Parsing Java Method Names for Improved Software Analysis

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MOTIVATION

- Modern software engineering tools are driven by sophisticated automatic software analysis
- Automatic analysis of software's natural language (user-defined names) requires accurate parsing of the multi-word names (e.g., `isPointInImage`)

RESEARCH QUESTION

How can we automatically identify the parts of speech and parse program identifiers with high accuracy?

Current Focus: program method signatures

TARGET APPLICATIONS

- Automatic comment generation
- Program search and navigation

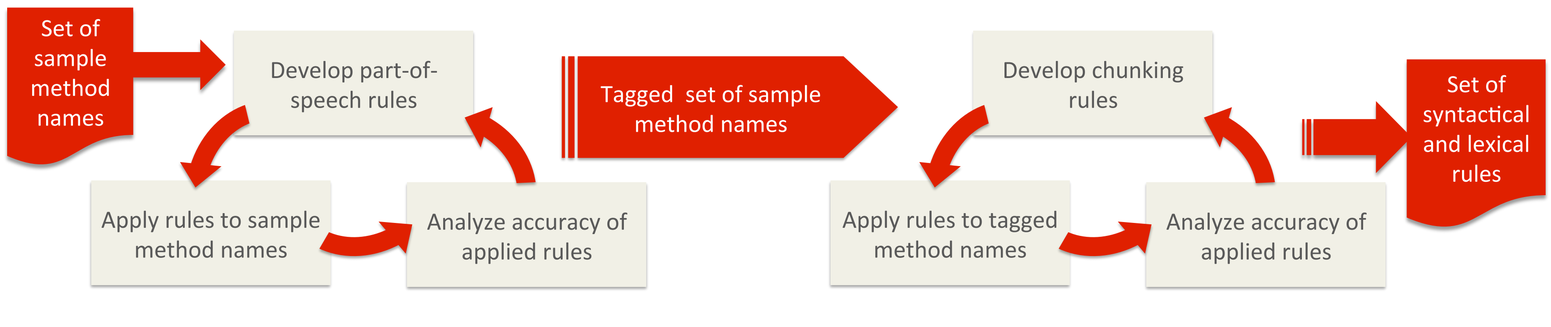
Method Name	`boolean isPointInImage(Point p)`
Parsed Name	[is]:VP [point]:NP [in [image]:NP]:preP
Generated Comment	/* Checks if point p is in image */

Example Method name parsing being used in automatic comment generation.

PARSING METHOD

- Two step algorithm: tagging and chunking
- Tagging uses morphology rules (e.g. words ending in "-ity" are nouns, adjectives form adverbs when "-ly" is added)
- Chunking uses cases (e.g., begins with "is", is a noun phrase, noun phrase + verb phrase, is a constructor)

RESEARCH PROCESS



Phase 1: Part of Speech Tagging

Find all parts of speech that can be applied to a given word through prefix and suffix patterns.

Phase 2: Phrase Chunking

Find patterns in syntax to form phrases (i.e. noun, verb, prepositional, and adjective phrases)

Rule Iterations	Application Output
1. If `word`+s exists, `word` is a noun	decode (noun) request (noun)
2. If `word`+ing and `word`+ed exist, `word` is verb	decode (noun, baseV) request (noun, baseV)
3. If `word` begins with "de-," `word` is only a verb, not a noun	decode (baseV) request (noun, baseV)

Example Part-of-speech tagging iterations on an example method name: `decodeRequest`.

CHALLENGES

TAGGING

- Most nouns do not follow any pattern and are difficult to identify
- Irregular verbs and adjectives are difficult to identify

CHUNKING

- Words with multiple parts-of-speech can give numerous parses for a single method name
- Syntax of method names are different from English
- There are different types of names which all have differing syntax
- Naming conventions differ between coding styles

EVALUATION

- Ran on a set of 200 sample method names collected randomly from 25 Java programs
- 187 (93.5%) chunked correctly
- 13 (6.5%) chunked incorrectly

CURRENT STATUS

- All tagging rules are implemented
- Chunking constructors and method names starting with "is," "can," and "has" is implemented
- Basic phrases and combinations of phrases (NP, VP, VP+NP, NP+PP, etc) implemented

NEXT STEPS

- Improve accuracy of tagging irregular nouns, verbs, and adjectives
- Evaluate how field names are used in program code
- Evaluate how common multiword phrases (e.g., "text field") must be chunked in method names

SUMMARY

- Various types of method names are parsed with high accuracy
- Results of research can be used to improve numerous software engineering tools