word in the source language. Joining the stem and the ending in the target language produces the required output word. After that, phrases and sentences of target natural language are produced by joining words into a sequence.

We study the problem of completeness of the finite transducer's input for the analyzed languages. Determination of transducer input's completeness for morphological analysis gives a guarantee that all the words of the analyzed language will be accepted. For agglutinative languages the problem of determining the completeness of the set of possible endings is a complex issue. In this article, we define the completeness of a set of endings in Kazakh language. The proposed technology is implemented for the Russian-Kazakh machine translation, translation quality assessment performed by the method of BLEU.