Web Based Collection and Comparison of Cognitive Properties in English and Chinese

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Abstract

Cognitive properties of words are very useful in figurative language understanding, language acquisition and translation. To overcome the subjectivity and low efficiency in manual construction of such database, we propose a web-based method for automatic collection and analysis of cognitive properties. The method employs simile templates to query the search engines. With the help of a bilingual dictionary, the method is able to collect tens of thousands of “vehicle-adjective” items of high quality. Frequencies are then used to obtain the common and independent cognitive properties automatically. The method can be extended conveniently to other languages to construct multi-lingual cognitive property knowledgebase.

1 Introduction

Cognitive Linguistics focuses on the cognitive and metaphorical usage in language. For example, In English the “pig” is fat, dirty and lazy, etc. But it is not the case in other languages. As in Chinese, 猪 (pinyin: zhu, means pig) is fat, lazy and happy, but not dirty. Different cultural backgrounds lead to differences in everyday cognitive knowledge (Lakoff 1980). Therefore it is beneficial for literature translation, cross language retrieval and language acquisition to compare the cognitive properties of words across languages. Traditionally, this kind of knowledge is generally possessed by experienced translators. In this article, we propose a method to collect the knowledge from the web automatically. It also makes a comparison between the obtained results with a traditional bilingual dictionary.

2 Related Work

To collect the cognitive properties by hand is considered as both labour intensive and subjective. Therefore the researchers have sorted to corpus and search engine for help. Kintsch(2000) collects the noun-adjective pairs like “pig-fat” using the Latent Semantic Analysis(LSA) method on a large corpora. Roncero(2006) considers the simile sentences which contain the specific metaphor property like “as adjective as noun”. Veale(2007) collects a large scale of English similes by querying the nouns and adjectives in WordNet from Google to construct the English lexical metaphor knowledgebase “sardonicus”, which contains about 10,000 items of “noun vehicle-adjective property”. In a similar way, Jia(2009) collects Chinese similes from Chinese search engine Baidu. A total number of about 20,000 “noun vehicle-adjective property” items were acquired.

Querying search engines is an efficient way to collect “noun-adjective” items. However, all the previous works are monolingual and do not use the frequencies of the items. Therefore, we want to extend the research to multi-languages and use frequency for the comparison of cognitive properties.

3 Construction of the Bilingual Cognitive Property Knowledgebase

Just like Veale(2007) and Jia(2009), we use specific simile templates to collect English and Chinese “noun vehicle-adjective property” items by querying the search engines and then construct the Chi-
3.1 Lexical Resources

WordNet 3.0 is a widely used lexical resource, which contains 21,479 adjectives and 117,798 nouns (Miller 1990). It supplies plenty of words for collecting English similes.

HowNet is a structured Chinese-English lexical semantic resource (Dong 2006). Different from WordNet, it defines the meaning of a word by a set of structured semantic features, named “sememes”. About 2200 sememes are used to define 95000 Chinese words and 85000 English words in HowNet (ver. 2007). For example, the noun 猪 (pig) and 笨 (stupid) are defined as follows.

猪 - pig, noun: {livestock|牲畜}
笨 - stupid, adjective: {foolish|愚}

3.2 English Item Collection

We used the 21,479 adjectives in WordNet to fill in the simile template “as ADJ as”. When querying Google, 3 limitations are set in advanced search to refine the search results: exact phrase, English language and up to 100 results for each query. We do not use the nouns in WordNet, but the template will supply thousands of nouns where querying Google. Thus, a number of 585,300 types (1,054,982 tokens) of “as…as…” items are gathered from Google. To trim the great number of nonsense, noisy and erroneous items, Veale (2007) manually checks the returned results. It is accurate but takes too much time. We introduce a simple trick for the purpose, which uses the dictionary for filtering. Nouns and adjectives in HowNet are taken to filter the “noun-adjective” items. Then, 27,331 types (87,529 tokens) of “noun-adjective” items are left, covering 6,319 nouns and 4,100 adjectives. Table 1 gives the top 10 most frequent items with their frequencies.

The frequency of “blood-red” is over 100, because it also occurs in returned results of other words. Ideally, it is better to use the simile template “as ADJ as NOUN” for the parings of 21,479 adjectives multiple 117,798 nouns. But the limitation of the frequency to query search engines makes it impossible to finish the collecting work within a short time.

| ID | VEHICLE | ADJ | FREQ |
|----|---------|-----|------|
| 1  | blood   | red | 628  |
| 2  | twilight| gay | 466  |
| 3  | grass   | perennial | 413 |
| 4  | ice     | cold | 392  |
| 5  | mustard | keen | 385  |
| 6  | snow    | white | 340 |
| 7  | sea     | boundless | 314 |
| 8  | feather | light | 289 |
| 9  | night   | black | 280  |
| 10 | hell    | mad  | 254  |

3.3 Chinese Item Collection

For Chinese, there are more simile templates. Three templates “像 (as)+NOUN+一样 (same)”, “像 (as)+VERB+一样 (same)”, “像 (as)+一样 (same)+ADJ” are adopted and are filled with the 51020 nouns, 27901 verbs and 12252 adjectives from HowNet to query Baidu (www.baidu.com). Verbs are also considered, because some of them may function grammatically as nouns in English. For example, “呼吸 (breath)” is a verb in Chinese, but it may serve as a noun phrase in certain contexts, and one of its cognitive properties extracted from Baidu is “自然 (natural)”. It tells people’s experience in breathing. We submit 91173 queries to Baidu, with configurations set to 100 returned results for each query. Totally, 1,258,430 types (5,637,500 tokens) of “vehicle-adjective” items are gathered. Then, nouns and adjectives in HowNet are used to filter these items, leaving only 24,240 items. The web database of the Chinese filtered items is already available for search at http://nlp.nju.edu.cn/lib/cog/ccb_nju.php. Table 2 shows the top 10 most frequent items with their frequencies.
TABLE 2. Top10 most frequent vehicle-adjective items in Chinese

| ID | VEHICLE  | ADJ     | FREQ |
|----|----------|---------|------|
| 1  | 苹果      | apple   | 时尚 fashionable | 1445 |
| 2  | 呼吸      | breath  | 自然 natural     | 758  |
| 3  | 晨曦      | sun rise| 朝气蓬勃 spirited | 750  |
| 4  | 纸        | paper   | 薄 thin          | 660  |
| 5  | 雨点      | rain drop| 密集 dense      | 557  |
| 6  | 自由      | freedom | 美丽 beautiful  | 543  |
| 7  | 纸        | paper   | 薄 thin          | 660  |
| 8  | 花儿      | flower  | 美丽 beautiful  | 497  |
| 9  | 妖精      | spirit  | 温柔 gentle      | 466  |
| 10 | 大海      | sea     | 深 deep          | 402  |

It is surprising to see that “apple” has taken the first place on the web media in China. And “snow-white” occurs in the top10 place in both languages. In next section, we will compare the cognitive properties based on the collection works done on Google and Baidu.

4 Bilingual Comparison

Previous sections have already done some comparison by showing the most frequent items in English and Chinese. In this section, we continue to find the common parts and differences in cognitive properties.

4.1 Common vehicles and properties

We can compare the common vehicles and properties in English and Chinese. By consulting HowNet, 3,106 types of bilingual “vehicle-property” items are gathered, including 1,500 English items and 2,254 Chinese items. They cover only about 10% of all items in each language.

Table 3 shows the top 10 most frequent bilingual items. We can see that people in different cultures share many same properties of things, such as “snow-white”, “blood-red”. However, the “fox-sly” is somewhat strange and interesting, for the animal is not as smart as man or monkey, but is considered sly. About 90% of the “vehicle-adjective” items do not have their corresponding items in the other language. But it does not necessarily mean that the two languages share few common parts. Too many words miss their translations only due to the size of the bilingual dictionary HowNet. For example, “snazzy” and “popular” are not translated to “时尚” or “时髦” in HowNet. Thus, “apple” does not appear in the bilingual common items. So a larger bilingual dictionary is necessary in further researches. However, no matter how large the dictionary is, it may still encounter the difficulty to find all the translation word pairs.

TABLE 3. Top10 most frequent vehicle-adjective pairs in English and Chinese

| ENG VEHICLE | ENG ADJ | ENG FREQ | CHS VEHICLE | CHS ADJ | CHS FREQ |
|-------------|---------|----------|-------------|---------|----------|
| snow white  | 340     | 雪白     | 521         |         |          |
| blood red   | 628     | 血红     | 227         |         |          |
| paper thin  | 132     | 纸薄     | 660         |         |          |
| ice cold    | 392     | 冰冷     | 256         |         |          |
| feather light | 289 | 羽毛轻 | 111         |         |          |
| honey sweet | 55      | 蜜甜     | 324         |         |          |
| sea boundless | 314 | 海大广阔 | 63         |         |          |
| steel strong | 64     | 钢铁硬 | 194         |         |          |
| fox cunning | 88      | 狐狸狡猾 | 166         |         |          |
| fox sly     | 85      | 狐狸狡猾 | 166         |         |          |

4.2 Dependent vehicles and properties

As can be seen below, the “vehicle-property” items depend on culture backgrounds.

TABLE 4. Top10 most frequent dependent vehicle-adjective pairs in English and Chinese

| ENG VEHICLE | ENG ADJ | ENG FREQ | CHS VEHICLE | CHS ADJ | CHS FREQ |
|-------------|---------|----------|-------------|---------|----------|
| twilight gay | 466 | 苹果apple | 时尚fashionable | 1445 |
| grass    | perennia l | 413 | 呼吸breath | 自然natural | 758 |
| mustard keen | 385 | 晨曦sun rise | 朝气蓬勃spirited | 750 |
| hell    | mad | 323 | 雨点rain drop | 密集dense | 557 |
| life    | large | 288 | 自由freedom | 美丽beautiful | 543 |
| punch    | pleased | 254 | 妖精spirit | 温柔gentle | 466 |
| beetroot | red | 240 | 阳光sunlight | 灿烂resplendent | 386 |
| hatter    | mad | 226 | 天神deity | 美丽beautiful | 341 |
| schoolchildren | cruel | 209 | 天使angle | 美丽beautiful | 337 |
| mountain | immovable | 100 | 裁判员referee | 狠ruthless | 300 |

Most of the items are dependent on their language and culture. Table 4 shows the top10 most frequent independent items in English and Chinese, But when a bilingual dictionary is used, some
items are wrong like “苹果-时尚” and “天使-美丽”， as HowNet does not give good translations. With the bilingual cognitive properties, we can see the cognitive property differences among languages in a quick and convenient fashion. It will supply useful information for a literature translator or a second language learner. Here is a detailed example of the common and dependent properties of translation word pairs “山” and “mountain”. The two concepts share 8 common properties and differ in more properties as shown in Table 5.

| CHS-Dependent | ENG-Dependent |
|---------------|---------------|
| 高σ high-196 | Common Properties | immovable-100 |
| 高耸 high-149 | CHS | ENG | dignified-4 |
| 深重 deep&heavy-85 | 沉重-153 | heavy-7 | determined-3 |
| 多 many-50 | 重-37 | heavy-7 | hyaloid-3 |
| 高大 high-27 | 稳重-34 | heavy-7 | insensate-2 |
| 执着 persistence-26 | 大-31 | big-2 | bottleful-2 |
| 平静 calm-9 | 沉稳-24 | heavy-7 | earthbound-1 |
| 坚实 stable-9 | 坚定-8 | staunch-1 | foggy-1 |
| 挺拔 upright-9 | 坚强-7 | stalwart-1 | phrasal-1 |
| 坚忍不拔 fortitudinous-8 | 坚强-6 | staunch1 | nonliving-1 |
| 崇高 sublimity-6 | | | converse-1 |
| ... | ... | ... | ...

In English, the most important property of mountain is “immovable” while it is “high” in Chinese.¹ The contrast is very useful in cross language teaching and communications. The automatic comparison is not very precise yet, we need to enlarge the scale of the cognitive property knowledgebase.

### 5 Conclusion and Future Work

Cognitive properties of words are very meaningful and useful but are not given in the traditional dictionaries. To overcome the difficulty in manual collecting, tagging and comparing of the cognitive properties in different languages, we employ search engines and bilingual dictionaries to construct an English-Chinese cognitive property knowledgebase. With the frequencies of the “vehicle-adjective” items, it is fast and convenient to see the language common and dependent properties of the word-pairs, which have translation relations. Using HowNet, we’ve already seen that most of the “vehicle-adjective” items are language dependent. Thus, the knowledgebase is very helpful to literature translators, language learners and machine translations.

In the future, we are to find better ways to collect more “vehicle-adjective” items from search engines and to use larger bilingual dictionaries to refine the common parts of English and Chinese cognitive properties. With more multi-lingual dictionaries, we are also able to deal with more languages under different cultures.

### Acknowledgments

We are grateful for the comments of the anonymous reviewers. This work was supported in part by National Social Science Fund of China under contract 10CYY021, 11CYY030, State Key Lab. for Novel Software Technology under contract KFKT2011B03, China PostDoc Fund under contract 2012M510178, Jiangsu PostDoc Fund under contract 1101065C.

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¹ The item “mountain-high” does not exist in our collection but appears in Google. Because it is hard to get the item only using the template “as adjective as”.

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