STO –LMF documentation

Morphology

April 2013

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1 Introduction

In the META-NORD project[1], an EU project which aimed at developing and documenting methodologies for building language resources for the under-resourced languages in the Baltic and Nordic countries, UCPH, Centre for Language Technology undertook various language resource initiatives including the upgrade of the STO export format to Lexical Markup Framework (LMF).

The Lexical Markup Language is an internationally well-known and accepted XML format and the ISO standard for Natural Language Processing (NLP) lexicons. See www.lexicalmarkupframework.org for more information on LMF.

The export format for STO used to be a flat, comma-separated text format for the morphological part and an XML format developed at UCPH for the syntactic part. The advantage of using an XML format common to various other lexical resources and widely accepted all over the world is obvious.

The following documentation is meant as an introduction to the STO LMF format. After the introduction of the LMF structure we describe the structure of the STO entries when converted to LMF and explain some of the choices and adjustments we have made. Finally, we show a table of data categories (STO and LMF) that have been changed in the conversion – i.e. a list of old and new data category names. As an appendix we add the lexical entry of circus as a good example of a complex noun entry.

Please note that this documentation does NOT document the general content and the linguistic aspects of STO. For an introduction and documentation of these parts, you may consult the STO Sprogteknologisk Ordbase, Danish Monolingual lexicon, Documentation, version 2.

2 Structure of the lexical entry

The structure of the morphology is based on the lexical entry, see fig.1

In STO the concept of a lexical entry was based on morphological units (MUs) and graphical morphological units (GMUs). Homonyms were presented as several MUs with a differing digit in the end, i.e. the Danish word 'fyr' (meaning a bloke, a fire, and a pine) had the MU-IDs FYR_1, FYR_2 and FYR_3. These entries are not directly related in the LMF version but since the MU-ID's have been kept in the lexical entry, they can all be found. The GMU is now the lexical entry and the ID for the lexical entry is identical to the ID of the corresponding GMU in the database.

The attributes of the **lexical entry** are the part of speech, an ID, an ID for the morphological unit to which it was attached in the STO database, source information, whether the word is an independent word or can only be used in connection with another word, and how the word can be decomposed if possible.

The lemma has a form representation telling what the written form of the lemma is, whether this form is officially approved by Retskrivningsordbogen, and for nouns some information about the joining element.

The wordforms have the more word specific information like gender, number, definiteness, case, mood, tense, etc., and also it comprises one or more form representations that specifiy the written word forms,

[1] META-NORD was funded by the DG INFSO of the European Commission through the ICT PSP Programme, Grant Agreement: No 270899

the inflectional paradigm, whether this specific word form is officially approved and the frequency of that word form (see 4 for more information on frequency).

A word which has two different spellings such as ‘hæfte’ and ‘hefte’ is structured as two separate lexical entries, each including a related form with the spelling variant and a link to the other lexical entry. These were treated as two separate spellings of the same GMU in the STO database, so this is a structural change.

```
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        <feat att="id" val="XX"/>
        <feat att="morphologicalUnitId" val="XX"/>
        <feat att="originalSource" val="XX"/>
        <feat att="independentWord" val="XX"/>
        <feat att="decomposition" val="XX"/>
        <Lemma>
          <FormRepresentation>
            <feat att="writtenForm" val="XX"/>
            <feat att="officiallyApproved" val="XX"/>
            <feat att="joiningElement" val="XX"/>
          </FormRepresentation>
        </Lemma>
        <WordForm>
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          <feat att="definiteness" val="XX"/>
          <feat att="grammaticalNumber" val="XX"/>
          <feat att="case" val="XX"/>
          <FormRepresentation>
            <feat att="writtenForm" val="XX"/>
            <feat att="inflectionalParadigm" val="XX"/>
            <feat att="officiallyApproved" val="XX"/>
            <feat att="frequency" val="XX"/>
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        </WordForm>
                    <WordForm>…
                                        <FormRepresentation>… </FormRepresentation>
                    </WordForm>
                    …
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                    <FormRepresentation>
          <feat att="writtenForm" val="XX"/>
                    </FormRepresentation>
          </RelatedForm>
</LexicalEntry>
```

Figure 1: An overview of the structure of a lexical noun entry.
See appendix A for a full noun entry with values.

3 Intensional/extensional morphology and inflectional paradigms

The STO database has what is called intensional morphology, i.e. all word forms are created dynamically from the lemma in combination with a specific inflectional pattern. In LMF we have chosen to write out all the explicit word forms of a lemma, choosing the extensional morphology approach.

However, this does not mean that we can leave the inflectional paradigms out of account. Several Danish words can follow different inflectional paradigms but a language user is recommended to use the same paradigm throughout a text. I.e. the word 'cirkus' can be inflected according to 4 officially approved paradigms (and several paradigms that are no longer approved) but a user should stick to the same paradigm in a text and not switch between 'et cirkus' and 'en cirkus' and its consecutive forms in the same text. For a language technology application it is also important to be able to follow a certain paradigm when generating word forms or controlling whether a word form is correct. (See appendix A for the full entry of 'cirkus'.)

We have chosen for each word form to list all the inflectional paradigms that this word form belongs to. So the wordform 'cirkussen' has the two paradigms MFG0246 and MFG0667 attached to it.

4 Frequency information

The frequency information that appears at the end of the form representation of each wordform is based on the two national Danish corpora, Korpus90 and Korpus2000. The figures are occurrences per one million words in the two corpora. The numbers are presented as '.XX' where the zero in front of the decimal point has been left out.

Notice that the frequency is on wordforms. Frequency for lemmas has not been included in the LMF version.

5 Adjustments compared to STO

The part of speech categories in the LMF version have been changed compared to the original STO where there were lexcats such as verbs, nouns, and subcategories common, proper, etc. In LMF we only have one level and the data categories have been chosen based on what did already exist in isoCat. The list of the LMF part of speech and the corresponding lexcat_id in STO can be found in the table below.

STO used to work with only one kind of conjunctions but since users have asked for lists of coordinating and subordinating conjunctions, we have now divided the set of conjunctions into these two sets.

In STO we used to have two words which were marked as obsolete: 'hin' and 'somme'. Since these words are not used in any current texts, we left them out of the LMF conversion. For this reason they don't figure in the table of data categories.

The pronouns 'De' and 'Deres' were marked as *Rpolite* and 'vor' was marked as *formal* in STO. In order to simplify things, all three pronouns have now been marked as *formal*.

6 Table of the STO data categories and the corresponding LMF categories

STO LMF morphology

LMF structure	LMF features		isoCat	STO xml	
	Attribute	Value		Attribute	Value
LexicalEntry					
	partOfSpeech		1345	lexcat_id	
		adjective	1230		ADJ_NORM
		ordinalAdjective	1338		ADJ_ORD
		numeral	1334		ADJ_CARD
		preposition	1366		ADPOS_PREP
		generalAdverb	1435		ADV_GENERAL
		coordinatingConjunction	1262		CONJ_COORD
		subordinatingConjunction	1393		CONJ_SUB
		interjection	1318		INTERJ
		properNoun	1371		NOUN_PROP
		commonNoun	1256		NOUN_COMM
		personalPronoun	1463		PRON_PERS
		demonstrativePronoun	1270		PRON_DEMO
		indefinitePronoun	1309		PRON_INDEF
		interrogativeRelativePronoun	3016		PRON_INTER
		reciprocalPronoun	1924		PRON_RECI
		possessivePronoun	1359		PRON_POSS
		existentialPronoun	3012		UNIQUE_FSUBJ
		infinitiveParticle	1896		UNIQUE_INFMARK
		unclassifiedParticle	1897		UNIQUE
		mainVerb	1400		VERB_MAIN
		deponentVerb	5278		VERB_MEDIAL
		unspecified	1908		WITHOUT
	id		1845	gmu_id	
		(string)			(string)
	morphologicalUnitId		5282	mu_id	
		(string)			(string)
	originalSource		2534	origin	
		(string)			(string)
	independentWord		5285	autonomy	
		yes	1904		YES
		no	1905		NO
Lemma					
FormRepresentation					
	writtenForm		1836	spelling	
		(string)			(string)
	officiallyApproved		5284	ro_approved	
		yes	1904		YES
		no	1905		NO
	joiningElement		5279	joining element	
		(string)			(string)
	joiningElementResult		5280	joining element result	
		(string)			(string)
	decomposition		5281	decomp	
		(string)			(string)
WordForm					
	grammaticalGender			gender	
		commonGender	1558		common
		neuter	1884		neuter
		unspecified	1908		unmarked
	definiteness			definiteness	
		definite	2004		definite
		indefinite	2005		indefinite
		unspecified	1908		unmarked
	grammaticalNumber			numerus	
		singular	1387		singular
		plural	1354		plural
		unspecified	1908		unmarked
	case			casus	
		genitiveCase	1293		genitive
		unspecified	1908		unmarked
	transcategorization		5272	transcat	
		transadverbial	5275		transadverbial
	adjectivalFunction		5289	funct	
		attributiveFunction	5287		attributive
		predicativeFunction	5288		predicative
		unspecified	1908		unmarked
	ownerNumber		1417	possessor	
		singular	1387		singular
		plural	1354		plural

	person		1328	person	
		firstPerson	1288		1
		secondPerson	1384		2
		thirdPerson	1402		3
	reflexivity		5286	reflexive	
		yes	1904		Rrefl
		no	1905		norefl
		unspecified	1908		unmarked
	register		1988	register	
		formalRegister	1992		formal
		formalRegister	1992		Rpolite
	verbFormMood		1427	mood	
		indicative	1885		indicative
		imperative	1844		imperative
		infinitive	1312		infinitive
		gerundive	2243		gerund
		participle	1341		participle
	tense		1286	tense	
		present	1367		present
		past	1347		past
	transcategorization		5272	transcat	
		transadjectival	5276		transadjectival
		transnominal	5277		transnominal
	voice		1413	voice	
		activeVoice	1227		active
		passiveVoice	1346		passive
FormRepresentation					
	writtenForm		1836	spelling	
		(string)			(string)
	inflectionalParadigm		5283	ginp_id	
		(string)			(string)
	officiallyApproved		5284	ro_approved	
		yes	1904		YES
		no	1905		NO
	frequency		5615	()	
		(string)			()

Appendix A: The lexical entry of ‘cirkus’

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<LexicalEntry>
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  <feat att="id" val="GMU_CIRKUS_1"/>
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  <feat att="originalSource" val="PAROLE"/>
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      <feat att="joiningElementResult" val="cirkus"/>
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