Building JATI: A Treebank for Indonesian

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Outline

1. What is a treebank?
2. Indonesian treebanks
3. The corpus: Kamus Besar Bahasa Indonesia (KBBI)
4. The parser: Indonesian Resource Grammar (INDRA)
5. Treebank development
6. Summary and future work

Treebank

- A treebank is a linguistically annotated corpus that includes some grammatical analysis beyond the part-of-speech level [8]
- Usages:
  - empirical linguistic research, as well as Natural Language Processing (NLP)
  - enables more precise queries
  - in qualitative research, such as finding an example of a certain linguistic construction or a counter-example to a claim about syntactic structure
  - in quantitative research, as a source of information about frequencies and co-occurrences
  - building statistical model, robust broad-coverage parsing
  - developing a broad-coverage grammar, test the grammar

Motivation

- We want to understand natural language
  - it is interesting in and of itself
  - it offers a view into human cognition
  - much knowledge is encoded in natural language
  - we want to make computers understand
- What does it mean for a machine to understand?
  - The system analyses text and grows clever
    - ★ it increase the lexicon
    - ★ it builds up the ontology
    - ★ it changes the stochastic model

Indonesian treebanks

- The Indonesian Dependency Treebank developed by Charles University in Prague [5]
- The Indonesian Treebank developed by the Faculty of Computer Science of University of Indonesia [4]
- The Indonesian Treebank in the Asian Language Treebank (ALT), built by the Agency for the Assessment and Application of Technology (BPPT) [13]
- the Indonesian Treebank in the ParGram Parallel Treebank (ParGramBank), based on LFG "IndoGram" [15]

Other treebanks

- Penn Treebank
- The LinGO Redwoods Treebank of English [11]
- Hinoki [2]

JATI Overview

- Based on an HPSG grammar of Indonesian: Indonesian Resource Grammar (INDRA) [6]
  We want to develop a broad-coverage grammar together with the treebank. Treebanking allows us to immediately identify problems in the grammar and improving the grammar directly improves the quality of the treebank [9]
- Parsing (a subset of) dictionary definition sentences: KBBI Fifth Edition [1]
- Creating a corpus that can be studied: JATI

The corpus: Kamus Besar Bahasa Indonesia (KBBI)

- The fifth edition of KBBI [1], published by Badan Pengembangan dan Pembinaan Bahasa
- The KBBI database, a machine-tractable dictionary [7]
- 108,240 entries, 126,643 definitions, 29,260 examples (as of 15 June 2017)

KBBI definition sentences

Definitions related to food, drinks, spices, edible things are extracted and edited

Before	After
minuman keras *yg* dibuat *dr* nira *yg* telah disuling	minuman keras *yang* dibuat *dari* nira *yang* telah disuling
kue kering, dibuat *dr* sagu dan dibungkus *dng* daun nipah	kue kering *yang* dibuat *dari* sagu dan dibungkus *dengan* daun nipah
makanan *terbuat dr* daging, udang, ikan *yg* dicincang	makanan *yang dibuat dari* daging, udang, *atau* ikan *yang* dicincang

- Shorter, compared with other commonly used text for corpora, such as newspaper text
- Contain more fragments, especially noun phrases
- Valid examples of naturally occurring texts

The parser: Indonesian Resource Grammar (INDRA)

- open-source Indonesian computational grammar [6]
  `https://github.com/davidmoeljadi/INDRA`
- parse and generate Indonesian text
- open-source tools in Deep Linguistic Processing with HPSG Initiative (DELPH-IN)
  - Documentation (`http://moin.delph-in.net/IndraTop`)
  - ITSDB or [incr tsdb()] [10]
  - Full Forest Treebanker (FFTB) [12]
- theoretical framework of Head Driven Phrase Structure Grammar (HPSG) [14]
- Minimal Recursion Semantics (MRS) [3]
- 1,885 types, 15,099 lexical items, 38 rules (as of 15 June 2017)

Choosing a Grammar

HPSG is chosen for the following reasons:

- Serious attempt to cover linguistic phenomena both core and periphery
- unification- and constraint-based context free grammar (phrase structure grammar)
  - consists of a set of rules and a lexicon of symbols (parts-of-speech) and words, surface oriented (no additional abstract structures)
- Integration of syntax and semantics (mono-stratal)
  we are most interested in semantics
  - tractable representation: MRS
- A vibrant research community
  - well developed open source tools
  - integration with shallow processing

Open Resources: DELPH-IN

Deep Linguistic Processing with HPSG Initiative

- Grammars: English (ERG), Japanese (JACY), Chinese (Zhong), Indonesian (INDRA), ...
- Development Environment: Linguistic Knowledge Builder (LKB)
- Processor: Answer Constraint Engine (ACE)
- Test Environment: ITSDB or [incr tsdb()]
- Treebanking tools: FFTB
- Machine Translation: LOGON

Approaches to Treebanking

- Manual Annotation
- Semi-Automatic
  - **Parse and repair by hand**: Penn WSJ, Kyoto Corpus

    ↑ 100% cover, reasonably fast

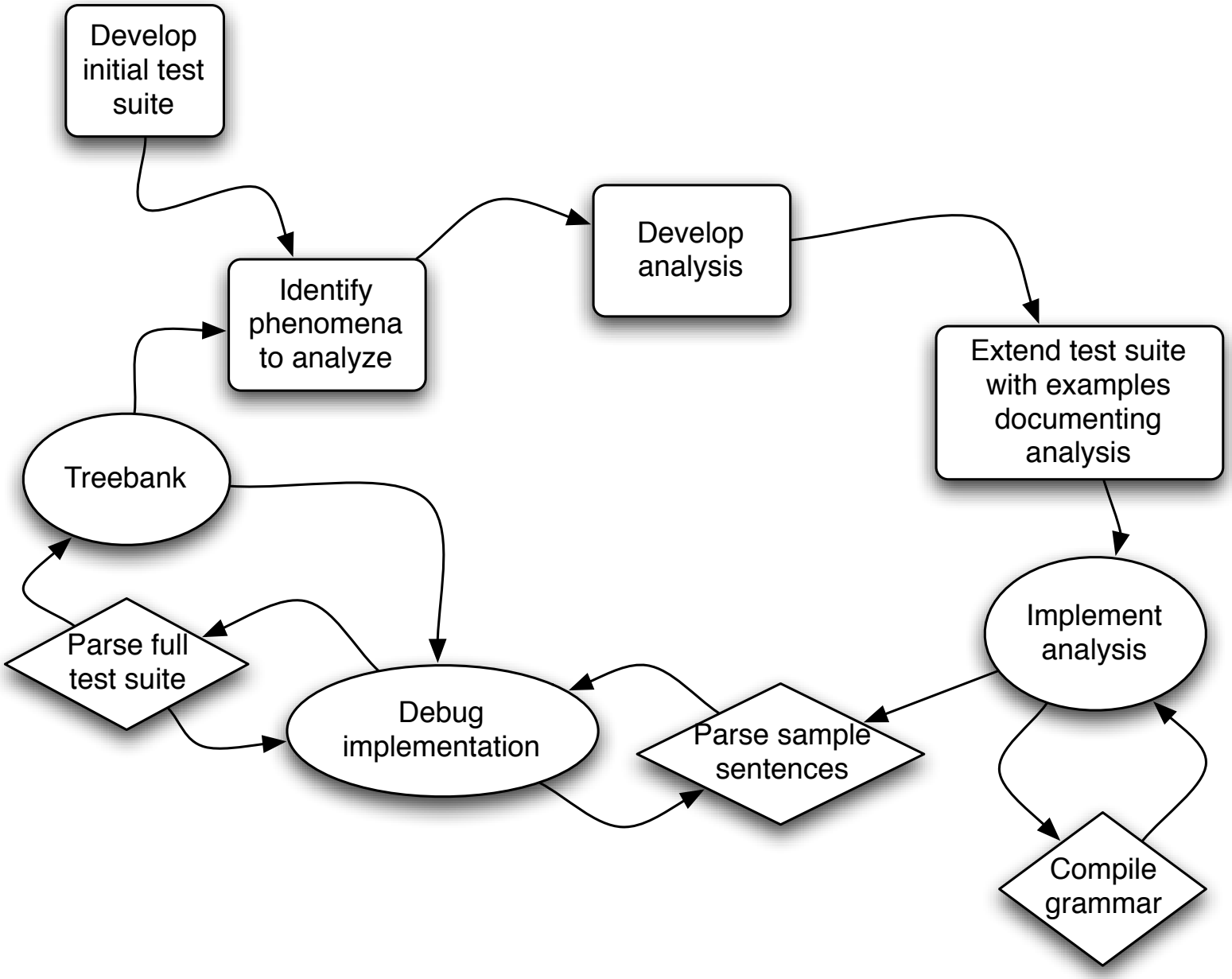
    ↓ Often inconsistent, Hard to update,
    Simple grammars only (prop-bank is separate)
  - **Parse and select by hand**: Redwoods, Hinoki, **JATI**

    ↑ All parses grammatical, Feedback to grammar,
    Consistent
    Both syntax and semantics, Easy to update

    ↓ Cover restricted by grammar

    ★ **Discriminant-based treebanking**: select or reject discriminants until one parse remains

Grammar development



Summary and future work

- Refining the analyses
  - Improving INDRA by adding new rules and lexical types
- Automate analysis
  - parse ranking
- Expanding the system
  - Adding non-familiar words (lexical acquisition)
  - Dynamic handling of unknown words

Long Term Goals

- Make text understanding available to everyone
  - Machine translation
  - Question answering
  - Speech recognition
  - Man-machine interfaces
- Link words to meanings for all languages

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  - "Treebanking an Open Forest: The Tanaka Corpus" by Francis Bond and Takayuki Kuribayashi

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Thank you

te.ri.ma ka.sih *n* rasa syukur;

ber.te.ri.ma ka.sih *v* mengucap syukur; melahirkan rasa syukur atau membalas budi setelah menerima kebaikan dsb