Implementing Large-Scale LFG Grammar for Wolof

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Project work

1. Build a morphological analyzer for Wolof (spoken in Senegal with $\approx$ 10 million speakers)
2. Implement a large-scale grammar using the (Lexical Functional Grammar) LFG formalism

- Motivation: No NLP resources available for Wolof
- Parallel Grammar (ParGram) project
  - Aim: produce wide coverage grammars for a variety of languages (English, German, French, Norwegian, Arabic, Urdu, Tigrinya etc.).
  - Collaboratively written grammars within the LFG framework
  - Use of a commonly-agreed-upon set of grammatical features
- NLP development plateforms:
  1. Morphological analysis: Xerox finite state tool (*FST*)
  2. Parsing: Xerox Linguistic Environment (XLE)

Wolof FST System

Morphological analysis using the Xerox tool (fst)

1. two-level morphology: 1) a lower surface and 2) an upper or lexical level
2. Input: surface form is transformed into a lexical form (stem + morphosyntactic features)
3. Use of intermediate level
4. The tool handles the input in both directions: analysis and generation

Example

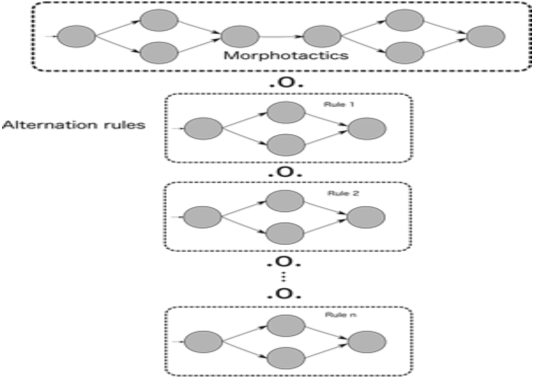
Task: Apply up ***fecceekuwaatoon*** "untied again" from ***fas***: "to tie"

Lexical:	fas+V+Base+Inv+E+MPSV+Iter+PST	
	$\Updownarrow$	Lexicon + morphotactics
Intermediate:	fas :i :e :u :aat :oon	
	$\Updownarrow$	Orthographic rules
Surface:	fecceekuwaatoon	

Morphological components

The components of the Wolof FST:

1. Lexicon: contains verbal and nominal stems, ideophone and closed classes
   - Statistics: common nouns (3800), proper nouns (1000), verbs (3500)
2. Morphotactics as **finite-state network** encoding the legal morphem. combination
3. Phonotactics as **finite-state transducers** describing the rules alternation
4. Composition of lexicon + phonotact. into a single network ⇒ **lex. transducer**



A Broad-Coverage LFG parser for Wolof

- The Wolof Grammar has 95.78 LFG style rules
- Tokenization using FST (handle MWE, clitics, etc.)
- Guessing mechanisms for unknown lexical entries
  1. First guessing strategy: used for words that are recognized by the morphological analyzer but are not in the lexicons.
  2. Second guessing strategy: used for those entries that are not recognized at all.

For modularity, transparency and performance reasons, the lexicons are divided into three lexicons

- A main lexicon containing open classes and which records subcategorization information.
- The second lexicon includes mainly closed class items (stems for determiners, pronouns, prepositions, etc.).
- There is additionally a lexicon for complex predicates entries (morphological applicative, causative, medio-passive etc.).

Robustness Techniques

Special techniques for disambiguation, increasing robustness and coverage

- FRAGMENT: the standard grammar collects enough information in cases where an input sentence does not get a full parse.
  - Return-value: well-formed chunks specified as rules in the standard grammar (e.g. NPs, PPs, Ss, etc.) or
  - The individuals input tokens parsed as TOKEN chunks if no chunks are available.
- SKIMMING: allows to overcome timeouts and memory problems (has been used to tackle performance problems for the English and German grammar).
- Disambiguation:
  - Optimality marks for preferences
  - Using discriminant-based methods
  - Constraint Grammar (CG) Rules

Data description

- Problem for automatic evaluation: no gold-standard available for Wolof.
- Possibility: manual evaluation
- The corpus is collected from stories. The data are randomly split into a development and a test set.

Table: Development Corpus

Total number of sentences	380
Total number of words	3875
Average number of words per sentence	10.0
Sentences less than 10 words	205
Sentences between 10 and 15 words	109
Sentences between 16 and 20 words	44
Sentences more than 20 words	22

Table: Test Corpus

Total number of sentences	150
Total number of words	1439
Average number of words per sentence	9.0
Sentences less than 10 words	87
Sentences between 10 and 15 words	41
Sentences between 16 and 20 words	16
Sentences more than 20 words	6

Possible evaluation scheme: classification of errors into minor errors and serious errors.

- Minor errors would include for instance (PP attachment, Scope of coordination, Best solution is not first solution, but among the first 10, pronominal reference, etc.)
- Serious error:
  - Wrong phrase structure in the main clause. This happens when the system builds the wrong tree because it assigns a POS or a subcategorization frame that is wrong in the context.
  - Three or more minor errors