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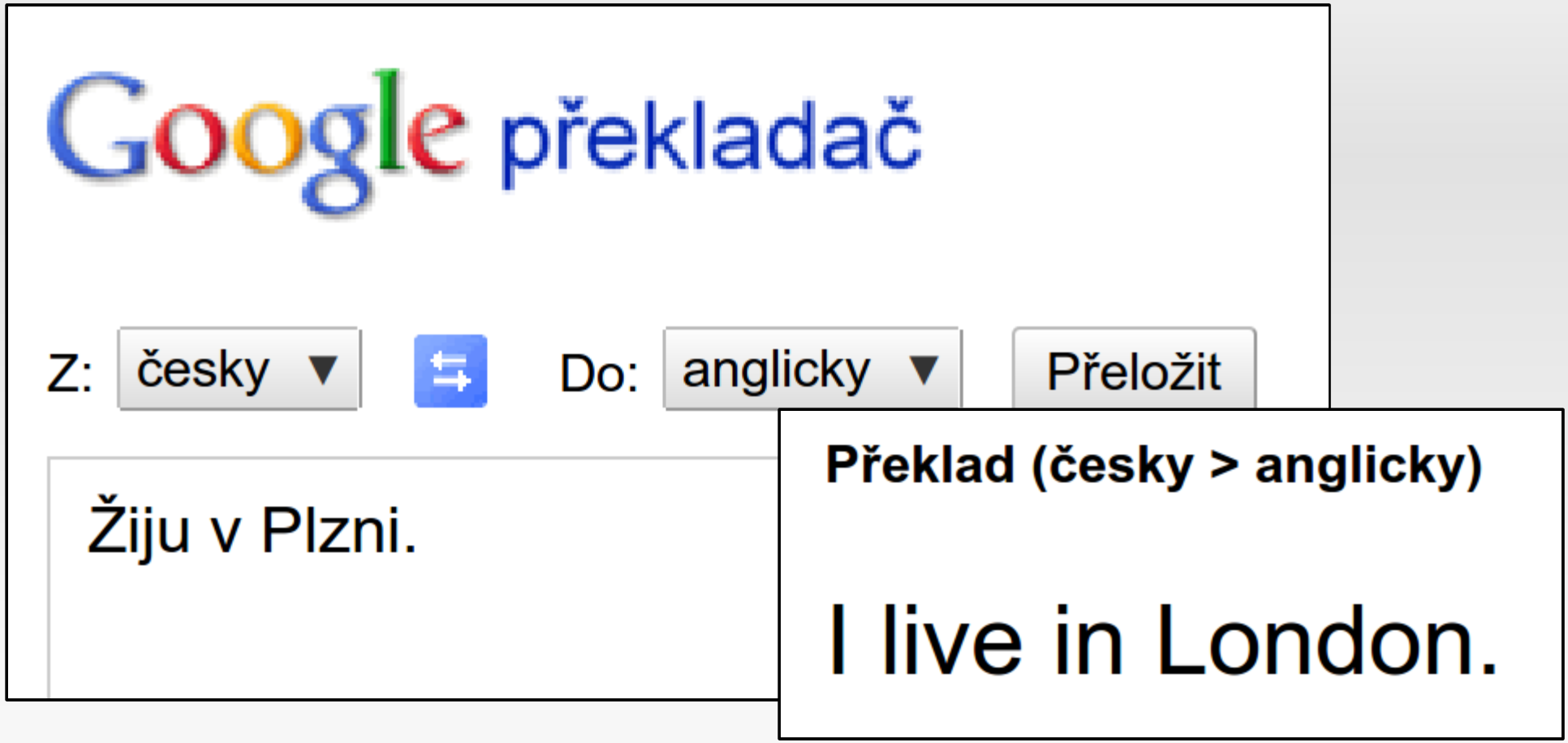
Machine Translation
of Named Entities
with Help of Wikipedia

Named Entity Translation

- **Rice University** is at 6100 **Main Street**.
- **Steven Bird** passed on the editorship...
- **fork()** creates a new process.

- **Univerzita rýže** je v 6100 **hlavní ulici**.
- **Steven pták** přenesl na editorship...
- **vidlička()** vytváří nový proces.

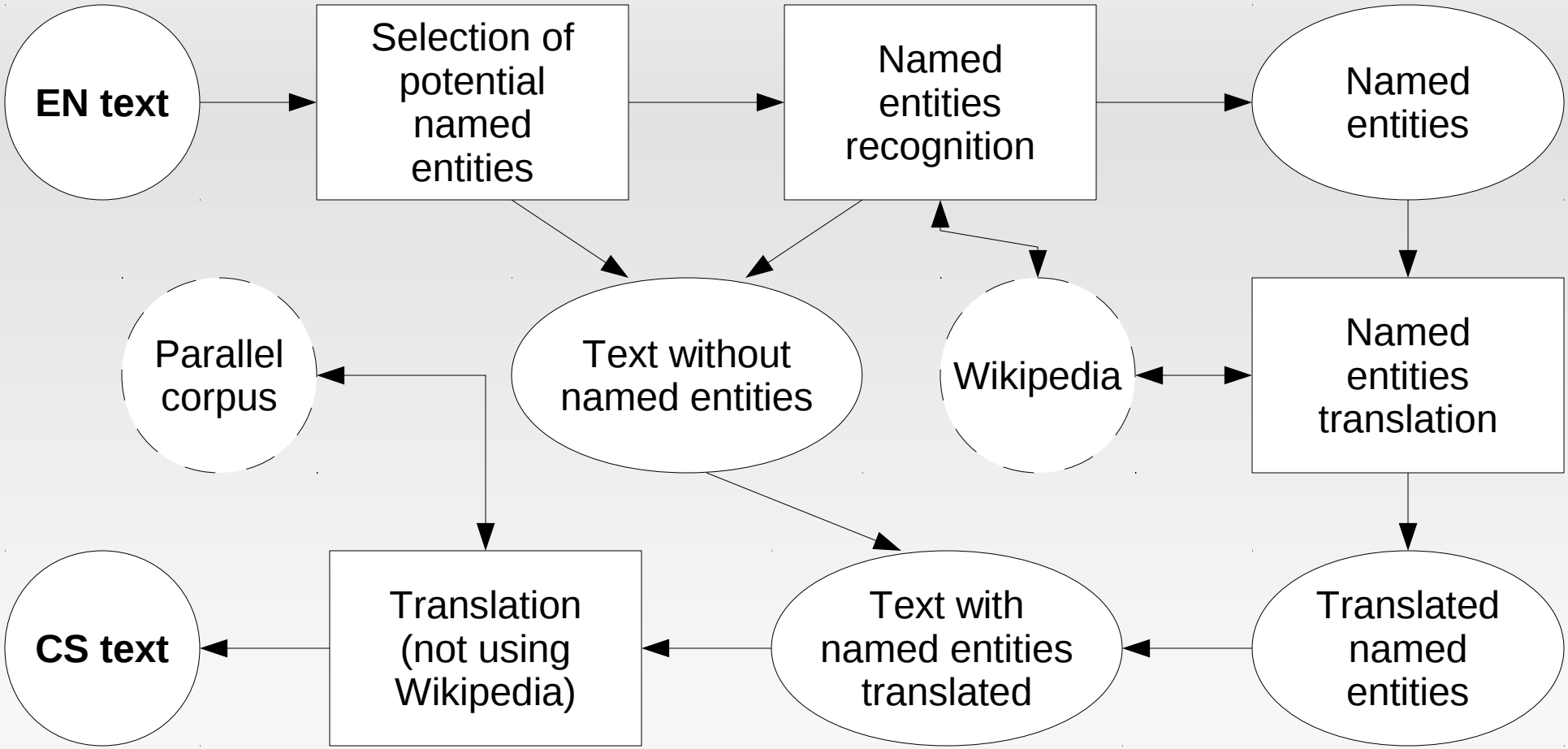
Google Translate



MT of NE with help of Wikipedia

- English to Czech translation
- Named entities recognition
  - look for possible named entities
  - filter the candidates using categories of the English article on Wikipedia
- Named entities translation
  - use title of the corresponding Czech article on Wikipedia
  - include inflected forms of the article name

Overview



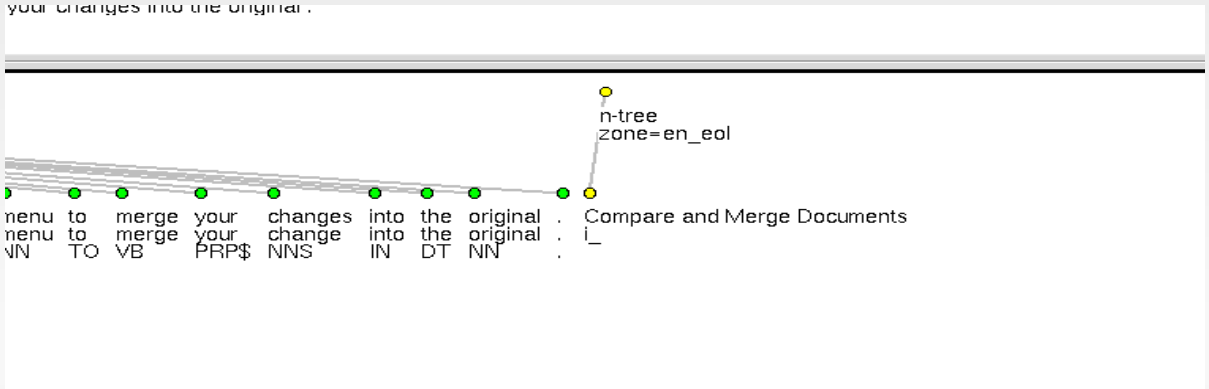
Named entity recognition

- Select phrases suspected to be named entities

  “Rice University is at 6100 **Main Street**.”
- Human inter-annotator agreement only 83%
- Simple recognizer
  - Look for sequences of words with capital first letter
  - Use a small set of rules for beginnings of sentences
  - Precision 0.57, recall 0.73 against human annotation
- Stanford NER

Stanford NER

- More efficient recognition approach
- Capable of better multi-word identification
- TectoMT built-in feature
- Over 90% accuracy
- Precision 0.70, recall 0.49 against our human annotation



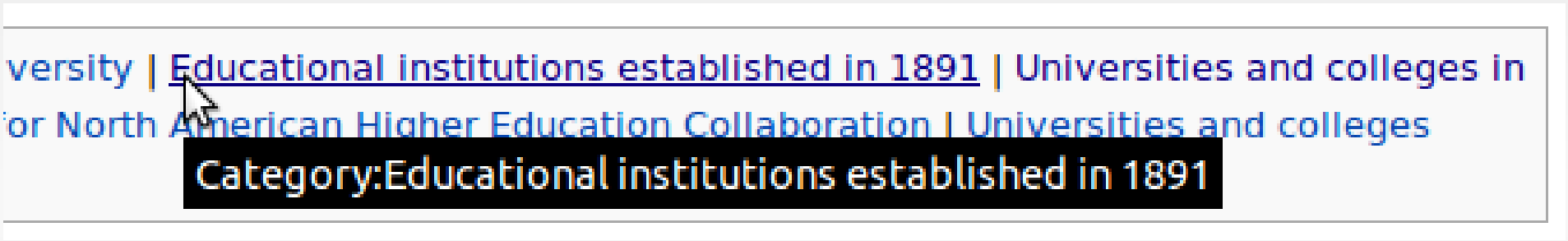
Named entity recognition

- Get categories of the article on Wikipedia
- Search superior categories (BFS)
  - Handmade list of categories containing named entities

Named entities categories

- Places
- People
- Organizations
- Companies
- Software
- Transport infrastructure

Get (all) categories



Superior categories search

- **Educational institutions established in 1891**
- Educational institutions established in the 1890s
- Educational institutions established in the 19th century
- Educational institutions by year of establishment
- Organizations by year of establishment
- **Organizations**

Get categories – WikiMedia API

- http://en.wikipedia.org/w/api.php?action=query&prop=**categories**&redirects&clshow=!hidden&format=**xml**&titles=**Rice_University**

```
<?xml version="1.0"?>
<api><query><pages>
  <page pageid="25813" ns="0"
    title="Rice University">
    <categories>
      <cl ns="14" title="Category:Association
        of American Universities" />
      <cl ns="14" title="Category:Educational
        institutions established in 1891" />
```

…

Named entity translation

Suppose that we have an English named entity:

- Look if there is the article on English Wikipedia
- Look if there is an equivalent Czech article
- Use all inflected occurrences of the translated name in the Czech article

Translation of “Spain”

Reading the articles

- Fetch the article content using WikiMedia API
- Ignore Wiki markup
- Trim last 3 letters of each word in the name, look for identical sequences of “stems” in the article
- Estimate the probability of different forms from the count of occurrences

Named entities in Moses

- Include our translation suggestions in the input data using XML markup
- Easy to incorporate alternative translations and their probabilities
- *p(e|f)*, *p(f|e)*, *lex(e|f)*, *lex(f|e)* replaced by our score
  - only intended to differentiate between our suggestions
  - phrase table entries have much lower scores
  - LM sorts this out sometimes
  - needed to supply nonzero probability for OOV in LM

Experimental setup

- CzEng 0.9 corpus
- 200k parallel sentences for TM
  - alignment computed on 4-letter word stems
- 5m target-side sentences for LM
  - different from the parallel data
- All data lowercased
- Tools used: SRILM, GIZA++, Moses decoder & toolkit, eman

Experimental results

- Several combinations are possible with our approach:

Input preprocessing	BLEU
only title translation, force our translations, force untranslated unknown* forms	25.13
only title translation, force our translations	25.38
only title translation, allow phrase table translations	25.80
all name forms & probabilities, allow phrase table translations	25.97
same as above, Stanford NER	25.98
none	**26.62**

** Named entity, but Czech article does not exist*

Experimental results

- Our method did sometimes improve translation:

Source:	It was **Nova Scotia** on Wednesday.
Baseline:	byl to **nova scotia** ve středu.
NE translated:	to bylo **nové skotsko** ve středu.

Source:	In August, 1860, they returned to the **Victoria Falls**.
Baseline:	v srpnu, 1860, se k vyjádření **falls**.
NE translated:	v srpnu, 1860, se na **viktoriiny vodopády**.

Sources of errors

- Wrong Wikipedia translation
  - the article is about a different meaning of the term
  - Brussels -> Bruselský region (Brussels Region)
- Failure of suffix trimming
  - the heuristics for searching in Wikipedia articles matches an unrelated term
  - Polsko -> pole (field), Nestlé -> nesprávně (incorrectly)
- Wrong named entity form
  - the article does not include the suitable inflected form
  - the language model fails to enforce the correct option

Manual evaluation

- 255 sentences, roughly 400 named entities
- No reference translations => BLEU not possible
- 3 systems:
  - baseline
  - translate unknown entities
  - keep unknown entities untranslated
- Outputs randomized by QuickJudge, ranked by 4 annotators, ties were allowed
- Translations differed only in 78 sentences

Manual evaluation

- All 4 annotators agree on a winner in about 25% cases
- Number of wins of each system:

Annotator	Baseline	Translate unknown	Keep unknown
1	46	**56**	51
2	38	45	**54**
3	41	39	**47**
4	35	43	**49**

Conclusion

- Improvement in some translations
- Drop in BLEU due to high number of errors
- Human evaluation favourable

- Future work:
  - better model probabilities of our translations
  - explore other ways of incorporating NE translations
  - improve NER

References

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  - http://ufal.mff.cuni.cz/czeng/