

An Assessment of Appropriate Sign Language Representation for Machine Translation in the Healthcare Domain

Sara Morrissey

Centre for Next Generation Localisation

Dublin City University

Dublin 9, Ireland

`smorri@computing.dcu.ie`

The healthcare domain is an area where machine translation (MT) can potentially play an important role in cross-communication between medical staff and (Deaf) patient (Somers, 2007). MT has the potential to be a cost-effective assistive device that facilitates the transfer of information between participants through their native languages when interpreters are not available or compromise confidentiality. But high translation quality and accuracy are imperative when dealing with such sensitive contexts. An error could cause any number of issues from clerical data entry inaccuracies to a misdiagnosis. While it is not appropriate for current MT systems to replace human interpreters in the doctor-patient communication scenario, one area that could benefit from MT assistance is interaction with the first point of contact, namely the medical secretary.

Our work investigates sign language representation (SL) formats with a view to their suitability for MT usage in a safety-critical domain. Being text-based processors, MT systems require text-based language to perform translation. As our focus is on data-driven MT, this raises one of the most interesting challenges for SL MT: finding suitable SL corpora in order to train the MT system. The ideal corpus is a bilingual digital database that is within a specific domain (Morrissey & Way, 2006). As few corpora exist for SLs in video or text-based representation format, we assess the most suitable format with a view to creating such a corpus.

In order to maximise the performance and accuracy of an MT system, certain processes are standard in data-driven MT systems. These include: *segmentation* for dividing the source and target language text in the database; *alignment* for drawing translation links between source and target sentences; and *algorithmic searches* for searching the source and target text for both the previous actions. The ideal SL representation format for MT facilitates easy development of these processes with the possibility of porting current state-of-the-art processes from spoken language MT to optimise performance as shown in (Stein et al., 2006) and (Morrissey, 2008), for example.

In our research we look at three SL representation categories: *linear* approaches such as Stokoe notation (Stokoe, 1960) and HamNoSys (Prillwitz et al., 1989); *multi-level* descriptions such as linguistic glossing (Leeson et al., 2006), partition/constituent modeling (Huenerfauth, 2005) and movement-hold theory (Liddell & Johnson, 1989); and *iconic* systems such as Sign Writing (Sutton, 1995). We compare these approaches against the processing requirements of data-driven MT systems and assess their suitability for use in a healthcare system.

The most appropriate SL representation for MT in the healthcare domain is one which encompasses the full range of linguistic features in SLs including phoneme description, non-manuals and the spatial nature of the language, that allows the greatest possibility of accurate production of the SL through animation, but that also facilitates the translation process. Our investigation outlines the pros and cons of each of the above representation categories in light of the requirements of an MT system and theorises that linear approaches are the most useful. It is our intention to follow up this work with future practical examinations of this theory through corpus and MT development and suggest a software interface for such a tool.

References

- Huenerfauth, M. 2005. Moving Heads and Moving Hands: Developing a Digital Corpus of Irish Sign Language. In *Proceedings of Information Technology and Telecommunications Conference 2006*, Ann Arbor, MI., pp.37–42
- Leeson, L., J. Saeed, A. Macduff, D. Byrne-Dunne and C. Leonard. 2006. American Sign Language Generation: Multimodal NLG with Multiple Linguistic Channels. In *Proceedings of the ACL Student Research Workshop (ACL 2005)*, Carlow, Ireland.
- Liddell, S. and R. E. Johnson. 1989. American Sign Language: The Phonological Base In *Sign Language Studies*, **64** pp.195–277.
- Prillwitz, S., R. Leven, H. Zienert, T. Hanke and J. Henning. 1989. Moving Heads and Moving Hands: Developing a Digital Corpus of Irish Sign Language. *HamNoSys. Version 2.0. Hamburg Notation System for Sign Languages: An Introductory Guide*, Hamburg Signum, Hamburg, Germany.
- Morrissey, S. and A. Way. 2006. Lost in Translation: the Problems of Using Mainstream MT Evaluation Metrics for Sign Language Translation. In *Proceedings of the 5th SALTMIL Workshop on Minority Languages at LREC'06*. Genoa, Italy, pp.91–98.
- Morrissey, S. 2008. Data-Driven Machine Translation for Sign Languages. PhD Thesis. Dublin City University.
- Somers, H. 2007. Theoretical and Methodological Issues Regarding the Use of Language Technologies for Patients with Limited English Proficiency. In *Proceedings of the Eleventh Conference on Theoretical and Methodological Issues in Machine Translation (TMI-08)*, Skövde, Sweden, pp.206–213.
- Stein, D., J. Bungeroth and H. Ney. 2006. Morpho-Syntax Based Statistical Methods for Sign Language Translation. In *Proceedings of the 11th Annual conference of the European Association for Machine Translation (EAMT'06)*, Oslo, Norway, pp.169–177.
- Stokoe, W. C. 1960. An Outline of the Visual Communication Systems of the American Deaf. In *Studies in Linguistics: Occasional papers, No. 8*, Department of Anthropology and Linguistics, University of Buffalo, Buffalo, New York, pp.78.
- Sutton, V. 1995. Lessons in Sign Writing, Textbook and Workbook (Second Edition). *The Center for Sutton Movement Writing, Inc., La Jolla, CA*.