A platform-independent user-friendly dictionary from Italian to LIS

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Abstract

The Lack of written representation for Italian Sign Language (LIS) makes it difficult to do perform tasks like looking up a new word in a dictionary. Most of the paper dictionaries show LIS signs in drawings or pictures. It's not a simple proposition to understand the meaning of sign from paper dictionaries unless one already knows the meanings. This paper presents the LIS dictionary which provides the facility to translate Italian text into sign language. LIS signs are shown as video animations performed by a virtual character. The LIS dictionary provides the integration with MultiWordNet database. The integration with MultiWordNet allows a rich extension with the meanings and senses of the words existing in MultiWordNet. The dictionary allows users to acquire information about lemmas, synonyms and synsets in the Sign Language (SL). The application is platform independent and can be used on any operating system. The results of input lemmas are displayed in groups of grammatical categories.

Keywords: LIS dictionary, Text to sign language, Signing Avatar. User interfaces, Mobile Phones, Italian Sign Language

1. Introduction

There are significant challenges in addressing marginalisation of persons with disabilities from the mainstream economy and society. These challenges include access to information and services for the people having some kind of disability. Sign Language is based on the combination of movements of hands, arms, body and facial expressions. Gestures are used for the communication in sign language. Sign Languages vary among countries, areas and cultures. These various forms of SL have its own vocabulary and grammar. Moreover there is extreme variability in the language within the same country, ethnicity because there is no standardized lexicon dataset to define and set the rules. An increasing request for LIS interpretation in educational, legal and health care context is foreseen. This is highly expected to extend to the culture and entertainments. Several attempts are made to define the standards for the signs and design a mechanism for the translation from text to sign language conversion.

The LIS Dictionary is developed within the Automatic TransLation into Sign Languages (ATLAS) project. ATLAS aims at developing tools to support deaf people's accessibility to IT contents and services (ATLAS Project). The purpose of ATLAS is to develop a system for the automatic translation from Italian written text to LIS, resorting to statistical and rule based translation strategies. In this paper we present a LIS dictionary that contains animated video sequences of hundreds of distinct LIS signs.

We believe that LIS videos in our dataset are a valuable resource for the research in sign language recognition, gesture recognition and human activity analysis. It also presents the challenges relevant to the areas of computer vision, machine learning, natural language processing and data mining. Open research problems including discriminating among visual motion classes, memory and run time efficiency for the heavy video data database on different devices.

In Section 2 we present the background and previous work related to Sign Language translation and resources. In Section 3 we present the lexical resources that are the core of our dictionary. In Section 4 we discuss the architecture of the LIS Dictionary, while in Section 5 we describe the interactive flow of our application. Section 6 is about the results and some statistics. The paper concludes with section 7, depicting conclusions and future work.

2. Background And Related Work

There have been numerous technological developments to facilitate Deaf communication through translation systems. eSign project aims at developing techniques and software tools to support the generation of natural sign language using an avatar. It focuses on prototype development to demonstrate the feasibility to present text to sign language (R.Elliott 2008). BlueSign (Blue sign partners) and Zardoz (T. Veale and A. Conway) are examples of working systems. Blue Sign doesn't take into consideration the grammar for LIS translation. Some examples that take into consideration statistical or example based techniques to perform translation (G. Masso 2010; Stein, 2006).

The corpora generation mechanism needs to be considered because it influences both the quality of annotations and the related information. Recent researches on corpora creation emphasized on the representation, proper documentation and machine readability (DGS-Corpus). The NGT Corpus (Koehn,P 2007) for Dutch Sign Language has collection of 2375 videos (as per September 2010) for about 72h of data on dialogues and narrations signed by 92 native signers.

The British sign language Corpus Project aims at creating a machine-readable digital corpus of spontaneous and elicited British sign language (BSL) collected from deaf

native signers and early learners across the United Kingdom. Although the recruitment of participants is being balanced for gender and age, it focused only on

signers exposed to BSL before the age of 7 years, and adult deaf native signers are disproportionately represented (Schembri 2008).

3. The ATLAS LIS Dictionary and MultiWordNet

The ATLAS LIS dictionary has more than three thousand signs as set of Avatar animations. Each sign is linked to corresponding Italian lemma. A team of deaf persons and a native signer interpreter created about four hundred signs. Whereas the rest of the signs in our lexicon video data set (Signary) are created using dictionary standards.

The Dictionary is extended with MultiWordNet (Pianta,E2002; Bentivogli,L 2004). MultiWordNet is a semanticdatabase that groups lemmas in sets of synonyms (synsets). It can be seen as a lexical matrix, having two dimensions: the lexical relations, between language specific words, and the conceptual relations among senses. Each synset expresses a distinct concept. In other words, synsets are linked by conceptual semantic and lexical relations.

The LIS Dictionary includes three sets of signs:

1- A set of signs that are commonly used within the LIS community, present in the Italian LIS dictionary.
2- A set of signs that are created within the ATLAS project by a work team composed by a native signer interpreter and deaf people. These signs can be categorized as follows:
   a. New signs, related to the weather forecast domain.
   b. New signs, general linguistic domain, not present in the dictionary but commonly used
   c. New signs, general linguistic domain, very specific and not present in the LIS lexicon
   d. New signs, present in the dictionary but considered obsolete by the work team.

All the signs have been animated through key frame animation technique and exported as animation files. Each animation file is converted into a high quality video.

In the LIS Dictionary, the user can search for a lemma and the output of the requested lemma is shown in synsets & grammatical categories. The results are grouped by synonymous word senses, and show them in the structures of grammatical type hierarchies. The grammatical distribution (i.e. noun, verb etc) helps the user to better understand the lemma and its senses. The words in the definitions (or ‘‘glosses’’), included in each synset, are manually disambiguated against MultiWordNet senses (Alonge 1998). Users will get not only the meaning of words in text language but also synonyms, related words and the synset along with the LIS sign. Even if the searched lemma does not have a sign in the database, users can see the signs of the related synonyms to better understand the concept.

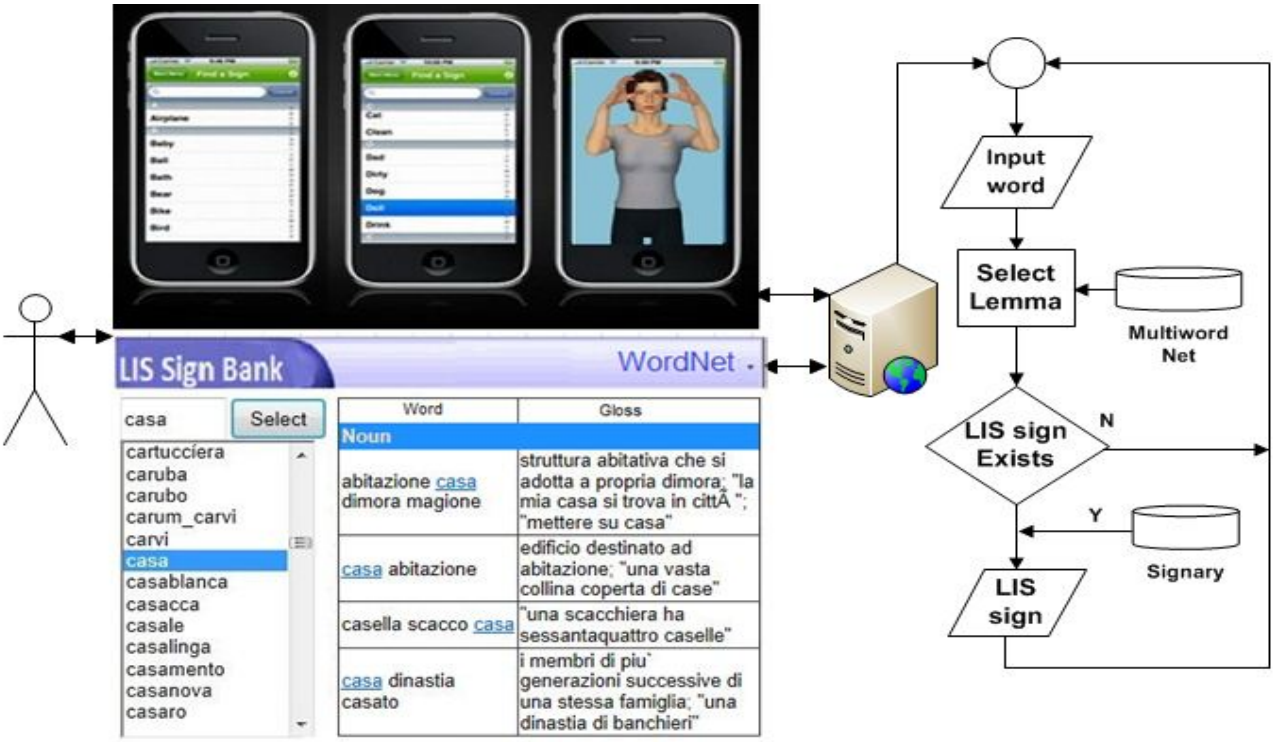

Figure 1: System Overview

4. Top Level System Overview

This section describes the system model shown in the figure 1.The diagram explains the ATLAS LIS dictionary that can be accessed via mobile or the web (Prinetto 2011). Users will have the facility to use web application or the mobile version for LIS dictionary. The system provides the choice to select an alphabetic character to view lemmas starting with it, which improves search process.

When user starts typing the corresponding possible keywords are shown which can be selected to request LIS video animation. The translation of the intended lemma can be seen as animated video. If requested lemma does not have the corresponding sign movie in LIS then user possibly can explore the words from synset existing in LIS data set to understand the

interface and results are shown on user interface. The ATLAS MultiMedia Archive (AMMA) is the database developed within the ATLAS project and is within the ATLAS server. The control flow of the Architecture is shown in the figure 2.

The processing sequence is shown as a sequence of

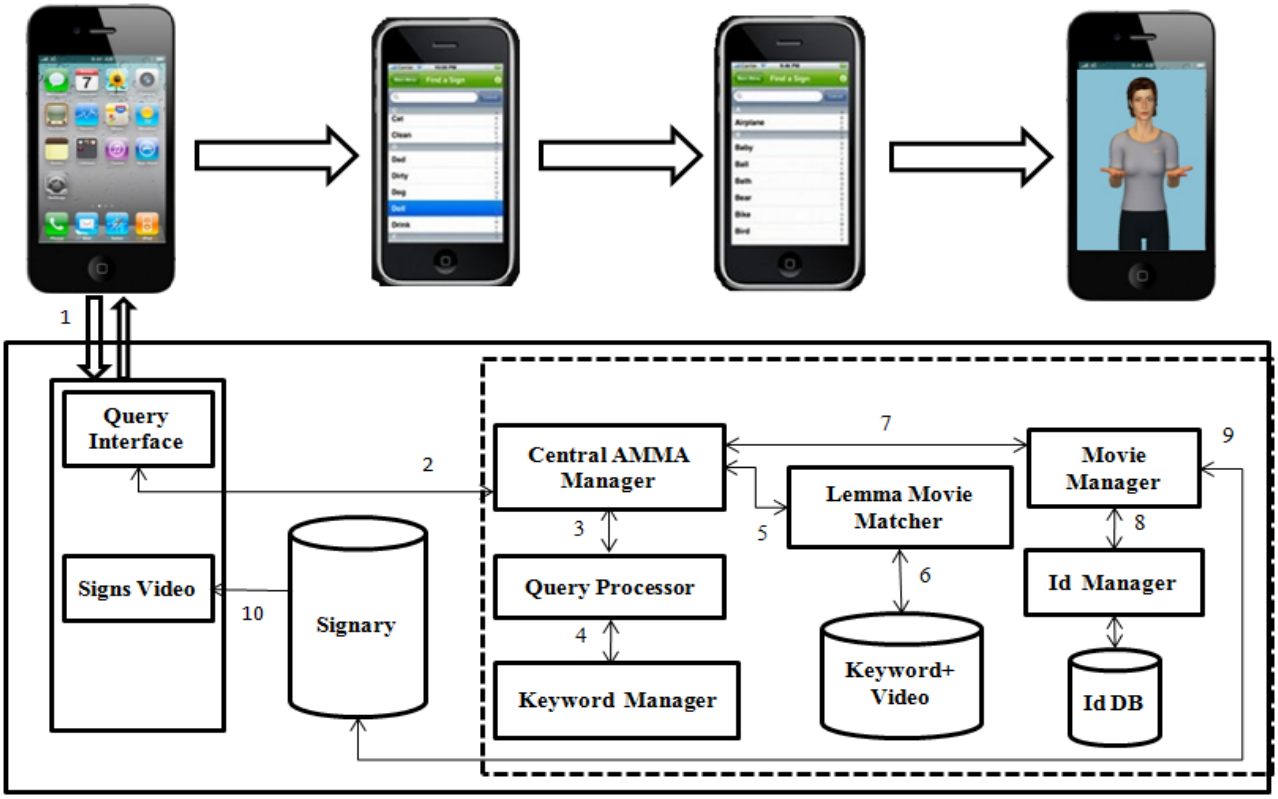

Figure 2: Interactive System Architecture

approximate meanings or sense of the word. Over all we cover about 25 percent of existing lemma in the MultiWordNet database. While we cover 20 percent of the synsets of the multiword net synsets which is a healthy ratio. Users can play pause or watch again and again the video of the intender sign. The LIS Dictionary is designed to be platform independent. Users can run the application on any mobile phone platform. The application will be comprehensive user friendly easy to understand and multi dimensional.

5. Interactive Architecture Flow

We have divided the functionality of the LIS dictionary into three major components. Keyword manager is responsible for handling requested lemmas and displays filtered matching words in drop down list. Query Processor is responsible for handling incoming queries and checks whether words filtering or sign display is requested. The video animations are matched with the lemmas by lemma movie matcher and are assigned a unique id. Id manager keeps track of the stored video signs along with the Id. User request is taken by query

steps. The request received from interface contains parameters to request for the specific information along with the authentication credentials of the user. Steps 1, 2and 3 show that the interface is linked with the AMMA database and the Query Processor. AMMA includes the Signary, the Keyword + Video DB and the Id DB. In figure 1 we specified just these three databases to better identify the single flow steps. The Query Processor in the central manager (underlined by the dotted line) checks whether user has started entering the word or it's the request to find the meaning the sign language. 4) If a letter is entered control is passed to keyword Manager which shows filtered result in the drop down menu. 5) When user requests/selects the word, the Query Processor sends it to lemma movie matcher. 6) The Movie Matcher searches for the corresponding lexical video from database containing the couple keyword-video and, if is found, sends back its Id to AMMA Manager.7) Then request is sent to Movie Manager to fetch corresponding path against the intended Id. 8) Movie Manager takes the path of the corresponding video from the Ids DB along with the Id.9) Movie Manager forwards the path containing the animated video to the signary.10) The

video stream of the sign stored against the given path is finally displayed on the user interface. User interface is shown in the signs videos area. Graphical user interface facilitates users with the icons to play pause resume and replay button. User can watch again or pause at a specific point to better understand the sign.

6. Results

Through MultiWordNet it is possible to resolve for each lemma a better semantic representation while the association with the dictionary provides access to their basic sign representation henceforth referred to as citation form. Each citation form is grouped in MultiWordNet synsets to manage synonyms. This grouping helps to check existence of the Italian source text in the LIS Dictionary. We have more than three thousand animated videos in the lexicon dataset. More than seventeen thousand lemmas of the MultiWordNet can be translated using LIS Dictionary. Users can explore the synonyms or related word of the requested in order to better understand the concept or the meanings. LIS dictionary covers more than seven thousand MultiWordNet synsets.

7. Conclusion and Future Work

The paper discussed the LIS dictionary which provides users with the ability to acquire information about signs and enables users to learn the signs corresponding to the words. The challenge is to ensure the development of appropriate mechanism to develop mobile phone application for all types of mobile operating systems. We implemented the MultiWordNet infrastructure to support both the limitation of annotated words (using the synonymous) and the disambiguation of word meaning. Future work includes the extension of the LIS dictionary in order to cover an even larger data set. A scalable videos visualization system will be proposed in order overcoming network overloading issues. A portal will be developed in order to enhance the sign verification by deaf users. Through the portal they could eventually propose new variants and improvements of existing signs.

In addition to the scalability we will also perform baseline experiments to get the feedback from the community on the lexical aspects.

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9. References

Alonge, A., ey et al.: The Linguistic Design of the Euro Word net Database, Special Issue on Euro Word net, in: N. Ide, D. Greenstein, P. Vossen (eds.), “Computers and the Humanities”, XXXII (1998), 2–3, 91–115.

ATLAS Project: www.atlas.polito.it

Bentivogli,L. et al “Revising WordNet Domains Hierarchy: Semantics, Coverage, and Balancing”. COLING 2004 Geneva, Switzerland, August 2004, pp. 101-10.

Blue sign partners: http://bluesign.dii.unisi.it/.

DGS-korpus: http://www.sign-lang.uni-hamburg.de/dgs-korpus/index.php/welcome.html

G. Masso and T. Badia, “Dealing with sign language morphemes for statistical machine translation” (2010), in 4th Workshop on the Representation and Processing of Sign Languages: Corpora and Sign Language Technologies, Valletta, Malta, May 2010, pp. 154157.

Koehn,P, Hoang,h; (2007), Moses:Open Source Toolkit for Statistical Machine Translation, Annual Meeting of the Association for Computational Linguistics (ACL), demonstration session, Prague,Czech Republic, June 2007.

Pianta,E. et al «MultiWordNet»: “Developing and Aligned Multilingual Database”.1st Global WordNet conference, Mysore, India, January 2002, pp. 293-302.

Prinetto, P.; Shoaib, U.; Tiotto, G.; The Italian Sign Language Sign Bank: Using WordNet for Sign Language corpus creation, proceedings of Communications and Information Technology (ICCIT), 2011, 134 – 137.

R.Elliott, et al. Linguistic modelling and language processing technologies for Avatar-based sign language presentation; universal access in the information society Volume 6, Number 4, (2008) 375-391.

Schembri,A.2008.British Sign Language Corpus Project:Open Access Archives and the Observer’s Paradox. LREC 2008,165-169.

Stein, D., Bungeroth, J., Ney, H. (2006): Morpho-Syntax Based Statistical Methods for Sign language Translation. In: 11th Annual conference of the European Association for Machine Translation, Oslo, Norway, June 2006, pp. 169–177.

T. Veale and A. Conway. Cross Modal Comprehension in ZARDOZ.