Experimenting with Slovak Wikipedia as a source for Language Technologies

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Wikipedia

• A well-known source of human knowledge maintained by crowd

• A lot of **facts** on various **topics** in a lot of **articles**:
  – 4,405,584 in English
  – 999,839 in Polish
  – 275,982 in Czech
  – 249,421 in Hungarian
  – 187,182 in Slovak
  – 138,292 in Slovene

Wikipedia as a text corpus

• Additional useful information:
  – *articles* represent information about *entities*
  – *links* represent *relations* between *entities*
  – *anchor texts* are *alternative names, inflected forms, abbreviations* of entities or *entity properties*

• Useful for **NLP tasks** such as NER, QA, MT, WSD, etc.

• NLP Tools based on English Wikipedia:
  – [WikipediaMiner](https://github.com/...) 
    • detecting and disambiguating Wikipedia topics when they are mentioned in documents
  – [Illinois Wikifier](https://github.com/...) 
    • disambiguation to Wikipedia with local and global algorithms
  – [DBpedia Spotlight](https://github.com/...) 
    • tool for annotating mentions of DBpedia resources in text. (Dbpedia is structured information in a from of RDF graphs)
Slovak Wikipedia

- Not explored so far as the English
- Good source of inflected forms and alternative names of entities not included on available dictionaries like Persons, Organizations, Locations
- We made two simple experiments showing possible use of Slovak Wikipedia for NLP:
  
  **E1:** Links and anchors extraction  
  **E2:** Named Entity Recognition
E1: Link and anchor text extraction

• The point
  – Collect entities (articles), their alternative names (anchors) and related entities (via links) and explore search over titles and anchors

• Parsed XML dump of Slovak Wikipedia
  – 737.3 MB uncompressed, 30th April 2013
  – Size of uncompressed English Wikipedia dump is about 44 GB!!

• We have used Map-Reduce paradigm for this task (Hadoop implementation)

• Parsed results were indexed in Solr
E1: Wikipedia parsing using Map-Reduce

INPUT

SPLIT

MAP

SHUFFLE

REDUCE

OUTPUT

XML dump

Article1

href1, anchor1
href1, anchor2
href2, anchor3

Article2

href1, anchor4
href3, anchor5

ArticleN

href4, anchor6
href4, anchor6
href5, anchor7
href6, anchor8

href1, anchor1
href1, anchor2
href1, anchor4

href2, anchor3

href3, anchor5
href3, anchor8

href4, anchor6
href4, anchor6
href5, anchor7

href1 anchor1
href1 anchor2
href1 anchor4

href2 anchor3

href3 anchor5
href3 anchor8

href4 anchor6
href4 anchor6

href5 anchor7

href5 anchor7

Article1

Article2

Article3

Article4

Article5

Solr
E1 Results

http://147.213.75.180:8080/stevo/skwikislovco/browse?q=hrad
E1 Results

• 310,571 articles processed including redirects from dump XML

• 4,212,467 outlinks with anchor texts extracted

• 3,977,843 inlinks
  – only outlinks to encyclopedia articles, lists, disambiguation pages, and encyclopedia redirects were converted to inlinks

• 696,874 articles indexed including non-existing

• 5.71 inlinks per article in average

• 13.60 inlinks per article (considering only articles referred more than once)

• Wikipedia link structure together with anchor texts could be a resource for creating training sets for NLP methods such as lemmatization, stemming or NER
E2: Named Entity Recognition

• The point
  – Annotate persons, locations and their inflected forms in Wikipedia texts and train a NER model on these texts

• Our goal was to automatically train NER model on Wikipedia content and make it applicable on newswire texts for person and location recognition
E2: Person names extraction and annotation

• There were 42,500 unique person names extracted and annotated in Slovak Wikipedia

• Approach:
  – Step 1 (22,511 unique lemmas of person names):
    • 16,454 names in Wikimedia markup; e.g. [[Ľudovít Štúr]] (* [[1815]])
    • 11,404 names in Infobox information fields
  – Step 2 (19,989 unique inflected person names):
    • Inflected forms discovered in anchor texts
E2: Location names extraction and annotation

• Location names were extracted and annotated similarly to person names
  – Step 1: 37,121 lemmas of location names
  – Step 2: 482 inflected location names

• Total 37,603 location names
E2: Model training

- Model training
  - Apache OpenNLP used with maximum entropy machine learning (no special tweaking made)

- Trained on annotated Wikipedia texts
  - Example of training data for person NEs:

```
```
E2: Training data and evaluation

### Training data

<table>
<thead>
<tr>
<th>Sentences</th>
<th>Tagged person names</th>
</tr>
</thead>
<tbody>
<tr>
<td>184,602</td>
<td>91,915</td>
</tr>
<tr>
<td>40,579</td>
<td>38,538</td>
</tr>
</tbody>
</table>

### Evaluation on Training data

<table>
<thead>
<tr>
<th></th>
<th>Precision</th>
<th>Recall</th>
<th>F1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person model</td>
<td>0.901</td>
<td>0.617</td>
<td>0.867</td>
</tr>
<tr>
<td>Location model</td>
<td>0.998</td>
<td>0.995</td>
<td>0.997</td>
</tr>
</tbody>
</table>

### Evaluation on Test data – manually annotated news articles

<table>
<thead>
<tr>
<th></th>
<th>Precision</th>
<th>Recall</th>
<th>F1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person model</td>
<td>0.891</td>
<td>0.372</td>
<td>0.517</td>
</tr>
<tr>
<td>Location model</td>
<td>1.0</td>
<td>0.292</td>
<td>0.433</td>
</tr>
</tbody>
</table>
E2: Entity merging

• Trained NER models were able to discover entities in text, but not recognize that different forms represent the same entity; e.g.
  
  [Michael Schumacher], [Michaela Schumachera],
  [Michaelom Schumacherom]

• Simple merging algorithm based on Levenstein distance and suffixes
### E2: Most frequent suffixes of person names found in Wikipedia

<table>
<thead>
<tr>
<th>Suffix</th>
<th>Frequency</th>
<th>Suffix</th>
<th>Frequency</th>
<th>Suffix</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>5 543</td>
<td>ov</td>
<td>130</td>
<td>ea</td>
<td>55</td>
</tr>
<tr>
<td>om</td>
<td>4 406</td>
<td>ová</td>
<td>127</td>
<td>s</td>
<td>54</td>
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<td>1 323</td>
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<td>103</td>
<td>e</td>
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<td>m</td>
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<td>ovho</td>
<td>88</td>
<td>ových</td>
<td>52</td>
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<tr>
<td>ho</td>
<td>589</td>
<td>mu</td>
<td>76</td>
<td>ovom</td>
<td>44</td>
</tr>
<tr>
<td>ou</td>
<td>541</td>
<td>ove</td>
<td>71</td>
<td>ému</td>
<td>41</td>
</tr>
<tr>
<td>ej</td>
<td>325</td>
<td>ovou</td>
<td>62</td>
<td>o</td>
<td>41</td>
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<td>vi</td>
<td>59</td>
<td>ovo</td>
<td>41</td>
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<tr>
<td>ého</td>
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<td>eho</td>
<td>56</td>
<td>i</td>
<td>40</td>
</tr>
<tr>
<td>us</td>
<td>143</td>
<td>ovu</td>
<td>56</td>
<td>OTHER</td>
<td>1 345</td>
</tr>
</tbody>
</table>
Conclusion

• Experiments does not provide ready to use solutions for NLP tasks, but show the use pattern of growing Wikipedia resource.

• Our intent was to show that Slovak Wikipedia can serve as a decent source for Language Technology training and evaluation
Thank you!