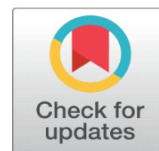# THAI SIGN LANGUAGE TO ENGLISH TRANSLATION USING VARIABLE HIDDEN NEURON ANN - A CASE STUDY

Sowjanya M N [1] ✉ ⓘ, Thimmaraju S N [2] ✉

[1] Assistant Professor, Department of MCA, VTU-RRC, Mysuru, Karnataka, India.
[2] Professor, Department of MCA, VTU-RRC, Belagavi, Karnataka, India.

ABSTRACT

Sign language translation has been a major challenge in all walks of life. The current society has been more accepting of the especially abled and the government has been actively making policy changes to accommodate and assimilate the especially abled into the society. Every country has made a conscious effort to develop its own syllable set in its native language even though globally used language is American Sign Language (ASL). In this paper a method proposed by the authors for ASL is applied on Thai Sign Language and the working of the ANN model is explored.

Keywords: Sign Language, ASL, ANN, Hidden Layer, Translation

1. INTRODUCTION

The ability to communicate to another being of the same species marked one of the greatest advances in civilization for all animals on earth. It brought forth a new era of languages with their own alphabet and grammar. Formal language and linguistics have been major parts of studying the history and psychology of a geographical area and its population. In larger countries such as India, every state can have its own language, and this makes the study even more granular and tedious. Genetic adversities and accidents have rendered many people with various handicaps. The biggest of such, being inability to speak and hear. Blindness coming in a close second, Braille Wikipedia (2021) made a groundbreaking contribution to ease the communication in printed form. However, the deaf and mute would have to rely on their hands and digits for communication with other people Wikipedia (2021). A study of various methods to aid people understand sign languages using machine learning methods was presented in Sowjanya and Thimmaraju (2019). In the research work connected to this, a multiple hidden neuron model was developed to translate sign language into English Sowjanya and Thimmaraju (2020). The estimation of the number of hidden neurons to provide added stability to the system was conducted in Sowjanya and Thimmaraju (2021). However, since the language in discussion was ASL and the stable data set was available, the full scope of the system could not be assessed in a comprehensive manner. Hence the system has been applied to Thai sign language Supawadee et al. (2012) and the results are presented to validate the hidden neuron model for ANN based sign language translation. The results are convincing and the system can be bench marked against existing systems.

2. MATERIALS AND METHODS

The dataset was taken from Supawadee et al. (2012) and Kittasil Silanon (2017). The gestures are slightly different from what is used in ASL as shown in Figure 1. Some of the initial gestures are shown in the Table 1 for reference.
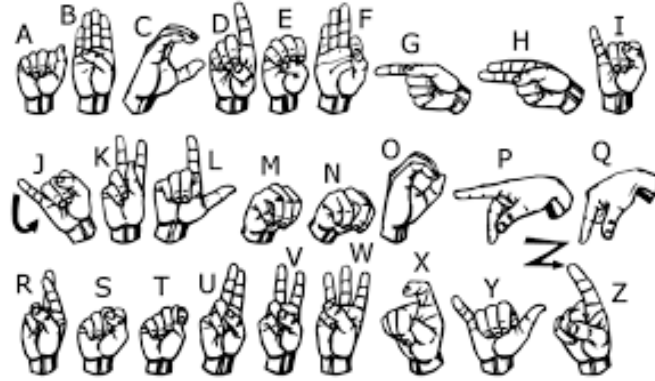

Figure 1 ASL gestures

Kittasil Silanon (2017). Since the gestures had varying signs, the task would require 17 hours of training. The training once completed, led to the system being fed 1000 more samples for validation of the same as presented in the modern standard TSL James Woodward (1996). This took a reduced time of 9 hours. Final phase was testing. Testing was also done with 1000 samples. The results are discussed in the next section.

3. RESULTS AND DISCUSSIONS

The experiment was run on 1000 files with varying number of users as given in http://facundoq.github.io/guides/sign_language_datasets/slr. The conditions were varied in time duration of the gesture and the speed. The sample of data obtained from the results is shown below.

Table 1 A section of the confusion matrix generated by the translator

Thai gesture	English Equivalent symbol	No. of samples	CM	A	B	C	D	E	F	G	H	I
	A	984	A	984	0	0	2	0	1	0	3	0
	B	992	B	0	992	0	0	2	0	0	0	0
	C	974	C	0	0	974	0	0	0	6	0	0
	D	976	D	2	0	0	976	0	0	0	0	0
	E	998	E	0	2	0	0	998	0	0	0	0
	F	988	F	1	0	0	2	0	988	0	0	0
	G	985	G	0	0	6	0	0	0	985	0	0
	H	982	H	3	0	0	0	0	0	0	982	0
	I	963	I	0	0	0	0	0	0	0	0	963

From the data presented in Table 1, it can be seen clearly that as the number of samples increases, the accuracy improves and loss reduces drastically. The accuracy and loss plots are shown in Figure 1.
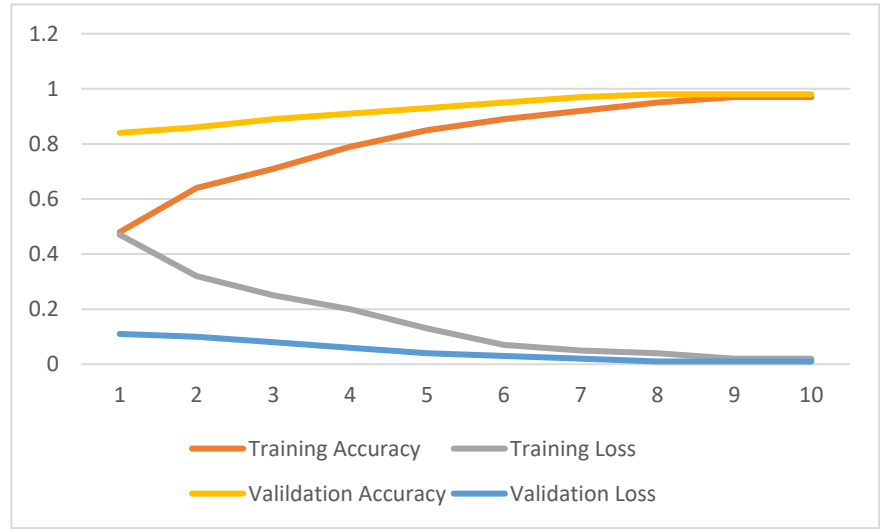

Figure 2 Training and Validation parameters
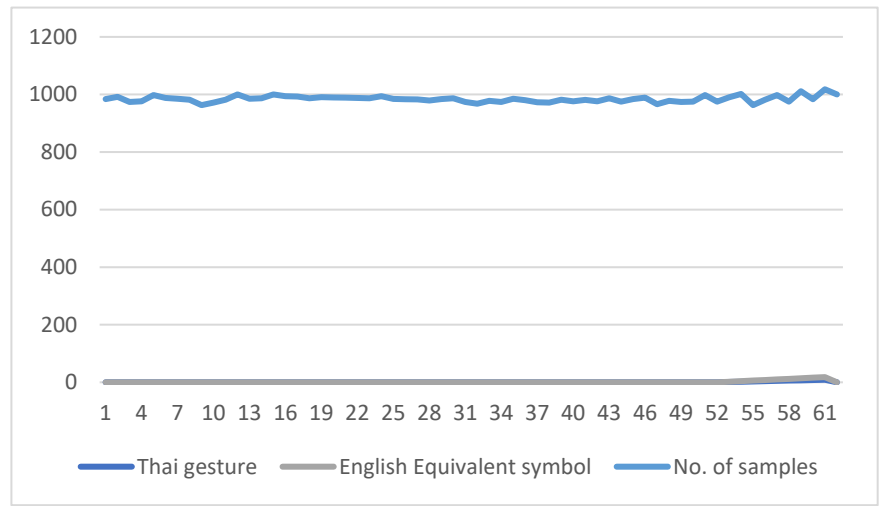

Figure 3 Accuracy of translation

The graphs clearly indicate that over time, the proposed model loss reaches 0 and remains as the translation tends to be 100% accurate.

4. CONCLUSIONS AND RECOMMENDATIONS

The proposed method having 7 neurons in the hidden layer, works well for the two most widely used sign languages. Thus, it can be extrapolated for any language and fares well against any existing system with better speed and any other user requirement.

The recommendations include that, the system can be bench marked against the existing standard translation systems and can be integrated into handheld

devices such as smart phones and laptops to aid the specially abled to be a part of the society seamlessly.

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