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Using a Wordnet Ontology to Improve the Search of the Digital Dialect Dictionary

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We will present…

- Method for automatic relating between dialect term and corresponding terms in standard language, www.vranje.co.rs
- The method uses SWRL rules defined in the Serbian WordNet ontology to identify sets of synonymous words.
- It also uses e-dictionaries to produce correct lemmas in the standard language that users usually use for search.
- The method was applied and evaluated on verbs and a group of nouns derived from verbs (verbal nouns).
- We compared results obtained by the system with human evaluators and achieved the accuracy of 89.7%.

Digital dictionary of the South Serbian dialect

http://www.vranje.co.rs

1st

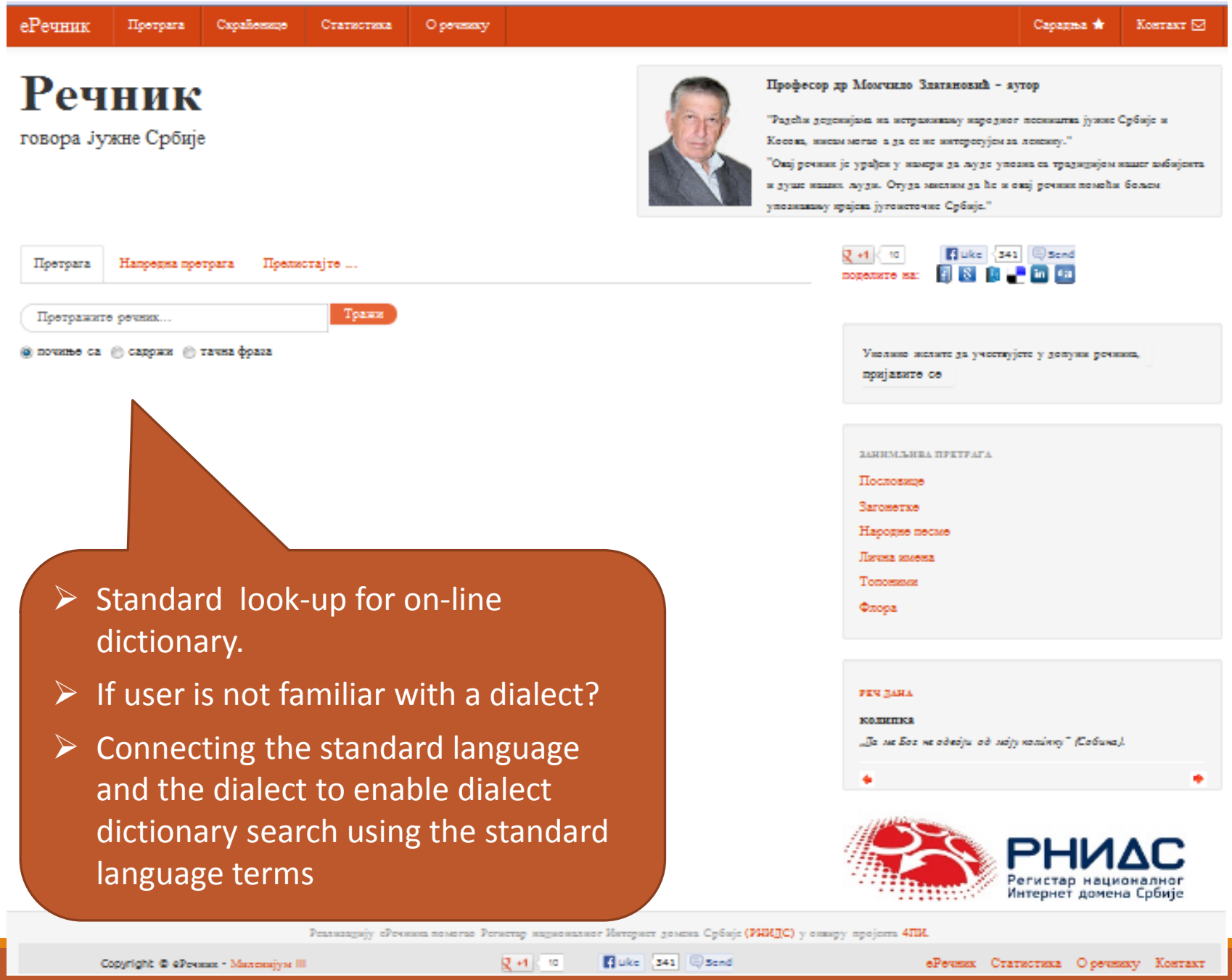
- implementation of an on-line dialect vocabulary for Serbian, produced from traditional dialect dictionaries

~20,000 entries:

- POS, linguistic information, sound (pronunciation), usage examples, dialect phrases, geolocation, etymology, semantic data, social networks and crowdsourcing.

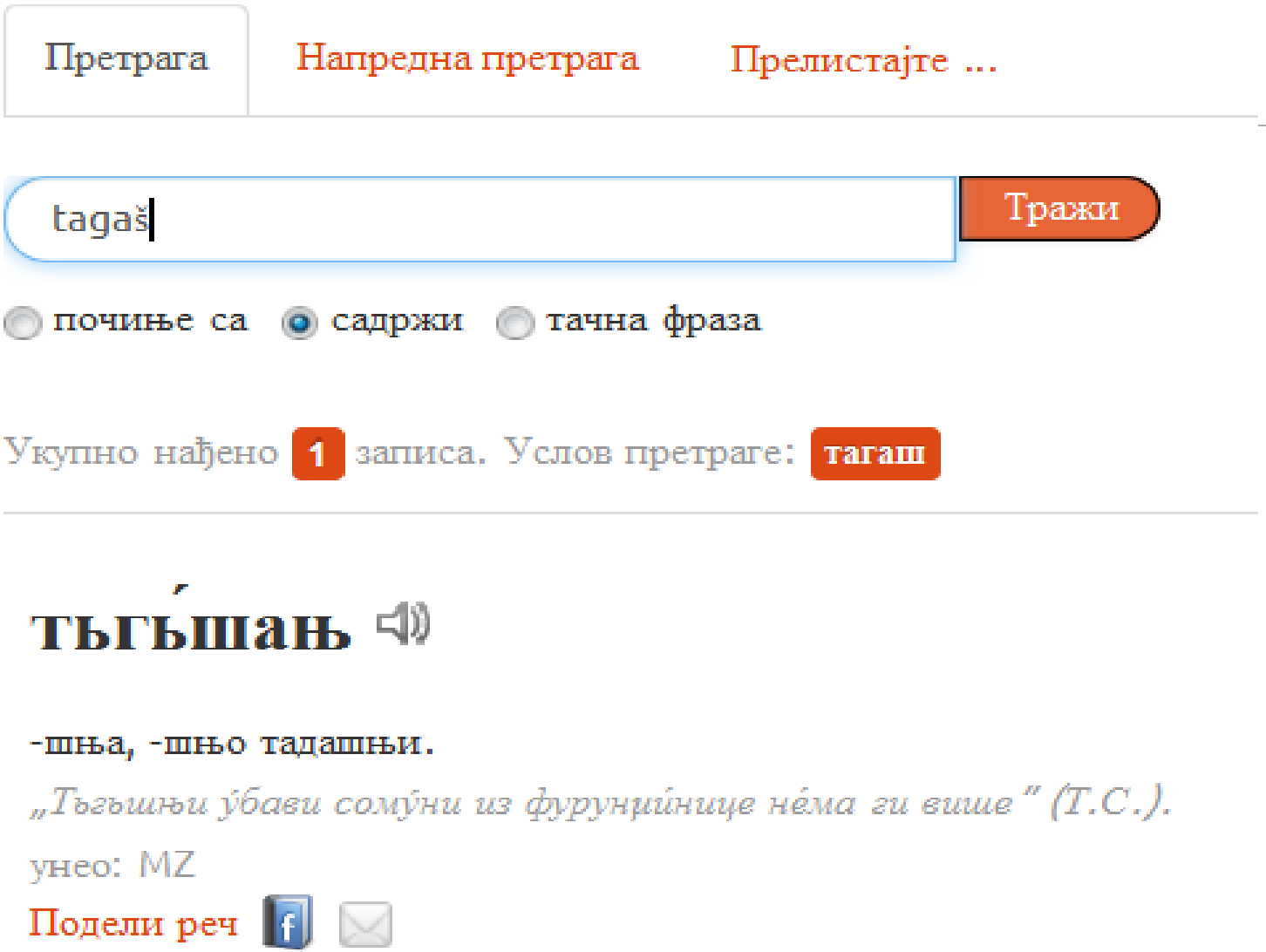
Search

- by a term, by boolean metadata queries
- browsing by the 1st letter

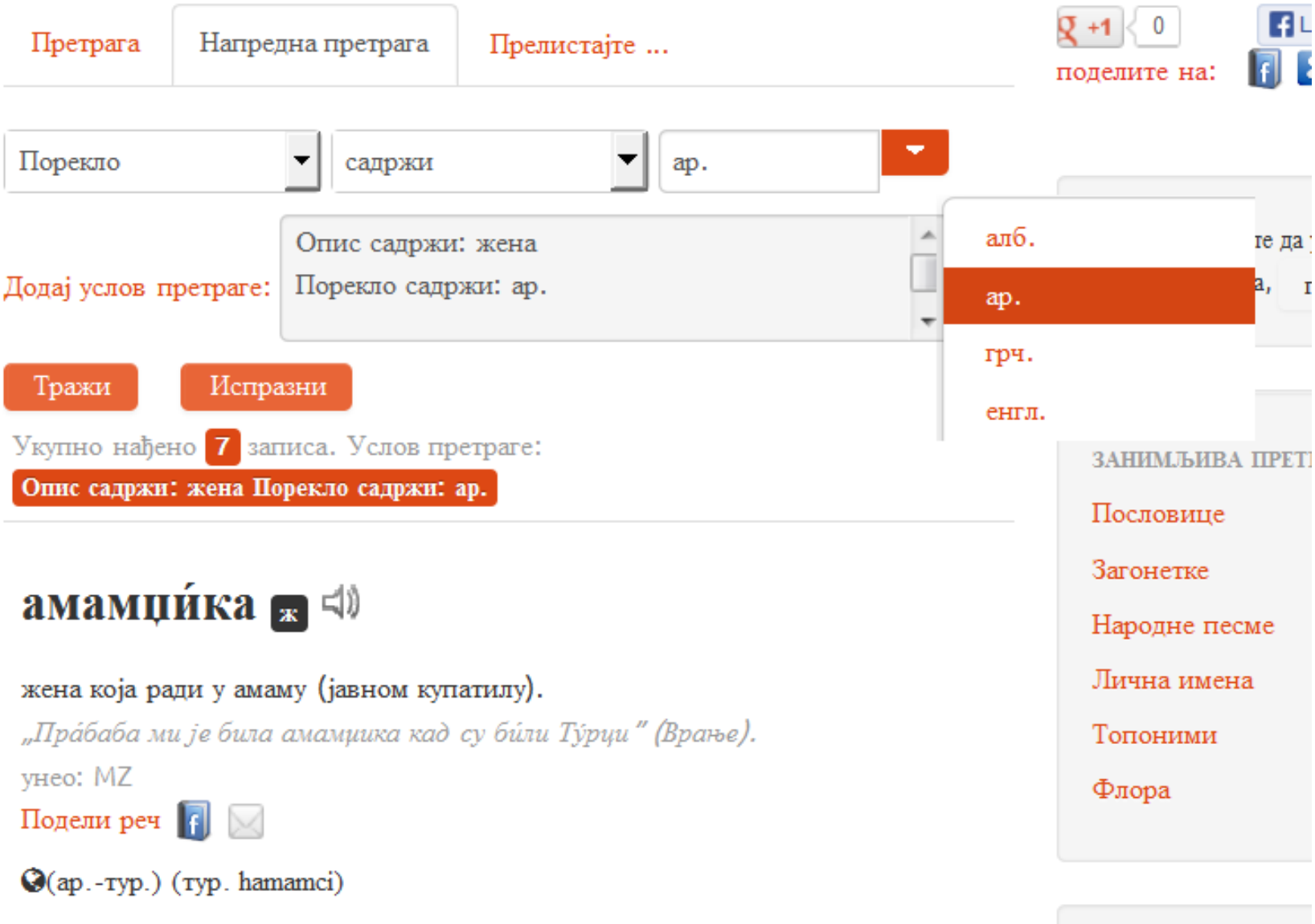


- Standard look-up for on-line dictionary.
- If user is not familiar with a dialect?
- Connecting the standard language and the dialect to enable dialect dictionary search using the standard language terms

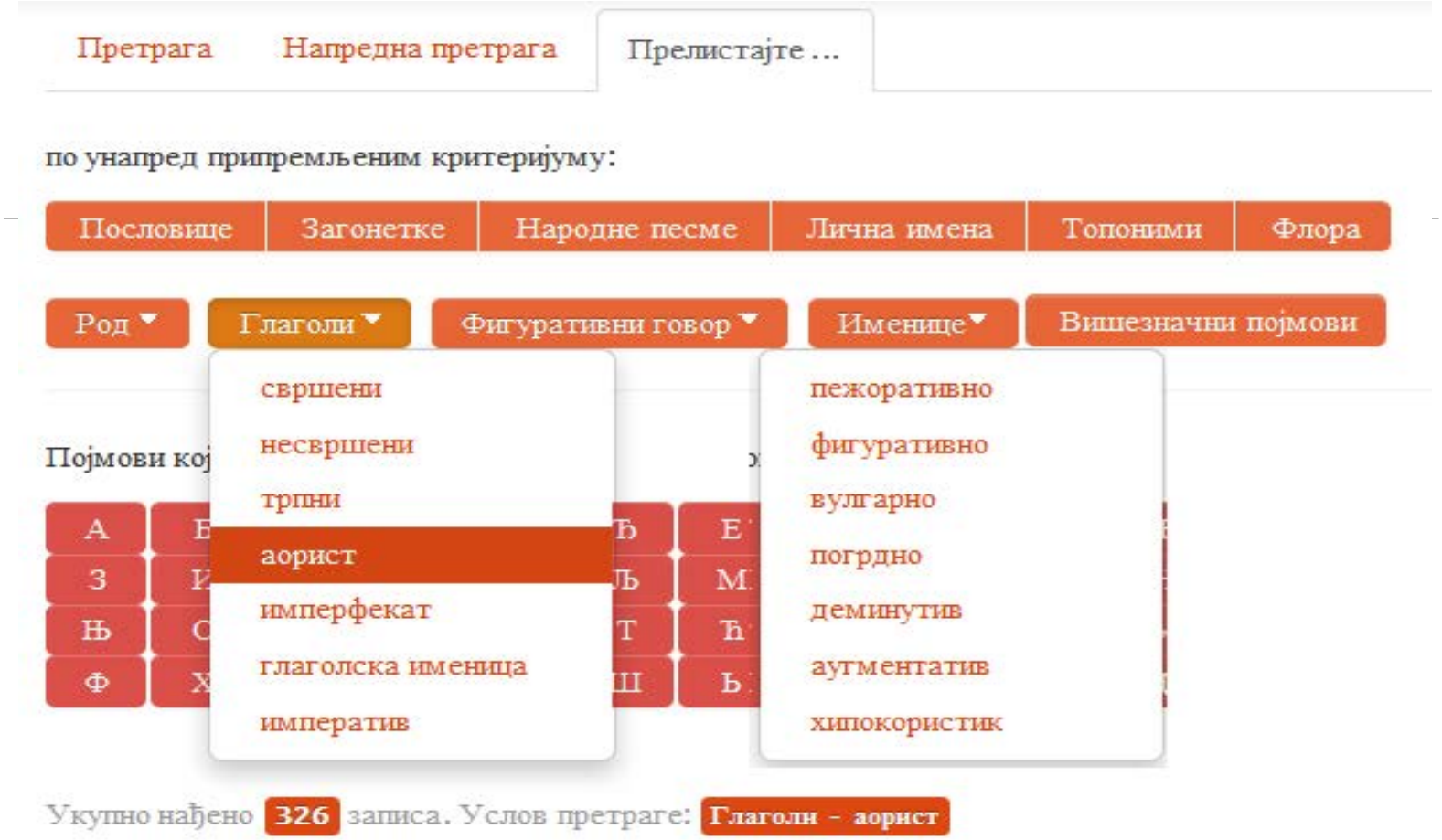
Typical keyword based search



Boolean query…



Semantic search



First letter search (filter)

Претрага | Напредна претрага | Прелистајте ...

по унапред припремљеним критеријуму:

Пословице | Загонетке | Народне песме | Лична имена | Топоними | Флора

Род | Глаголи | Фигуративни говор | Именице | Вишезначни појмови

Појмови који почињу словом:

А	Б	В	Г	Д	Ђ	Е	Ж
З	И	Ј	К	Л	Љ	М	Н
Њ	О	П	Р	С	Т	Ћ	У
Ф	Х	Ц	Ч	Џ	Ш	Ь	Дз

Укупно нађено 69 записа. Услов претраге: Дз

дзьвни

одјекује.

„Удара сас чук, па све дзьвни" (Владовце). „Петлови појев, мори, Морава дзьвни" (нар. пес.) (Врање)

Geolocated search results

ашл Тражи

○ почиње са ◉ садржи ○ тачна фраза

Укупно нађено 2 записа. Услов претраге: ашлак

ашльк м

мали трошак.

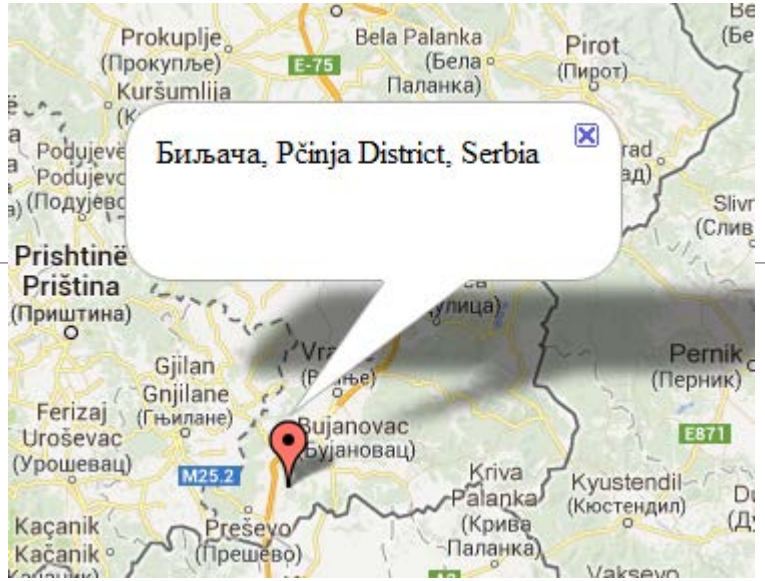
„Дај неки динáр, да ми се нáђе за ашльк" (Биљача).

унео: MZ

Подели реч

(ар.-тур.) (тур. harçlık)

Биљача



цицијашльк м

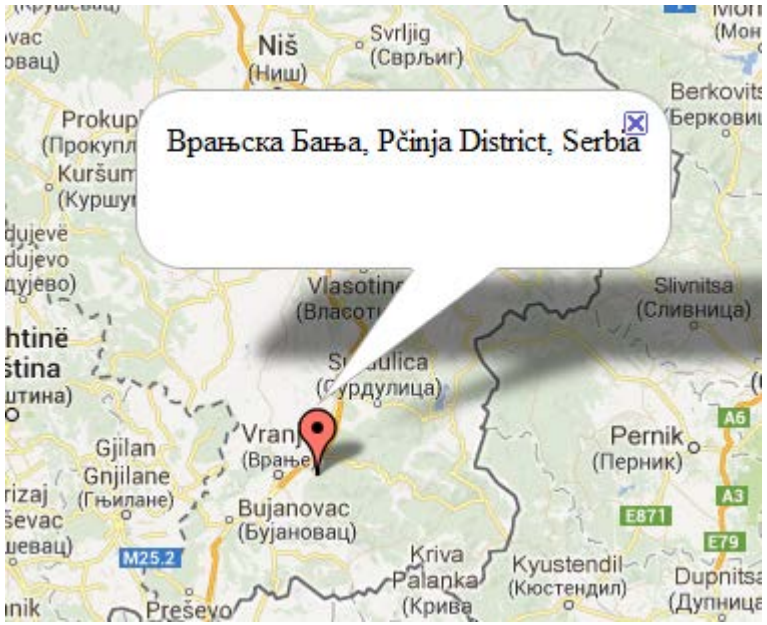
тврдичлук.

„Од њóјан цицијашльк пóголем га нéма" (Врањска Бања).

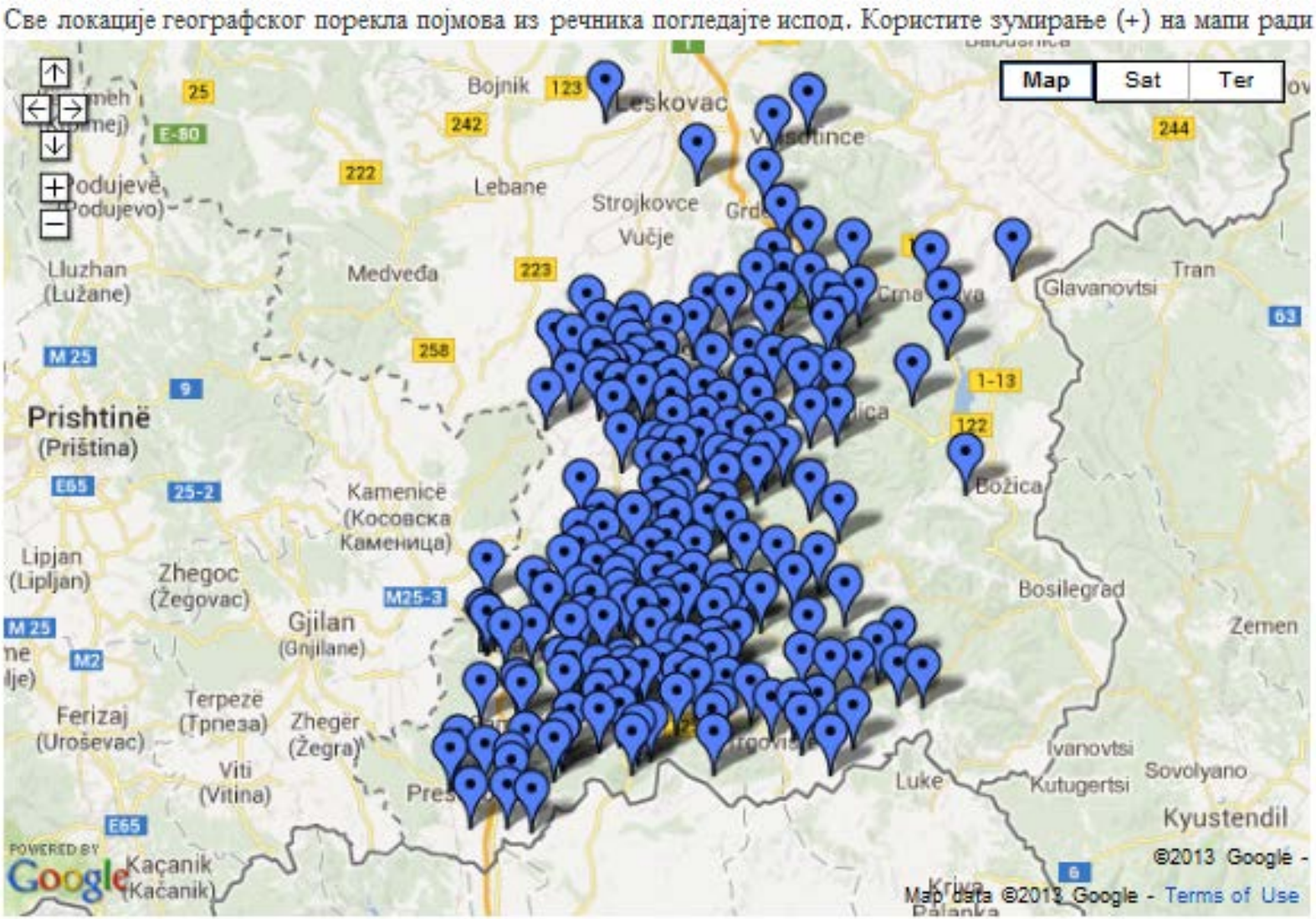
унео: MZ

Подели реч

Врањска Бања



Lexical entry geolocation



Resources for improvement of searching performances

- Serbian morphological e-dictionaries and grammars
  - to produce all inflected forms of standard terms
  - 140,000 lemmas & 5 million forms; 18,000 multi-word lemmas
- Serbian WordNet (SWN) OWL2 ontology
  - rules expressed in Semantic Web Rule Language (SWRL) to generate synonymous groups on the basis of the indirect synonymy relation.
- University of Belgrade
  - Human Language Technology Group

Use of morphological e-dictionaries

- Headword of the verb entry is the present tense, first person singular
- User search for verbs using ifinitive
- Infinitive form (lemma) of dialect verb and verb in the standard Serbian (from definition) was added
- After separation of all synonyms aligned with a dialect, infinitive forms were attached to the original form.
- For 3,452 verb entries 7,353 synonyms were detected

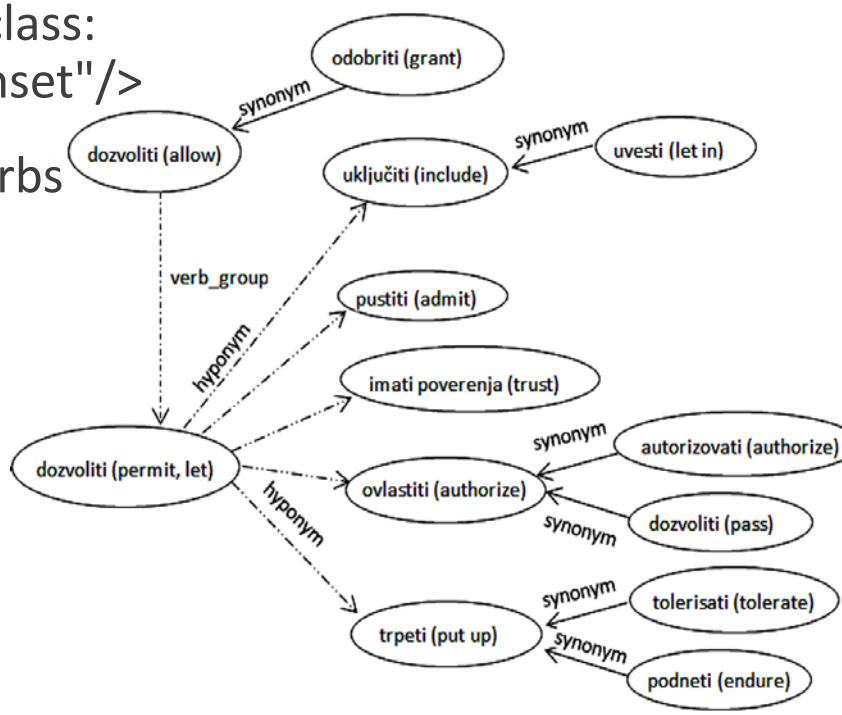
- batalim_bataliti | batalen, ostavim_ostaviti, napustim_napustiti
- batisujem | kvarim_kvariti, upropašćujem_upropašćivati
- bednim se | lepo se odevam_odevati, doterujem_doterivati se
- begam_begati | begaj, ja bega_begati, ti bega_begati, begajeći, bežim_bežati

Use of morphological e-dictionaries

- Lemma was assigned for 505 dialect forms out of 3,452 dialect forms given in first person singular, present tense.
- Infinitive forms were assigned to 4,384 word forms in standard Serbian that were connected to dialect forms (out of 7,353).
- Not lemmatized words that consisted of word not presented in e-dictioanries, or adjectives used to describe verbs
- Relation between verbal nouns and verbs was established in some entries but not systematically.
- In e-dictionaries all verbal nouns are marked with a special marker -> 700 relation were established.

Finding the set of near synonyms by using the WordNet ontology

- Serbian WordNet (SWN), based on Princeton WordNet (PWN) has more than 22,000 concepts (synsets)
- SWN ontology has currently 2,243 verb synsets defined as ontology individuals belonging to the VerbSynset class:
  <rdf:type rdf:resource="&swn30;VerbSynset"/>
- Rules: generate synonymous pairs of verbs found in the SWN ontology not based only on the relation of direct synonymy.
- Broader set of synonyms for each verb defined in SWN ontology produsedusing relations: synonym, similar to, also see, verb group, hyponym.



Reasoning rules in the SWN ontology

- Eclipse Java EE IDE Luna and Apache Jena for reasoning at the level of OWL 2 language by converting OWL rules into the Jena rules format.

"[rule1:(?a eg:label ?b)(?a eg:synonym ?c)(?c eg:label ?e) ->
(?b eg:indirectSynonymy ?e)]"

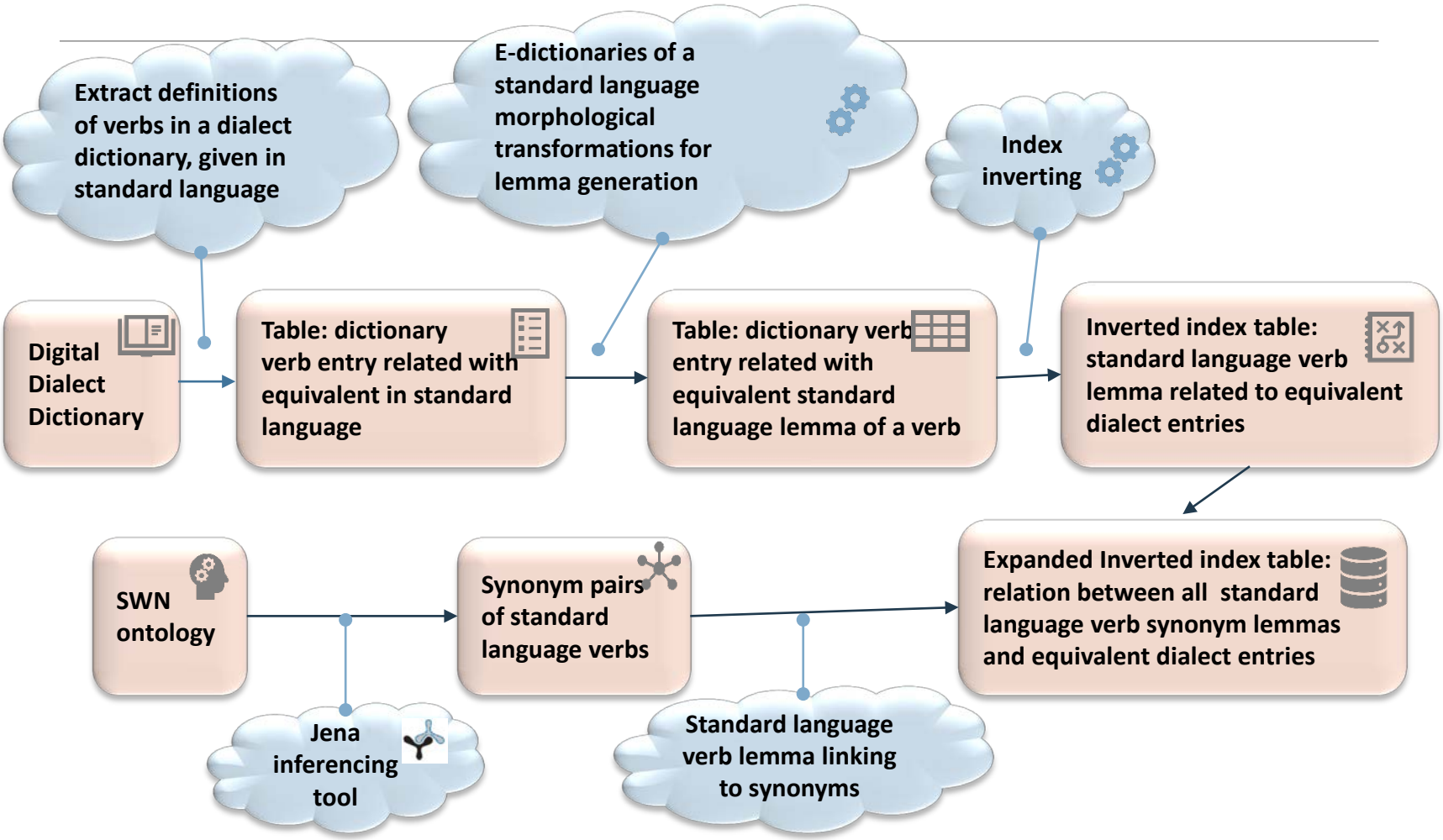
"[rule2:(?a eg:label ?b)(?a eg:similar_to ?c)(?c eg:label ?e) ->
(?b eg:indirectSynonymy ?e)]

.....

"[rule6:(?a eg:similar_to ?c)(?a eg:label ?b)(?c eg:synonym ?d)
(?d eg:label ?e) -> (?b eg:indirectSynonymy ?e)]„

- 33 reasoning rules for indirectSynonymy relation
- after inferencing, 6,430 indirectSynonymy related pairs of verbs.

Architecture of the system for building a resource that improves the dialect dictionary search tool



Example

1) Definition extraction

- isabim
  "(imp. isabi; aor. ja isabi, ti isabi; r.pr. isabija, -ila, -ilo) svr. iskvarim, upropastim.„

2) Lemmatization

- isabim |
  isabi; ja isabi; ti isabi; isabija; iskvarim_iskvariti; upropasti_upropastiti

3) Inverted table

- upropastiti |
  isabim batišem dokrajišem istrovim izabim izakam oznobim profućkam

4) Inference rules

- upropastiti |
  unerediti, uništiti, uprskati, zabrljati, zakrmačiti, zasvinjiti

5) Join

- Upropastiti, unerediti, uništiti, uprskati, zabrljati, zakrmašiti, zasvinjiti | isabim, batišem, dokrajišem, istrovim, izabim, izakam, oznobim, profućkam

Evaluation

- Estimation of the accuracy of pairing the DD and SL entries: 2 language experts annotated the inverted (step 3)
  - ✓ Infinitive SL has similar meaning as DD verb ?
    - 1 - yes
    - 2 - not clear
    - 3 - no
- Automatic procedure: DD headwords not related to any infinitive
- Infinitive classified ~ take a part in relations 1) related 2) unrelated
  - Human marks 1 with related $\Rightarrow$ true positives.
  - Human marks 2 and 3 compared to related $\Rightarrow$ false positives.
  - Comparing with the unrelated set $\Rightarrow$ false and true negatives.

Evaluation

	System Yes	System No
Expert yes	$tp = 3022$	$fn = 436$
Expert no	$fp = 0$	$tn = 784$

The confusion matrix

- whether dictionary entries are correctly aligned with standard language entries
  - P = tp=(tp + fp) = 1.000
  - R = tp=(tp + fn)) = 0.874
  - F1 = 2PR=(P + R) = 0.933
  - Accuracy= 0.897

Remarks

- method is completely precise
- FN: shortcomings in the DD
  - typos, non-standard verb forms,
  - missing SL verb in definition,
  - misineterpreted DD verb

Conclusion

Method for improving search of the DD with key-terms in SL

- SL e-dictionaries lemmatize verb forms
- Serbian WordNet based SWRL rules identifies sets of synonymous words for each verb and verbal noun defined in the ontology
- Join two sets of synonym words (from DD and from SL)

Evaluation of the method with data provided by humans

- Accuracy =89.7%.

Future work

- experiment with other POS
- try to expand the set of ontological rules used in this system