Development of Resources for a Bilingual Automatic Index System of Broadcast News in Basque and Spanish

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Abstract

The development of an automatic index system of broadcast news requires appropriate Video and Language Resources (LR) to design all the components of the system. Nowadays, large and well-defined resources can be found in most widely used languages (Informedia), but there is a lot of work to do with respect to minority languages. The main goal of this work is the design of resources in Basque and Spanish for the transcription of broadcast news. These two languages have been chosen because they are both official in the Basque Autonomous Community and they are used in the Basque Public Radio and Television *EITB* (EITB).

Introduction

The development of Information Retrieval systems requires of appropriated digital resources. Since the main goal of our project is the development of an index system of broadcast news in the Basque Country, it is essential to create resources for all the languages used in the mass media. The analysis of the specific linguistic problematic indicates that both Basque and Spanish are official in the Basque Autonomous Community and they are used in the Basque Public Radio and Television *EITB* (EITB) and in most of the mass media of the Basque Country (radios and newspapers). Thus it is clear that both languages have to be taken into account to develop an efficient index system. Therefore, all of the tools (ASR system, NLP system, index system) and resources (digital library, Lexicon) to be developed will be oriented to create a bilingual system in Basque and Spanish. 1

Spanish has been briefly studied for development of these kind of systems but the use of Basque language (a very odd minority language) introduces a new difficulty to the development of the system, since it needs specific tools and the resources available are fewer.

Basque is a Pre-Indo-European language of unknown origin and it has about 1.000.000 speakers in the Basque Country. It presents a wide dialectal distribution, including six the main dialects, and this dialectal variety entails phonetic, phonologic, and morphologic differences.

Moreover, since 1968 the Royal Academy of the Basque Language, *Euskaltzaindia* (Euskaltzaindia) has been involved in a standardisation process of Basque. At present, morphology, which is very rich in Basque, is completely standardised in the unified standard Basque, but the lexical standardization process is still going on. The standard Basque, called “Batua”, has nowadays a great importance in the Basque community, since the public institutions and most of the mass media use it. Furthermore, people who have studied Basque as a second language use "Batua" as well.

Hence, we have made use of the standard version of Basque as well as the standard Spanish in the development of the resources presented in this work.

The following section describes the main morphological features of the language and details the statistical analysis of morphemes using three different textual samples. Section 3 presents the resources developed. Section 4 describes the processing of the data. Finally, conclusions are summarised in section 5.

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Table 1. Main characteristics of the textual databases for morphologic analysis

	STDBASQUE	NEWSPAPER	BCNEWS
Text amount	1,6M	1,3M	2,5M
Number of words	197,589	166,972	210,221
Number of pseudo-morphemes	346,232	304,767	372,126
Number of sentences	15,384	13,572	19,230
Vocabulary size in words	50,121	38,696	58,085
Vocabulary size in pseudo-morphemes	20,117	15,302	23,983

Morphological features of Basque

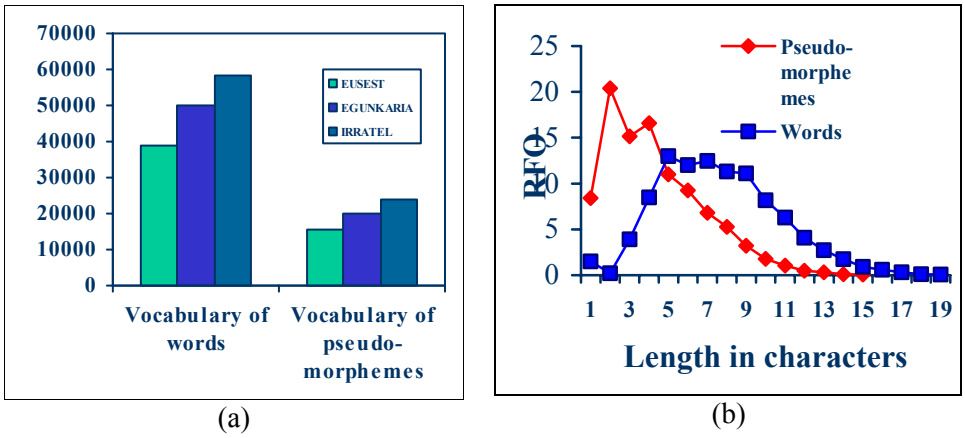
Basque is an agglutinative language with a special morpho-syntactic structure inside the words (Alegria et al., 1996) that may lead to intractable vocabularies of words for a CSR when the size of task is large. A first approach to the problem is to use morphemes instead of words in the system in order to define the system vocabulary (Peñagarikano et al., 1999).

This approach has been evaluated over three textual samples analysing both the coverage and the Out of Vocabulary rate, when we use words and pseudo-morphemes obtained by the automatic morphological segmentation tool *AHOZATI* (Lopez de Ipina et al., 2002). Table 1 shows the main features of the three textual samples relating to size, number of words and pseudo-morphemes and vocabulary size, both in words and pseudo-morphemes for each database (Lopez de Ipina et al., 2003).

The first important outcome of our analysis is that the vocabulary size of pseudo-morphemes is reduced about 60% (Fig. 1, a) in all cases relative to the vocabulary size of words. Regarding the unit size, Fig. 1 (b) shows the plot of Relative Frequency of Occurrence (RFO) of the pseudo-morphemes and words versus their length in characters over the textual sample *STDBASQUE*. Although only 10% of the pseudo-morphemes in the vocabulary have fewer than four characters, such small morphemes have an Accumulated Frequency of about 40% in the databases (the Accumulated Frequency is calculated as the sum of the individual pseudo-morphemes RFO) (Lopez de Ipina et al., 2002).

To check the validity of the unit inventory, units having less than 4 characters and having plosives at their boundaries were selected from the texts. They represent some 25% of the total. This high number of small and acoustically difficult recognition units could lead to an increase of the acoustic confusion, and could also generate a high number of insertions (Fig. 2 over the textual sample *EGUNKARIA*).

Finally, Fig. 3 shows the analysis of coverage and Out of Vocabulary rate over the textual sample *BCNEWS*. When pseudo-morphemes are used, the coverage in texts is better and complete coverage is easily achieved. OOV rate is higher in this sample.



(a) (b)

Fig. 1. (a) Vocabulary size of the words and pseudo-morphemes in the three textual samples and (b) Relative Frequency of Occurrence (RFO) of the words and pseudo-morphemes in relation to their length in characters (*STDBASQUE* sample)

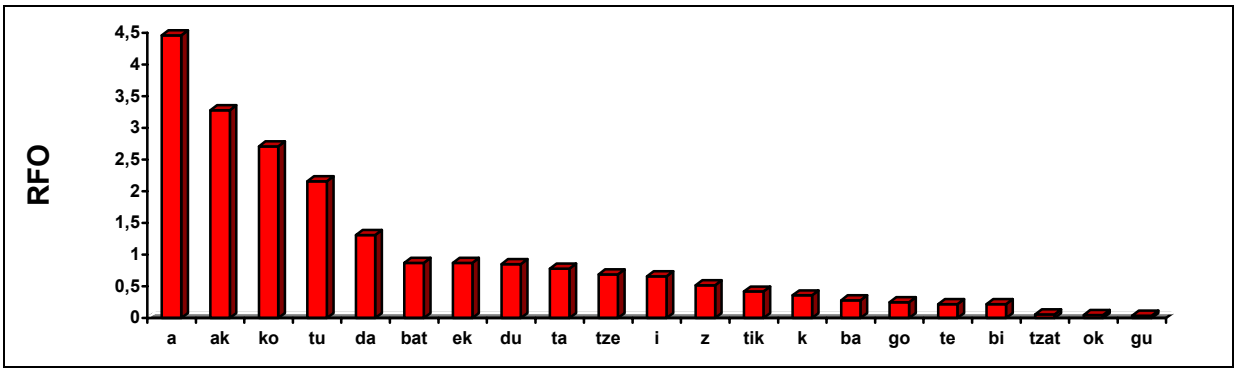


Fig. 2. Relative Frequency of Occurrence (RFO) of small and acoustically difficult recognition units in *BCNEWS* sample.

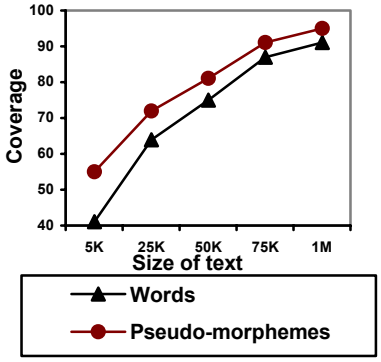
Resources Developed

Resources in Spanish

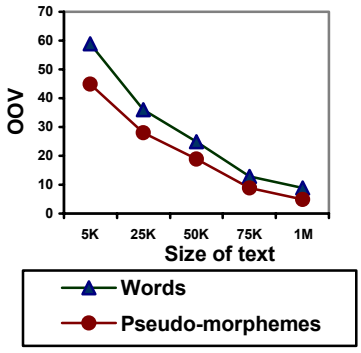
- 6 hours of video in MPEG4 (WMV 9) format of "*Teleberri*" program, the daily program of broadcast news in Spanish.
- 6 hours of audio (WAV format) extracted from the video (MPEG4) files.
- 6 hours of audio transcription in XML format containing information about speaker changes, noises and music fragments, and each word's phonetic and morphologic information.
- 1 year of scripts, in text format, of the "*Telberri*" program. The text is divided in sentences and paragraph.
- 1 year of local newspapers in Spanish *Gara* (GARA), in text format. The text is divided in sentences and paragraph.
- Lexicon extracted from the XML transcription files, including morphologic, phonologic and orthographic information.

Resources in Basque

- 6 hours of video in MPEG4 (WMV 9) format of "*Gaur Egun*" program, the daily program of broadcast news in Basque directly provided by the Basque Public Radio and Television *EITB* (EITB).
- 6 hours of audio (WAV format) extracted from the video (MPEG4) files.
- 6 hours of audio transcription in XML format containing information about speaker changes, noises and music fragments, and each word's phonetic and orthographic transcription including word's lemma and Part-Of-Speech disambiguated tags.
- 1 year of scripts, in text format, of the "*Gaur Egun*" program.
- 1 year of local newspapers in Basque (*Euskaldunon Egunkaria* (Egunkaria)), in text format.
- Lexicon extracted from the XML transcription files, including phonologic, orthographic, and morphologic information.



(a)



(b)

Fig. 3. Coverage (a) and OOV rate (b) for the textual sample *BCNEWS*

Processing Methodology

Processing of the audio data

The audio data has been extracted out from the MPEG4 video files, using FFmpeg free software[2]. The audio files have been stored in WAV format (16 KHz, linear, 16 bits).
When the audio data was ready, the XML label files were created manually, using the *Transcriber* free tool (Barras et al., 1998). The XML files include information of distinct speakers, noises, and paragraphs of the broadcast news. The files also contain phonetic and orthographic information of each of the words. As Basque is an agglutinative language with very rich inflection variety (Alegria et al., 1996), Basque XML files include morphologic information such as each word's lemma and Part-Of-Speech tag. Using this transcribed information, a Lexicon for each language has been extracted. The Lexicon stores information of each different word that appears in the transcription. This information could be very useful for developing speech recognition tools.

Processing of the video data

The video data used in this work has been provided directly by the Basque Public Radio and Television. The format used to store the broadcast contents is MPEG4 (WMV 9), and the Basque Public Radio and Television has been very kind offering us all these resources.

Processing of the textual data

There are two independent types of textual resources: The text extracted from the newspapers *Gara* (GARA) and *Euskaldunon Egunkaria* (Egunkaria)), and the scripts of the "Teleberri" and "Gaur Egun" programs. These last resources are very interesting because they are directly related (date, program) with the texts read in the broadcast news both in Spanish and Basque.
All of the were processed to include morphologic information such as each word's lemma and Part-Of-Speech tag. Using all the information, a Lexicon for each language has been extracted taken into account the context of the word in order to eliminate the ambiguity. The Lexicon stores information of each different word that appears in the transcription, and this information could be very useful for developing speech recognition tools.

[2] Available online at http://ffmpeg.sourceforge.net

Concluding Remarks

Basque and Spanish are both official languages in the Basque Country, and they are used in the Basque Public Radio and Television *EITB* (EITB) and in most of the mass media of the Basque Country. Hence, this work deals with the development of appropriated resources for a bilingual automatic index system of broadcast news in Basque and Spanish. Since Basque is an agglutinative language, analysis of coverage and words OOV has been carried out in order to develop an appropriate Lexicon. Finally, lexicons are created for both languages using morphologic and phonetic information, not just extracting a word list.

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