Identifying and Exploiting Definitions in Wordnet Bahasa

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Wordnet Bahasa

- A lexical database of the Malay languages: Indonesian and Standard Malay (Nurril Hirfana Mohamed Noor et al., 2011; Bond et al., 2014)
- Built based on Princeton Wordnet
- 40,493 synsets, 118,903 senses, 43,113 unique words
- 14,190 Indonesian definitions from the Asian Wordnet project (Riza et al., 2010)
    - crowd-sourced definitions
    - little quality control
- Add Indonesian definitions + clean up
    - Correcting, deleting and choosing definitions semi-automatically using Python 3.4
    - Extracting semantic relations between lemmas and definitions using Python 3.4 and the Natural Language Toolkit (NLTK) (Bird et al., 2009)
    - Ideas to improve Wordnet

Correcting definitions (1/3)

- Misspellings, typos, abbreviations

Before correction	After correction	Meaning	Number of hits
(double space)	(single space)		416
dimana	*di mana*	“where”	313
dengans	*dengan*	“with”	121
dgn	*dengan*	“with”	93
utk	*untuk*	“for”	52
kpd	*kepada*	“to”	25
pd	*pada*	“at”	23
lain lain	*lain-lain*	“others”	21
enerji	*energi*	“energy”	12
bagain	*bagian*	“part”	12

Table: Some examples of misspellings, abbreviations and typos, before and after the correction

Correcting definitions (2/3)

- Deleting hyphens between words

Synset	Definition	
14118423-n ‘severe diabetes mellitus...’	*diabetes-mellitus-tergantung-insulin* “diabetes mellitus depending on insulin”	Before correction
	diabetes mellitus tergantung insulin	After correction

Table: An example of a definition having hyphens, before and after the correction

Correcting definitions (3/3)

- Deleting the first word which is the same as the lemma and brackets

Synset	Definition	
09543673-n ‘an evil spirit or ghost’	*Ghoul (roh jahat atau hantu)* “Ghoul (an evil spirit or ghost)”	Before correction
	roh jahat atau hantu “an evil spirit or ghost”	After correction

Table: An example of a definition with lemma as the first word, before and after the correction

Deleting definitions

- Definitions written in English or names

Synset	Definition
03491491-n	Hanging Gardens of Babylon
09164241-n	ho chi minh city
10875910-n	George Herbert Walker Bush
11252392-n	rain in the face
13615557-n	a unit of measure for capacity officially adopted in the British Imperial System

Table: Some examples of deleted definitions

Choosing definitions (1/3)

- Choosing the longest definition which includes others

Synset	Definition	
07904637-n ‘gin flavored with sloes (fruit of the blackthorn)’	*buah dari semak* “fruit of the blackthorn”	Before cleaning up
	gin yang diberi rasa sloea “gin flavored with sloes”	
	gin yang diberi rasa sloea (buah dari semak) “gin flavored with sloes (fruit of the blackthorn)”	
	gin yang diberi rasa sloea (buah dari semak)	After cleaning

Table: An example of a synset with many parts of definition, before and after the cleaning up

Choosing definitions (2/3)

- Choosing the best definition based on the English and Japanese definitions

Synset	Definition	
01711910-a ‘causing a sharply painful or stinging sensation’	*kedinginannya menggigit ke tulang* “the coldness bites to bones”	Before correction
	kedinginannya menusuk ke tulang “the coldness stings to bones”	
	sejuk hingga menggigit ke tulang “cool biting to bones”	
	sejuk hingga menusuk ke tulang “cool stinging to bones”	
	sejuk hingga menusuk ke tulang “cool stinging to bones”	After correction

Table: An example of a synset having many definitions, before and after the correction

Choosing definitions (3/3)

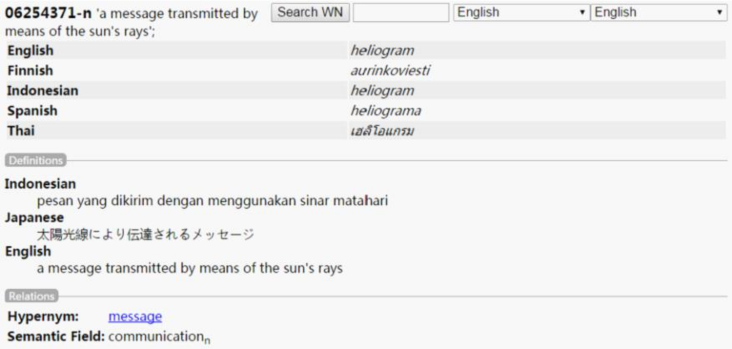
- Correcting manually one or two words in the definition

Synset	Definition	
00731471-a ‘supported by both sides’	*didukung oleh dua negara* “supported by both countries”	Before correction
	didukung oleh dua partai “supported by both parties”	
	didukung oleh dua pihak “supported by both sides”	After correction

Table: An example of a synset having two definitions, before and after the correction

Uploading definitions

- Open Multilingual Wordnet (1.2) hosted by NTU in Singapore (`http://compling.hss.ntu.edu.sg/omw/`)



06254371-n 'a message transmitted by means of the sun's rays';

English	*heliogram*
Finnish	*aurinkoviesti*
Indonesian	*heliogram*
Spanish	*heliograma*
Thai	*เฮลิโอแกรม*

Indonesian
pesan yang dikirim dengan menggunakan sinar matahari

Japanese
太陽光線により伝達されるメッセージ

English
a message transmitted by means of the sun's rays

Hypernym: message

Semantic Field: communication$_n$

Figure: A screenshot of synset 06254371-n ‘heliogram’

Extracting relations from definitions

- The basic method is based on Bond et al. (2004) which use a grammar to parse definitions and extract relations
- We used regular expressions in this paper
- Indonesian language:
  - strong tendency to be head-initial (Sneddon et al. 2010, pp. 160-162)
  - Noun + Adjective, Noun + Demonstrative, Noun + Relative clause
  - Numeral + Noun, Classifier + Noun
- We modified the definitions, so that the first word could be taken as a potential genus term

Some Indonesian definitions

(1) ***09500625-n ‘Pegasus’***
*seekor **kuda** bersayap dalam mitologi Yunani*
one-CL horse winged in mythology Greece

“a winged horse in Greek mythology”

(2) ***05316175-n ‘ocular muscle’***
*satu dari **otot-otot** kecil pada mata...*
one of muscle-RED small at eye

“one of the small muscles of the eye”

Modifying definitions

- For each definition for nouns and verbs, the following words at the beginning were removed:
  - words between brackets, relating to domain: e.g. *(Ilmu komputer)* "(Computer science)"
  - numerals: e.g. *satu* "one", *tiga* "three", *5* "five"
  - determiners: e.g. *setiap* "every", *sejenis* "a kind of", *salah satu* "one of", *beberapa* "some", *berbagai* "various", *segala* "all"
  - relativizer: *yang* "which"
  - prepositions: e.g. *untuk* "for", *dari* "of", *dalam* "in"
  - other stop words: e.g. *seperti* "like", *tentang* "about", *termasuk* "including", *biasanya* "usually"
- The plural (reduplicated) form of the head was changed to its singular (non-reduplicated) form: e.g. *otot-otot* "muscles" → *otot* "muscle"
- Punctuations, e.g. / ; , dividing two words were replaced as a space

Extracting relations

Using Python 3.4 and NLTK (Bird et al., 2009),
for each genus term (adjusted first word) in each definition,

- Check if it is in Wordnet
  - If it is not in Wordnet, check if it is in the Indonesian dictionary KBBI `http://badanbahasa.kemdikbud.go.id/kbbi/` (Alwi et al., 2008)
  - If the genus term is in Wordnet,
    - If it is the same as a lemma → **synonym**
    - If it is in one of the hyponym synsets → **hyponym**
    - If it is in one of the hypernym synsets → **hypernym**
    - If it is in one of the instance hypernym synsets → **instance hypernym**
    - If no relations can be extracted, check manually

Results and discussion

Out of 14,190 original lines of definitions from the Asian Wordnet project,

- 1,522 definitions (10.7%) were deleted
- The remaining 12,668 definitions (89.3%) consist of:
  - 10,549 definitions for nouns
  - 1,663 definitions for adjectives
  - 409 definitions for verbs
  - 47 definitions for adverbs

Out of 10,958 definitions for nouns and verbs which were examined for relations,

- Relations could be extracted from 6,257 definitions (57.1%)
- Problems were found in the remaining 4,701 definitions (42.9%)
  - Relations could not be extracted from 3,943 definitions
  - The first word in 747 definitions could not be found in Wordnet
  - 11 definitions do not have explicit semantic relations with the lemmas

Relations extracted from lemmas and definitions

Relation	Number of synsets	Example	
		Synset	Definition
Hypernym	5,451	00021939-n artifact	*suatu* ***objek*** *buatan manusia* “a man-made object”
Instance h.	549	02956500-n Capitol	***gedung*** *DPR di AS* “the government building in the US”
Synonym	252	00004475-n organism	***makhluk*** *hidup yang dapat …* “a living thing that can …
Hyponym	5	00029677-n process	*sebuah* ***fenomena*** *yang berkelanjutan* “a sustained phenomenon”
Total	6,257		

Table: Four relations extracted from 6,257 definitions

Problems found in extracting relations (1/2)

	Problem	Example	
		Synset	Definition
1	No correct synset in Wordnet Bahasa	14350206-n myelitis	***inflamasi*** *pada syaraf …* "inflammation of the spinal cord"
2	No explicit relation	14573846-n viremia	***kehadiran*** *suatu virus…* "the presence of a virus…"
3	Relational noun	07603411-n choc	***singkatan*** *dalam bahasa Inggris…* "colloquial British abbreviation…"
4	Compound	14364217-n sword-cut	***bekas*** *luka dari sayatan pedang* "a scar from a cut made by a sword"
5	Incomplete definition	00046344-n stunt	*tidak biasa atau berbahaya* "not usual or dangerous"

Table: Five types of problem found in extracting relations in 3,943 definitions when the genus candidates are in Wordnet

Problems found in extracting relations (2/2)

	Problem	Example	
		Synset	Definition
1	Word in online KBBI data	13436063-n automatic data processing	***pemrosesan*** *data secara otomatis* “automatic data processing”
2	Word not in online KBBI data	09603258-n Pluto	***karakter*** *kartun anjing*… “a cartoon character…”
3	Compound	07865105-n chili dog	***hot*** *dog dengan daging sapi*… “a hotdog with chili con carne…”
4	Derived word with negation	14099050-n visual aphasia	***ketidakmampuan*** *memahami*… “inability to perceive…”
5	Incomplete definition	14155506-n cystic fibrosis	*disebabkan kerusakan suatu gen* “caused by defect in a single gene”
6	Incorrect definition	00662589-v insure	*membagikan kawasan untuk*… “allot regions for soldiers”

Table: Six types of problem found in extracting relations in 747 definitions when the genus candidates are not in Wordnet

Summary and future work

Things to be improved in Wordnet Bahasa:

1. Edit the incomplete Indonesian definitions
2. Delete the incorrect Indonesian definitions
3. Add new lemmas from KBBI and possibly derived words with negation
4. Add existing lemmas to the correct synsets
5. Sense tag the definitions (project from English)

Things to be improved in Wordnet in general:

1. Make definitions more informative, possibly add the hypernyms
2. Standardize definitions, possibly make some guidelines
3. Quality control in the translation process

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