A Grammar Sparrer for Norwegian

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ABSTRACT

We demonstrate an on-line tool for grammatical error detection for Norwegian with freely chosen inputs, and error-messages informing the user about possible mistakes; the system also generates grammatically correct alternatives for ill-formed input strings. The system is built as an extension to a general-purpose large HPSG grammar of Norwegian, with special 'mal'-rules identifying a set of 40 types of errors. The system is still a prototype.

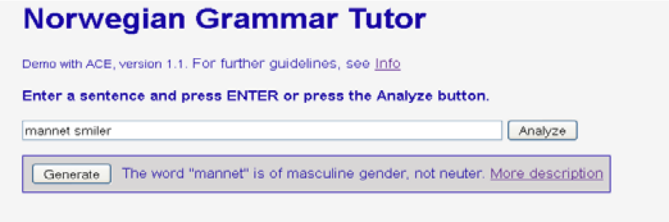
KEYWORDS: Computer Assisted Language Learning, HPSG, LKB, error message, mal-rules

1 Introduction

The ***Norwegian Online Grammar Sparrer*** is an interactive online Grammar Tutor with freely chosen written inputs, with error-messages informing the user about possible mistakes, and generated grammatically correct alternatives for some ill-formed input strings. The system is developed at NTNU, and was first taken into use in 2011. It is built as an extension to a general-purpose large HPSG grammar of Norwegian (see below).

2 Functionalities of the system

The main functionalities can be illustrated as follows. A user writes a putative Norwegian sentence into a window, as shown in FIGURE 1;[1] if grammatical, the system responds that the sentence is grammatical, while if ungrammatical, the system informs the user in what respect the string is ungrammatical. FIGURE 1 shows how, for the ungrammatical string "Mannet smiler", one gets the feedback *The word "mannet" is of masculine gender, not neuter*.



Norwegian Grammar Tutor

Demo with ACE, version 1.1. For further guidelines, see Info

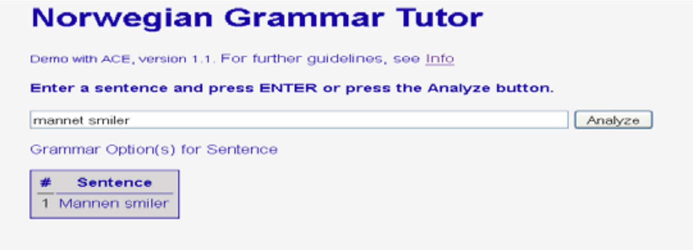
Enter a sentence and press ENTER or press the Analyze button.

mannet smiler

The word "mannet" is of masculine gender, not neuter. More description

FIGURE 1: Illustration of *Error Information* display

In addition to the slot for error message(s), the window provides three buttons: *Info* takes one to a detailed instruction about the tool,[2] *More description* takes one to succinct information about the relevant aspect of Norwegian grammar,[3] and by pushing *Generate*, one can get an example of how the intended sentence should be written, as illustrated in FIGURE 2 for the same string:



Norwegian Grammar Tutor

Demo with ACE, version 1.1. For further guidelines, see Info

Enter a sentence and press ENTER or press the Analyze button.

mannet smiler

Grammar Option(s) for Sentence

#	Sentence
1	Mannen smiler

FIGURE 2: Illustration of *Correct Option* generation

[1] http://regdili.idi.ntnu.no:8080/studentAce/parse

[2] http://typecraft.org/tc2wiki/Classroom:Norwegian_Grammar_Checking

[3] In the relevant case, http://typecraft.org/tc2wiki/The_Noun_Phrase_-_Norwegian.

We call the system ‘grammar sparring’ to highlight the circumstance that the system immediately responds to each move by the user. While the interface shown above is for this interaction, a more general wiki interface is being hosted at *TypeCraft*[4], with instructions and pages supplementing those accessed by the buttons *Info* and *More description* mentioned above.[5]

3 The system architecture

The system builds on the computational grammar ***NorSource*** of Norwegian, developed at NTNU,[6] and is an implemented HPSG grammar (Pollard and Sag 1994) based on the development platform LKB (Copestake 2002). LKB grammars are purely *declarative*, in that they define what are possible structures in a language, while the status of *un*grammatical for a given string resides in its not being included in this set of structures; thus, such a grammar contains no negative statements. NorSource uses the architecture of the *HPSG Grammar Matrix* (Bender 2010, 2012), which includes the semantic representation formalism *Minimal Recursion Semantics* (*MRS*; Copestake et al. 2005); such a representation accompanies any parse produced by the grammar, and from it, sentences of the language can be generated (such a grammar is thus both ‘analyzing’ and ‘generating’). This generation capacity is crucial in the *recommendation* capacity illustrated in Figure 2, the recommended sentence being generated from the MRS of the input string.

With Norsource as a so-called ‘bon-grammar’, a 'mal-apparatus' is built onto the 'bon'-grammar, with ‘mal-rules’ accommodating a predefined set of grammatical errors. Norsource and the ‘mal-apparatus together constitute the full system named ***NorMal***, all parts of Norsource thus being used in NorMal, while NorMal includes files not used in Norsource. When an illformed string is parsed, with an error type which has been assigned a mal-rule, the set of syntactic rules accepting the string will include a mal-rule. The strategy enabling generation of recommendations is to let mal-rules and mal-lexical entries introduce into the MRS exactly the same EP(s) as their ’bon’-counterparts generally introduce, whereby generation can produce well-formed strings coming very close to the intended form.

Norsource currently has close to 200 phrasal combinatory rules, and verb- and adjective lexicons with approximately 10,000 entries each. A noun lexicon with about 50,000 entries is also available, but not used in the Grammar Sparrer, as it induces too much parse ambiguity at the present point. The number of MRSs from a parsed sentence generally depends on the strictness of the rules of the grammar, but even with the fairly strict format presently used, a given parse – especially with mal-rules involved – will be associated with many MRSs. While it is in many cases impossible to predict the intended grammatical sentence of the user, a qualified guess is still possible. In this regard, it is essential that the relevant MRS can be automatically chosen, and for this purpose we use the parse ranker Velldal (2008) implemented with treebanking in [tsdb++] (Oepen et al. 1998, 2002), a tool in the LOGON system (Oepen et al. 2004). A number of sentences representative of the expected input of our system are treebanked and a ranking model is trained, using Rob Malouf's Toolkit for Advanced Discriminative Modeling (http://tadm.sourceforge.net/). The model is loaded with the grammar and it sorts the MRSes

[4] http://typecraft.org

[5] http://typecraft.org/tc2wiki/Feedback_messages, http://typecraft.org/tc2wiki/Grammar_sparring_phenomena

[6] http://typecraft.org/tc2wiki/Norwegian_HPSG_grammar_NorSource

according to the ranking model. For the selection of MRS for a given parse, the system will choose the first MRS in the list.

Such selection is particularly important in cases where parses with alternative mal-rules – or sets of mal-rules – are produced in a parse. It is similarly essential if one wants to deploy the large noun lexicon: in Norwegian, there are very many noun stems homophonous with verb stems, and only systematic tree-banking can 'relegate' the noun options below the verb option on the parse ranking.

From the outset, parsing in the system has been done in processing system PET[7], and generation in LKB. During the last year we have taken into use the system ACE[8], integrated for both purposes, thereby increasing speed by a significant factor.

4 Pedagogical development and outlook

We originally based our mal-rule development on a corpus of common errors among L2 learners of Norwegian at NTNU. The set of phenomena covered in this corpus has proved adequate for the system so far, but we will soon face the need for increasing the phenomena range.[9]

With a running log of sentences processed by the Sparrer, we get continuous feedback on the number of use interactions (approximately 3000 per month, currently), and on the behavior of the system regarding correct identification of grammatical vs. ungrammatical, and delivery and correctness of error messages. The Sparrer is in addition a recommended facility in the Norwegian L2 course NoW hosted at NTNU,[10] an environment in which more systematic pedagogical developments of the tool can be tried out and tested in the future.

In the general context of Computer Assisted Language Learning, the present system follows a type of architecture envisaged in Schneider, D. and K. McCoy (1998), and situated relative to LKB systems in Bender et al. (2004). Relative to the overview of CALL systems presented in Heift et al. (2007), the system is 'rule based' rather than 'constraint-based' (despite HPSG as a framework being commonly called 'constraint-based'). Among CALL systems implemented with LKB, to our knowledge the only other system in current use is a system based on the English grammar ERG (cf. Flickinger 2010), used in primary school teaching, with a more closed pedagogical architecture, and with a significantly broader scope.

What the present type of system perhaps most interestingly demonstrates is the way in which a fully 'generic' grammar – i.e., a domain- and purpose-neutral grammar – can be seamlessly extended into a working pedagogical system. This aspect is particularly interesting in view of the fact that there are currently 8-10 fairly large grammars based on the Grammar Matrix format, and thus using the same formalism as Norsource: an architecture made operative for one of them can relatively easily be applied to others as well. In addition to the rapid avenue to a multi-lingual system of grammar checkers thereby opening, the circumstance that the grammars in all of their modules use largely the same formalism opens for the possibility of creating parallel repositories of language information, and thereby the build-up of parallel pedagogical resources.

[7] http://moin.delph-in.net/PetTop

[8] http://moin.delph-in.net/AceTop

[9] See footnote 5 for links to overview of phenomena.

[10] http://www.ntnu.edu/now

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