Adapting an Efficient Entry System for Sign Languages

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Abstract

Building sign language written corpora may, combined with video corpora, provide richer sign language research frameworks. Tools that allow direct sign language writing could increase sign language corpora availability significantly. Here, adaptation of a free efficient computer entry system to allow sign writing is presented.

1. Introduction

Most sign language corpora projects are based in video recordings and their annotation. Although such corpora resources have proven their importance they have almost only gloss notation for annotating the videos and rarely provide direct entry for form aspects of sign languages. Building sign language written corpora may, combined with video corpora linguistics, provide richer sign language research frameworks.

Video corpora annotation resources are not always available for production[1] and post-production[2] of such videos and later annotation. Providing tools that allow building corpora from direct writing could increase qualified sign language data sets size significantly. Such tools would also improve the meaningfulness of sign language corpora once those would be written by sign language users, mostly deaf.

Here an adaptation of an efficient computer entry system to allow sign language direct writing is presented. The following sections introduce predictive writing systems, the tool chosen to be used as a sign language writing tool, the sign language notation and technologies used for the adaptation. Then we report on the current status of the project as well as on future work.

2. Efficient and predictive entry systems

The Human-Computer Interaction research field has achieved important results in a wide variety of input, output and presentation technologies for writing; entry; script, video and audio recognition and many other alternate forms of interaction. There are several entry systems made targeting accessibility and higher efficiency(in general or for specific purposes). Some adopt different layout approaches, others implement inference predictions to speed up writing, novel devices bring approaches that (solely or combined) apply touch, multi-touch, gestures, pressure sensors, video-capture and other techniques. Since inference has become a feature used on a daily basis through mobile phones and mobile computing devices, we present here a discussion on how to implement a novel interface with inference for Sign Language Writing.

[1]camera, experienced signers and time

[2]annotation software, skillful annotation individuals, disk space for video storage and -more- time

2.1. Dasher

Dasher (Ward et al., 2000) is an information-efficient text-entry interface, driven by natural continuous pointing gestures. It is designed to be an alternative entry system when a keyboard is not available or cannot be used. Particularly

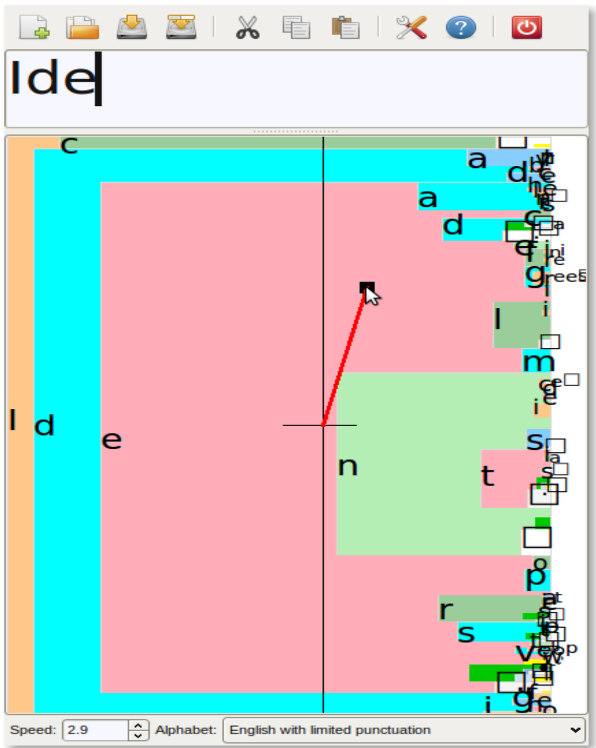

Figure 1: A dasher example. Writing “idea” in English

in cases when a small, mobile device is used to write information or when motionally-impaired computer users may not be able to use a full-sized keyboard.

Amongst the reasons to choose dasher, three are remarkable:

1. Dasher uses continuous gestures movements of a pointing device to “dive” into the symbols.
2. Dasher uses inference based on language model built up from a training text. Using the system increases its

quality. (Each writing is appended to the training text.)

3. Dasher is distributed under a Free Software License (no patents, no royalties,no license cost, and source code available for further developments) (FSF, 1991).

These characteristcs suggest that Sign Language users would benefit from using dasher because reason 1 helps in sticking to a gesture approach for expression rather than switching to some sort of keyboard approach. The "diving" metaphor also allows users to have direct access to the whole Sign-Symbol-Sequence without having to fall back on symbol palettes or key-stroke combinations. The growing training text referred as the second reason improves prediction and enlarges its corpus. Such corpora based predictions are continuously adapting themselves to its users. There are reports that show that with prediction, dasher is even faster than a virtual keyboard (Ward and MacKay, 2002) or modified keyboard layouts. The tird reason allows researchers, users and hackers to access the software source code for debugging, feature improvements or new developments.
In figure 1 we see an example of dasher zooming prediction. As the user selects a letter from the word been written("Idea", in the example), dasher zooms into the most likely letters to follow the previously selected ones(the context). The more a letter is likely to occur in the context[3], the bigger its size gets. In figure 1, after have selected the sequence "I", "d", "e" the more likely letters are "n"(for "Identity", "Identical"...), "a"(for "Idea", "Ideal", "Ideas"...) and so forth.
Dasher is available for use in dozens of languages. Using the application to write in any of those languages requires the user to set up an alphabet definition(that tells dasher which characters are valid and should be recognised in the chosen language) and a training text(a sort of corpus) written in that language.

3. Adapting Dasher for Sign language input

Agreeing with usefulness requirements as suggested by(Vettori et al., 2004), the choice of a sign language notation and an entry system to investigate the benefits of inference prediction in sign writing would have to fulfill the needs of both sign language researchers and users or, at least, try to do so. In addition to dasher(which is available or distributed within all major GNU/Linux distributions), we've chosen SignWriting as notational system because it is a broadly known notation after decades of usage and because it is used by some local deaf communities. Furthermore, SignWriting has an XML representation(SWML(Costa, 2009), (Costa and Dimuro, 2003)) that allows to interchange data with other SignWriting based tools.
We've assumed that LIBRAS[4] has entropy comparable to written English, for simplicity reasons. An alphabet definition mapping SWMA2004 to Unicode glyphs was built and adaptations were made to the dasher source code to support this notation. A TrueType font to render signwriting symbols was compiled. A training text(in SWML), composed of children tales with restricted context and lexicon, was loaded as initial corpus.

Figure 2: "idea" in LIBRAS SignWriting notation

While for spoken languages the dasher diving canvas presents a linear character set(a to Z plus numbers and punctuation) as seen in figure1, for signwriting use, the diving canvas was modified to match an alphabet definition to present a nested character set so that the user may dive into category, then group, choose the symbol in the next level and keep diving through variation, fill, and rotation to completely define the symbol to use.

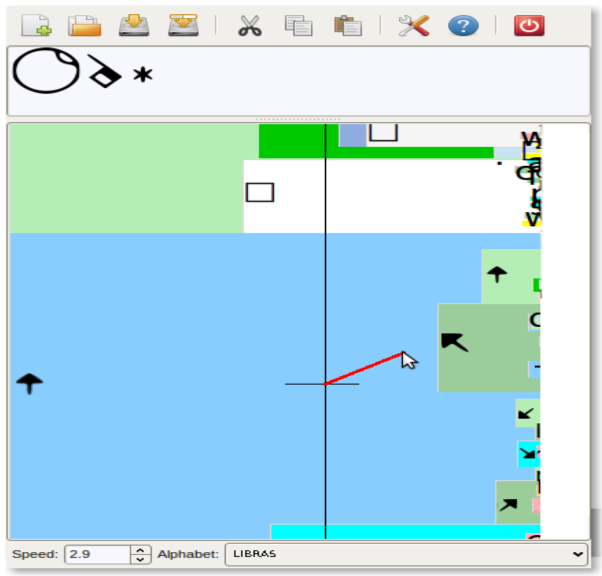

Figure 3: Writing "idea" in LIBRAS

4. Discussion, Conclusions and future work

A small group of occasional SignWriting users with varying signwriting skills were asked to perform writing tests. Results currently suggest a promising writing speed curve. Error rate results are inconclusive(as users performs more tests, some have increasing error rate while others have decreasing rates). Original output of dasher written texts, linear/left-to-right/top-down[5], remains currently unchanged for signwriting in the present work. The task of recognising if written sign matches the intended one relies on user experience with signwriting and knowledge

[3] According to the inference based on language model built up from the training text

[4] Brazillian Sign Language

[5] minor settings (as right-to-left) allowed

of LIBRAS. Error rates can be further investigated either by defining and running larger writing experiments or by defining an alternative to overcome the problem of linear output of dasher written texts. The alternatives may address issues by using matching algorithms. Through this framework, we suggest that using inference for Sign Language entry systems can speed up writing considerably. Improving text entry Efficiency for Sign Language may benefit not only research but also practitioners allowing them to access communication tools with more efficient writing and exchangeable format so they would be able, for instance, to use animated web instant messaging communication(Denardi et al., 2006).

The mentioned issues address several areas for future work, including address the spatial nature of SignWriting notation Vs. the linear writing offered by dasher; the unsettled SignSpelling that allows sign lexicographic ordering and searching should be studied in order to determine if it should be forced or corpora growth would lead to a long-term settling. The investigation can be reproduced using other notational system such as HamNoSys(Schmaling and Hanke, 2001), (Prillwitz and et al., 1987) , ELiS(Estelita, 2008) or Stokoe(Stokoe, 1960)(Stokoe et al., 1965)or even other Sign Language notations.

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6. References

A. C. R. Costa and G. P. Dimuro. 2003. SignWriting and SWML: Paving the way to sign language processing. In O. Streiter, editor, *Traitement Automatique des Langues de Signes, Workshop on Minority Languages*, Batz-sur-Mer, June 11-14.

A. C. R. Costa. 2009. The SWML site. Located at: http://swml.ucpel.tche.br.

Rubia M. Denardi, Paulo F. Blauth Menezes, and Antnio Carlos da Rocha Costa. 2006. An animator of gestures applied to the sign languages. In *2nd Workshop on the Representation and Processing of Sign Languages*, Genoa. ELRA, ELRA.

Mariangela B. Estelita. 2008. *ELiS - Escrita das Linguas de Sinais: Proposta teorica e verificacao pratica*. Ph.D. thesis, UFSC - Universidade Federal de Santa Catarina. (Doutorado em Linguistica) Coordenao de Aperfeioamento de Pessoal de Nvel Superior.

Free Software Foundation FSF. 1991. Gnu general public license, version 2. http://www.gnu.org/licenses/old-licenses/gpl-2.0.html.

S. Prillwitz and et al., 1987. *HamNoSys. Hamburg Notation System for Sign Languages. An introduction.* Hamburg:Zentrum fr Deutsche Gebaerdensprache.

C. Schmaling and T. Hanke. 2001. HamNoSys 4.0. In T. Hanke, editor, *ViSiCAST Deliverable D5-1*, chapter Interface definitions. This chapter is available at http:// www.sign-lang.uni-hamburg.de/projekte/ HamNoSys/HNS4.0/englisch/HNS4.pdf.

William C Stokoe, Dorothy C Casterline, and Carl G Croneberg. 1965. *A Dictionary of American Sign Language on Linguistic Principles*. ., 2nd edition.

W. Stokoe. 1960. Sign language structure: An outline of the visual communication systems of the American deaf. Buffalo, NY: Univ. of Buffalo. – E.E.U.U.

Chiara Vettori, Oliver Streiter, and Judith Knapp. 2004. From CALL to Sign Language Processing: the design of e-LIS, an Electronic Bilingual Dictionary of Italian Sign Language and Italian. In Oliver Streiter and Antonio Carlos da Rocha Costa, editors, *Workshop on the Representation and Processing of Sign Languages*, 4th International Conference on Language Resources and Evaluation, LREC 2004, Lisboa, May.

D. J. Ward and D. J. C. MacKay. 2002. Fast Hands-free writing by Gaze Direction. *Nature*, 418(6900):838.

D.J. Ward, A.F. Blackwell, and D.J.C. MacKay. 2000. Dasher - A Data Entry Interface Using Continous Gestures and Language Model. In *Proceedings of UIST2000*, page 129 137.