Interactive Second Language Learning from News Websites

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Slides available at: dwz.cn/kan-nlptea2
Formal language learning is time-consuming, and learning materials are often limited.
…but we also spend over 35B hours every month keeping up with the news.
WordNews

A browser extension for vocabulary learning when reading online news
Debris on the Indian island of Reunion is to be transported to France to find out whether it is from the missing flight MH370, Malaysia’s prime minister has said.

Initial reports suggest the 2m-long object is very likely to be from a Boeing 777, Najib Razak said.

The Malaysia Airlines - a Boeing 777 - vanished while travelling from Kuala Lumpur to Beijing in March 2014.

The search has focused on the southern Indian Ocean east of Reunion.

Oceanographer David Griffin, of Australia’s science agency, told the BBC that the location of the find was “consistent with where we think debris might have turned up”.

There were 239 passengers and crew on board the plane when it went missing.
News Context

• Identify the news category by URL pattern

http://edition.cnn.com/2015/07/08/entertainment/feat-tom-selleck-droughtshaming-water/index.html

7 categories: Entertainment, World, Finance, Sports, Fashion, Technology, Travel

• Classify words based on category document frequency
  E.g., “superstar” belongs to “Entertainment”

• For both English and Chinese news and words
Outline

• Introduction

• Translating
  Word Sense Disambiguation (WSD)

• Testing
  Distractor Generation

• Conclusion
Word Sense Disambiguation

• Expanded College English Test 4 Dictionary
  – English, Chinese (relative frequency), part-of-speech
  – 33,664 English-Chinese pairs and
    ~4k unique English words

• Baseline: always choose the most frequent relative Chinese translation
  – 100% of coverage as it always has a translation
  – Low accuracy as it lacks context modeling
Word Sense Disambiguation

• Approach 1: News Category
  – Pick the Chinese translation with the same category as the news article
  – E.g., “利息” => “interest” in Finance news

• Approach 2: Part-of-Speech (POS)
  – Pick up the Chinese translation with the same POS as the target English word
  – E.g., “book” => “书” (noun) and “预定” (verb)
WSD: Bing Translator Based Methods

- Approach 3: Substring Match

1. Bing Translator

2. Look up dictionary
   - noun: 俱乐部, 棒, …
   - verb: 凑份子, …

3. Matched: 俱乐部 (Bing) is a substring of 俱乐部 (dict)

Limited by dictionary coverage!
WSD: Bing Translator Based Methods

1. Bing Translator

... into the world's top 40 clubs

2. Look up dictionary

...进入世界顶级40名俱乐部

noun: 顶部, 顶端, 顶,
adj: 上面的, 最大的,...
verb: 盖

3. No output using substring match
WSD: Bing Translator Based Methods

• Approach 4: Relaxed Match

1. Bing Translator + Chinese Segmentation

2. Look up dictionary

   noun: 顶部, 顶端, 顶
   adj: 上面的, 最大的
   verb: 盖

3. Relaxed Match: 顶级 (Bing) is superset of 顶 (dict)

…进入世界顶级40名俱乐部

… into the world's top 40 clubs
WSD: Bing Translator Based Methods

1. Bing Translator + Chinese Segmentation
   ... state department spokeswomen said ...

2. Look up dictionary
   noun: 态, 国, 州, ...
   verb: 声明, 陈述, ... 发言, ...
   adj: 国家的

3. Two relaxed matches, both wrong
   国家 (Bing) => 国 (dict)
   发言人 (Bing) => 发言 (dict)

... 国家 部门 的 发言人 说 ...
WSD: Bing Translator Based Methods

• Approach 5: Bing Alignment

1. Bing Translator + Bing Alignment

2. Look up dictionary

... state department spokeswomen said ...

Better - No output if the alignment is phrase to phrase

... 国家 部门 的 发言人 说 ...

noun: 态, 国, 州, ...
verb: 声明, 陈述, ... 发言, ...
adj: 国家的
WSD: Evaluation

![Bar chart showing WSD evaluation results for different methods.](chart.png)
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What is a set of suitable distractors?

• Have the same **form** as the target word
  – Same POS tag
• Fit the sentence **context**
  – News category
• Have proper **difficulty** level according to user’s level of mastery
  – Difficult distractors are more semantically similar to the target words
Generating proper distractors

The difficulty level is measured by Lin distance between the target word and candidate distractor in WordNet.

\[ sim(t, d) = \frac{2 \cdot \log P(lso(t, d))}{\log P(t) + \log P(d)} \]

A distractor is deemed hard when its similarity to target word is above threshold (e.g., 0.1)
Distractor Generation

1. WordNews Hard: Same word form +
   Same news category +
   Semantically Similar

2. Random News: Same word form +
   Same news category

Vary the number of hard distractors based on user’s knowledge level
- Beginner: two random + one hard
- Intermediate: three hard
Human Evaluation

• Baseline
  – WordGap System (Knoop and Wilske, 2013)
    • Distractor: target’s synonyms of synonyms in WordNet

• Evaluation 1: WordGap vs. Random News
• Evaluation 2: WordGap vs. WordNews Hard
Human Evaluation

22. Most sex workers that Hail-Jares encounters through street-based outreach are not in it for a _____, or because they lack the drive to succeed, she says. *

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| lark |   |   |   |   |   |   |
| frolic |   |   |   |   |   |   |
| runaround |   |   |   |   |   |   |
| cavort |   |   |   |   |   |   |
| remember |   |   |   |   |   |   |
| film |   |   |   |   |   |   |
| architect |   |   |   |   |   |   |

One is the target word, three are from WordGap, and the other three are from WordNews Hard or Random News
Human Evaluation

- **WordGap vs. Random News.**

|        | # of wins | Avg. Score |
|--------|-----------|------------|
| WordGap | 27        | 3.84       |
| Random News | 23    | 4.10       |

- **WordGap vs. WordNews Hard.**

|        | # of wins | Avg. Score |
|--------|-----------|------------|
| WordGap | 21        | 4.16       |
| WordNews Hard | 29   | 3.49       |

Lower scores are better
Conclusion

• **WordNews**: a Chrome extension enabling interactive vocabulary learning when reading online news

Word Sense Disambiguation based on Machine Translation

Distractor Generation based on news context and semantic similarity

• Future work
  – Mobile client and longitudinal user study

Thanks for listening!

Slides available at: dwz.cn/kan-nlptea2

Image Courtesy: www.heley-int.com