Creating a tagset, lexicon and guesser for a French tagger

Jean-Pierre Chanod and Pasi Tapanainen
Rank Xerox Research Centre, Grenoble Laboratory
6, chemin de Maupertuis, 38240 Meylan, France
Jean.Pierre.Chanod,Pasi.Tapanainen@xerox.fr
http://www.xerox.fr/grenoble/mltt/home.html

Abstract

We earlier described two taggers for French, a statistical one and a constraint-based one. The two taggers have the same tokeniser and morphological analyser. In this paper, we describe aspects of this work concerned with the definition of the tagset, the building of the lexicon, derived from an existing two-level morphological analyser, and the definition of a lexical transducer for guessing unknown words.

1 Background

We earlier described two taggers for French: the statistical one having an accuracy of 95–97 % and the constraint-based one 97–99 % (see (Chanod and Tapanainen, 1994; Chanod and Tapanainen, 1995)). The disambiguation has been already described, and here we discuss the other stages of the process, namely the definition of the tagset, transforming a current lexicon into a new one and guessing the words that do not appear in the lexicon.

Our lexicon is based on a finite-state transducer lexicon (Karttunen et al., 1992). The French description was originally built by Annie Zaenen and Carol Neidle, and later refined by Jean-Pierre Chanod (1994).

Related work on French can be found in (Derouault, 1985).

2 Tagset

We describe in this section criteria for selecting the tagset. The following is based on what we noticed to be useful during the developing the taggers.

2.1 The size of the tagset

Our basic French morphological analyser was not originally designed for a (statistical) tagger and the number of different tag combinations it has is quite high. The size of the tagset is only 88. But because a word is typically associated with a sequence of tags, the number of different combinations is higher, 353 possible sequences for single French words. If we also consider words joined with clitics, the number of different combinations is much higher, namely 6525.

A big tagset does not cause trouble for a constraint-based tagger because one can refer to a combination of tags as easily as to a single tag. For a statistical tagger however, a big tagset may be a major problem. We therefore used two principles for forming the tagset: (1) the tagset should not be big and (2) the tagset should not introduce distinctions that cannot be resolved at this level of analysis.

2.2 Verb tense and mood

As distinctions that cannot be resolved at this level of analysis should be avoided, we do not have information about the tense of the verbs. Some of this information can be recovered later by performing another lexicon lookup after the analysis. Thus, if the verb tense is not ambiguous, we have not lost any information and, even if it is, a part-of-speech tagger could not resolve the ambiguity very reliably anyway. For instance, dort (present; sleeps) and dormira (future; will sleep) have the same tag VERB-SG-P3, because they are both singular, third-person forms and they can both be the main verb of a clause. If needed, we can do another lexicon lookup for words that have the tag VERB-SG-P3 and assign a tense to them after the disambiguation. Therefore, the tagset and the lexicon together may make finer distinctions than the tagger alone.

On the other hand, the same verb form dit can be third person singular present indicative or third person singular past historic (passé simple) of the verb
dire (to say). We do not introduce the distinction between those two forms, both tagged as VERB-SG-P3, because determining which of the two tenses is to be selected in a given context goes beyond the scope of the tagger. However, we do keep the distinction between dit as a finite verb (present or past) on one side and as a past participle on the other, because this distinction is properly handled with a limited contextual analysis.

Morphological information concerning mood is also collapsed in the same way, so that a large class of ambiguity between present indicative and present subjunctive is not resolved: again this is motivated by the fact that the mood is determined by remote elements such as, among others, connectors that can be located at (theoretically) any distance from the verb. For instance, a conjunction like quoique requires the subjunctive mood:

Quoique, en principe, ce cas soit fréquent. (Though, in principle, this case is [subjunctive] frequent.)

The polarity of the main verb to which a subordinate clause is attached also plays a role. For instance, compare:

Je pense que les petits enfants font de jolis dessins. (I think that small kids make [indicative] nice drawings.)

Je ne pense pas pas que les petits enfants fassent de jolis dessins. (I do not think that small kids make [subjunctive] nice drawings.)

Consequently, forms like chante are tagged as VERB-P3SG regardless of their mood. In the case of faire (to do, to make) however, the mood information can easily be recovered as the third person plural are font and fassent for indicative and subjunctive moods respectively.

2.3 Person

The person seems to be problematic for a statistical tagger (but not for a constraint-based tagger). For instance, the verb pense, ambiguous between the first- and third-person, in the sentence Je ne le pense pas (I do not think so) is disambiguated wrongly because the statistical tagger fails to see the first-person pronoun je and selects more common third-person reading for the verb.

We made a choice to collapse the first- and second-person verbs together but not the third person. The reason why we cannot also collapse the third person is that we have an ambiguity class that contains adjectival and first- or second-person verbs. In a sentence like Le secteur matières (NOUN-PL) plastiques (ADJ-PL/NOUN-PL/VERB-P1P2) . . . the verb reading for plastiques is impossible. Because noun — third-person sequence is relatively common, collapsing also the third person would cause trouble in parsing.

Because we use the same tag for first- and second-person verbs, the first- and second-person pronouns are also collapsed together to keep the system consistent. Determining the person after the analysis is also quite straightforward: the personal pronouns are not ambiguous, and the verb form, if it is ambiguous, can be recovered from its subject pronoun.

2.4 Lexical word-form

Surface forms under a same lexical item were also collapsed when they can be attached to different lemmata (lexical forms) while sharing the same category, such as peignent derived from the verb peigner (to comb) or peindre (to paint). Such coincidental situations are very rare in French (El-Bèze, 1993). However, in the case of suis first person singular of the auxiliary être (to be) or of the verb suivre (to follow), the distinction is maintained, as we introduced special tags for auxiliaries.

2.5 Gender and number

We have not introduced gender distinctions as far as nouns and adjectives (and incidentally determiners) are concerned. Thus a feminine noun like chaise (chair) and a masculine noun like tabouret (stool) both receive the same tag NOUN-SG.

However, we have introduced distinctions between singular nouns (NOUN-SG), plural nouns (NOUN-PL) and number-invariant nouns (NOUN-INV) such as taux (rate/rates). Similar distinctions apply to adjectives and determiners. The main reason for this choice is that number, unlike gender, plays a major role in French with respect to subject/verb agreement, and the noun/verb ambiguity is one of the major cases that we want the tagger to resolve.

2.6 Discussion on Gender

Ignoring gender distinction for a French tagger is certainly counter intuitive. There are three major objections against this choice:

- Gender information would provide better disambiguation,
- Gender ambiguous nouns should be resolved, and
• Displaying gender provides more information.

There is obviously a strong objection against leaving out gender information as this information may provide a better disambiguation in some contexts. For instance in le diffuseur diffuse, the word diffuse is ambiguous as a verb or as a feminine adjective. This last category is unlikely after a masculine noun like diffuseur.

However, one may observe that gender agreement between nouns and adjectives often involve long distance dependencies, due for instance to coordination or to the adjunction of noun complements as in une envie de soleil diffuse where the feminine adjective diffuse agrees with the feminine noun envie. In other words, introducing linguistically relevant information such as gender into the tagset is fine, but if this information is not used in the linguistically relevant context, the benefit is unclear. Therefore, if a (statistical) tagger is not able to use the relevant context, it may produce some extra errors by using the gender.

An interesting, albeit minor interest of not introducing gender distinction, is that there is then no problem with tagging phrases like mon allusion (my allusion) where the masculine form of the possessive determiner mon precedes a feminine singular noun that begins with a vowel, for euphonic reasons.

Our position is that situations where the gender distinction would help are rare, and that the expected improvement could well be impaired by new errors in some other contexts. On a test suite [Chanod and Tapunainen, 1995] extracted from the newspaper Le Monde (12 000 words) tagged with either of our two taggers, we counted only three errors that violated gender agreement. Two could have been avoided by other means, i.e. they belong to other classes of tagging errors. The problematic sentence was:

L’armée interdit d’autre part le passage…
(The army forbids the passage…) where interdit is mistakenly tagged as an adjective rather than a finite verb, while armée is a feminine noun and interdit a masculine adjective, which makes the noun–adjective sequence impossible in this particular sentence.

Another argument in favour of gender distinction is that some nouns are ambiguously masculine or feminine, with possible differences in meaning, e.g. poste, garde, manche, tour, page. A tagger that would carry on the distinction would then provide sense disambiguation for such words.

Actually, such gender-ambiguous words are not very frequent. On the same 12 000-word test corpus, we counted 46 occurrences of words which have different meanings for the masculine and the feminine noun readings. This number could be further reduced if extremely rare readings were removed from the lexicon, like masculine ombre (a kind of fish while the feminine reading means shadow or shade) or feminine litre (a religious ornament). We also counted 325 occurrences of nouns (proper nouns excluded) which do not have different meanings in the masculine and the feminine readings, e.g. élève, camarade, jeune.

A reason not to distinguish the gender of such nouns, besides their sparsity, is that the immediate context does not always suffice to resolve the ambiguity. Basically, disambiguation is possible if there is an unambiguous masculine or feminine modifier attached to the noun as in le poste vs. la poste. This is often not the case, especially for preposition + noun sequences and for plural forms, as plural determiners themselves are often ambiguous with respect to gender. For instance, in our test corpus, we find expressions like en 2 25 pages, à leur tour, à ces postes and pour les postes de responsabilité for which the contextual analysis does not help to disambiguate the gender of the head noun.

Finally, carrying the gender information does not itself increase the disambiguation power of the tagger. A disambiguator that would explicitly mark gender distinctions in the tagset would not necessarily provide more information. A reasonable way to assess the disambiguating power of a tagger is to consider the ratio between the initial number of ambiguous tags vs. the final number of tags after disambiguation. For instance, it does not make any difference if the ambiguity class for a word like table is [feminine-noun, finite-verb] or [noun, finite-verb], in both cases the tagger reduces the ambiguity by a ratio of 2 to 1. The information that can be derived from this disambiguation is a matter of associating the tagged word with any relevant information like its base form, morphological features such as gender, or even its definition or its translation into some other language. This can be achieved by looking up the disambiguated word in the appropriate lexicon.

Providing this derived information is not an intrinsic property of the tagger.

Our point is that the objections do not hold very strongly. Gender information is certainly important
in itself. We only argue that ignoring it at the level of part-of-speech tagging has no measurable effect on the overall quality of the tagger. On our test corpus of 12,000 words, only three errors violate gender agreement. This indicates how little the accuracy of the tagger could be improved by introducing gender distinction. On the other hand, we do not know how many errors would have been introduced if we had distinguished between the genders.

2.7 Remaining categories

We avoid categories that are too small, i.e. rare words that do not fit into an existing category are collapsed together. Making a distinction between categories is not useful if there are not enough occurrences of them in the training sample. We made a category MISC for all those miscellaneous words that do not fit into any existing category. This accounts for words such as: interjection oh, salutation bonjour, onomatopoeia miaou, wordparts i.e. words that only exist as part of a multi-word expression, such as priori, as part of a priori.

2.8 Dividing a category

In a few instances, we introduced new categories for words that have a specific syntactic distribution. For instance, we introduced a word-specific tag PREP-A for words de, des and du, and tag PREP-DE for words à, au and aux. Word-specific tags for other prepositions could be considered too. The other readings of the words were not removed, e.g. de is, ambiguously, still a determiner as well as PREP-DE.

When we have only one tag for all the prepositions, for example, a sequence like

```
   determiner noun noun/verb preposition
```

is frequently disambiguated in the wrong way by the statistical tagger, e.g. Le train part à cinq heures (The train leaves at 5 o’clock). The word part is ambiguous between a noun and a verb (singular, third person), and the tagger seems to prefer the noun reading between a singular noun and a preposition.

We succeeded in fixing this without modifying the tagset but the side-effect was that overall accuracy deteriorated. The main problem is that the preposition de, comparable to English of, is the most common preposition and also has a specific distribution. When we added new tags, say PREP-DE and PREP-A, for the specific prepositions while the other prepositions remained marked with PREP, we got the correct result, with no noticeable change in overall accuracy.

3 Building the lexicon

We have a lexical transducer for French \cite{Karttunen2} which was built using Xerox Lexical Tools \cite{Karttunen1}. In our work we do not modify the corresponding source lexicon but we employ our finite-state calculus to map the lexical transducer into a new one. Writing rules that map a tag or a sequence of tags into a new tag is rather straightforward, but redefining the source lexicon would imply complex and time consuming work.

The initial lexicon contains all the inflectional information. For instance, the word danses (the plural of the noun danse or a second person form of the verb danser (to dance)) has the following analyses:

\[
\begin{align*}
\text{danser} & \ +\text{IndP} +\text{SG} +\text{P2} +\text{Verb} \\
\text{danser} & \ +\text{SubjP} +\text{SG} +\text{P2} +\text{Verb} \\
\text{danser} & \ +\text{Fem} +\text{PL} +\text{Noun}
\end{align*}
\]

Forms that include clitics are analysed as a sequence of items separated by the symbols < or > depending on whether the clitics precede or follow the head word. For instance vient-il (does he come, lit. comes-he) is analysed as:

\[
\begin{align*}
\text{venir} & \ +\text{IndP} +\text{SG} +\text{P3} +\text{Verb} \\
& \ > \ il +\text{Nom} +\text{Masc} +\text{SG} +\text{P3} +\text{PC}
\end{align*}
\]

From this basic morphological transducer, we derived a new lexicon that matches the reduced tagset described above. This involved two major operations:

- handling cliticised forms appropriately for the tagger’s needs.
- switching tagsets

In order to reduce the number of tags, cliticised items (like vient-il are split into independent tokens for the tagging application. This splitting is performed at an early stage by the tokeniser, before dictionary lookup. Keeping track of the fact that the tokens were initially agglutinated reduces the overall ambiguity. For instance, if the word danses is derived from the expression danses-tu (do you dance, lit. dance-you), then it can only be a verb reading. This is why forms like danses-tu are tokenised as danses- and tu, and forms like chante-t-il are tokenised as chante-t- and il. This in turn requires that forms like danses- and chante-t- be introduced into the new lexicon.

\footnote{The tags represent: present indicative, singular, second person, verb; present subjunctive, singular, second person, verb; and feminine, plural, noun.}

\footnote{The tags for il represent: nominative, masculine, singular, third person, clitic pronoun.}
With respect to switching tagsets, we use contextual two-level rules that turn the initial tags into new tags or to the void symbol if old tags must simply disappear. For instance, the symbol \(+\text{Verb}\) is transformed into \(+\text{VERB-P3SG}\) if the immediate left context consists of the symbols \(+SG +P3\). The symbols \(+\text{IndP}, +SG\) and \(+P3\) are then transduced to the void symbol, so that \textit{vient\textdagger} (or even the new token \textit{vient\textdagger}) gets analysed merely as \(+\text{VERB-P3SG}\) instead of \(+\text{IndP} +SG +P3 +\text{Verb}\).

A final transformation consists in associating a given surface form with its ambiguity class, i.e., with the alphabetically ordered sequence of all its possible tags. For instance \textit{danses} is associated with the ambiguity class \([+\text{NOUN-PL} +\text{VERB-P1P2}]\), i.e., it is either a plural noun or a verb form that belongs to the collapsed first or second person paradigm.

4 Guesser

Words not found in the lexicon are analysed by a separate finite-state transducer, the guesser. We developed a simple, extremely compact and efficient guesser for French. It is based on the general assumption that neologisms and uncommon words tend to follow regular inflectional patterns.

The guesser is thus based on productive endings (like \textit{ment} for adverbs, \textit{ible} for adjectives, \textit{er} for verbs). A given ending may point to various categories, e.g., \textit{er} identifies not only infinitive verbs but also nouns, due to possible borrowings from English. For instance, the ambiguity class for \textit{killer} is \([\text{NOUN-SG VERB-INF}]\).

These endings belong to the most frequent ending patterns in the lexicon, where every rare word weights as much as any frequent word. Endings are not selected according to their frequency in running texts, because highly frequent words tend to have irregular endings, as shown by adverbs like \textit{ja-mais, toujours, peut-être, hier, souvent} (\textit{never, always, maybe\ldots}).

Similarly, verb neologisms belong to the regular conjugation paradigm characterised by the infinitive ending \textit{er}, e.g., \textit{déballaduriser}.

With respect to nouns, we first selected productive endings (\textit{iste, eau, eur, rice\ldots}), until we realised a better choice was to assign a noun tag to all endings, with the exception of those previously assigned to other classes. In the latter case, two situations may arise: either the prefix is shared between nouns and some other category (such as \textit{ment}), or it must be barred from the list of noun endings (such as \textit{ient}, an inflectional marking of third person plural verbs).

We in fact introduced some hierarchy into the endings: e.g., \textit{ment} is shared by adverbs and nouns, while \textit{iguement} is assigned to adverbs only.

Guessing based on endings offers some side advantages: unknown words often result from alternations, which occur at the beginning of the word, the rest remaining the same. e.g., derivational prefixes as in \textit{israélo-jordano-palestinienne} but also oral transcriptions such as \textit{les z’oreilles} (the ears), with \textit{z’} marking the phonological liaison. Similarly, spelling errors which account for many of the unknown words actually affect the ending less than the internal structure of the word, e.g. the misspelt verb forms \textit{appellaient, geulait}. Hyphens used to emphasise a word, e.g. \textit{har-mo-ni-ser}, also leave endings unaltered. Those side advantages do not however operate when the alternation (prefix, spelling error) applies to a frequent word that does not follow regular ending patterns. For instance, the verb \textit{construit} and the adverb \textit{très} are respectively misspelt as \textit{constuit} and \textit{trés}, and are not properly recognised.

Generally, the guesser does not recognise words belonging to closed classes (conjunctions, prepositions, etc.) under the assumption that closed classes are fully described in the basic lexicon. A possible improvement to the guesser would be to incorporate frequent spelling errors for words that are not otherwise recognised.

4.1 Testing the guesser

We extracted, from a corpus of newspaper articles (Libération), a list of 13 500 words unknown to the basic lexicon. Of those unknown words, 9385 (i.e. about 70\%) are capitalised words, which are correctly and unambiguously analysed by the guesser as proper nouns with more than 95\% accuracy. Errors are mostly due to foreign capitalised words which are not proper nouns (such as \textit{Eight}) and onomatopoeia (such as \textit{Ooooh}).

The test on the remaining 4000 non-capitalised unknown words is more interesting. We randomly selected 800 of these words and ran the guesser on them. 1192 tags were assigned to those 800 words by the guesser, which gives an average of 1.5 tags per word.

For 113 words, at least one required tag was missing (118 tags were missing as a whole, 4 words were lacking more than one tag: they are misspelt irregular verbs that have not been recognised as such). This means that 86\% of the words got all the required tags from the guesser.

273 of the 1192 tags were classified as irrelevant. This concerned 244 words, which means that 70\%
of the words did not get any irrelevant tags. Finally, 63% of the words got all the required tags and only those.

If we combine the evaluation on capitalised and non-capitalised words, 85% of all unknown words are perfectly tagged by the guesser, and 92% get all the necessary tags (with possibly some unwanted ones).

The test on the non-capitalised words was tough enough as we counted as irrelevant any tag that would be morphologically acceptable on general grounds, but which is not for a specific word. For instance, the misspelt word *statisticiens* is tagged as *[ADJ-PL NOUN-PL]*; we count the *ADJ-PL* tag as irrelevant, on the ground that the underlying correct word *statisticiens* is a noun only (compare with the adjective *platoniciens*).

The same occurs with words ending in *ement* that are systematically tagged as *[ADV NOUN-SG]*, unless a longer ending like *équement* is recognised. This often, but not always, makes the *NOUN-SG* tag irrelevant.

As for missing tags, more than half are adjective tags for words that are otherwise correctly tagged as nouns or past participles (which somehow reduces the importance of the error, as the syntactic distribution of adjectives overlaps with those of nouns and past participles).

The remaining words that lack at least one tag include misspelt words belonging to closed classes (e.g., *trés, vavec*) or to irregular verbs (*constuist*), barbarisms resulting from the omission of blanks or hyphens (e.g., *quand-mêne, so ciêté*). We also had a few examples of compound nouns improperly tagged as singular nouns, e.g., *rencontres-télè*, where the plural marking only appears on the first element of the compound.

Finally, foreign words represent another class of problematic words, especially if they are not nouns. We found various English examples (e.g., *at, born, of, enough, easy*) but also Spanish, e.g., *levantarse*, and Italian ones, e.g., *palazzi*.

5 Conclusion

We have described the tagset, lexicon and guesser that we built for our French tagger. In this work, we re-used an existing lexicon. We composed this lexicon with finite-state transducers (mapping rules) in order to produce a new lexical transducer with the new tagset. The guesser for words that are not in the lexicon is described in more detail. Some test results are given. The disambiguation itself is described in (Chanod and Tapanainen, 1995).

Acknowledgments

We want to thank Irene Maxwell and anonymous referees for useful comments.

References

[Chanod1993] Jean-Pierre Chanod. A Broad-Coverage French Grammar checker: Some Underlying Principles. in the Sixth International Conference on Symbolic and Logical Computing. pp 97-111, Dakota State University, 1993.

[Chanod1994] Jean-Pierre Chanod. Finite-State Composition of French Verb Morphology. Technical Report MLTT-005, 16 pages, Rank Xerox Research Centre, Grenoble, 1994. [http://www.xerox.fr]

[Chanod and Tapanainen1994] Jean-Pierre Chanod and Pasi Tapanainen. Statistical and Constraint-Based Taggers for French. Technical report MLTT-016, Rank Xerox Research Centre, Grenoble, 1994.

[Chanod and Tapanainen1995] Jean-Pierre Chanod and Pasi Tapanainen. Tagging French – comparing a statistical and a constraint-based method. In the proceedings of the Seventh Conference of the European Chapter of the ACL. pages 149-156. Association for Computational Linguistics, Dublin, 1995. cmp-lg/9503003.

[Derouault1985] Anne-Marie Derouault. Modélisation d’une langue naturelle pour désambiguïsation des chaînes phonétiques. Doctorat d’état ès sciences, Université VII, 1985.

[El-Bèze1993] Marc El-Bèze. Les modèles de langage probabilistes: quelques domaines d’application. Thèse d’habilitation à diriger des recherches. LIPN: Université Paris-Nord, 1993.

[Karttunen1993] Lauri Karttunen. Finite-State Lexicon Compiler. Technical report, Xerox Palo Alto Research Center, 1993.

[Karttunen and Beesley1992] Lauri Karttunen and Ken Beesley. Two-Level Rule Compiler. Technical report, Xerox Palo Alto Research Center, 1992.

[Karttunen et al.1992] Lauri Karttunen, Ron Kaplan and Annie Zaenen. Two-level morphology with composition. In proceedings of Coling-92. The fourteenth International Conference on Computational Linguistics. Vol I, pages 141–148. Nantes, 1992.
This appendix contains an example of a tagged corpus.
Mr Milan Pancevski s’est prononcé pour la liberté d’association politico-socialiste et donc pour l’abandon du monopole de la Ligue de la LCY. C’est la seule façon, a-t-il dit, de préserver les valeurs de la révolution yougoslave.

Il y a des provinces autonomes, mais, pour ce qui est de la réforme du système économique et politique, ainsi que du fonctionnement de la LCY, c’est la seule façon de dire que c’est de la préserver les valeurs de la révolution yougoslave.