Sri Lankan Sign Language Tutor

K.S.S. Fernando and S.D.H.S. Wickramarathne
Uva Wellassa University, Badulla, Sri Lanka

Introduction

Sign Language Recognition is one of the major research areas of Human Computer Interaction (HCI). A large number of researches had been done in this area for American Sign Language, Indian sign language, Chinese sign language, Thai sign language, etc. (Rajathi et al., 2013). But, less amount of researches are done related to Sinhala sign language recognition. Specially no research work found in developing a tutor for Sinhala sign language.

There may have problems when teaching sign language to disabled children due to lack of teachers, less/no attention to every child at every moment due to lack of resources, parents of these disabled children may be too busy, less interest of children to study, etc. Therefore, this research was carried out to develop an automated tutor to the Sri Lankan deaf community for Sinhala sign language to practice & check their knowledge.

Methodology

This is an Image based Sign Recognition System which uses Fourier Descriptors for feature Extraction (Nixon et al., 2002). The system architecture can be divided into five modules as shown in Figure 1.

In Image Acquisition Module, images of 200*200dpi (dots per pixel) resolution which contains only the hand was captured in a black background by wearing a black long sleeve top with a white glove. In Image Processing Module, image processing techniques will be applied to manipulate the image. It results the pure contour of the shape as the final output.

In Feature Extraction Module, Fourier Transformation is applied on closed contour. For that the shape contour is sampled to 64 points by equal arc length method and Centroid distance function is applied. Discrete Fourier Transformation is applied to the Centroid distance shape signature which result 32 Fourier Descriptors. The Fourier Descriptors were modified in order to preserve scale and rotation invariance by dividing them by the first Fourier Descriptor. The first 10 Fourier Descriptors except the first Fourier Descriptor are taken into account.

In Neural Network Module, a neural network of 10 input layers, 6 output layers and 8 output layers is used. The 10 Fourier Descriptors of each sign are fed as the input and a pattern for each sign was fed as the output. It will output the results as a neuron weight file. This weight file is used in Result Module to determine the correctness (right/wrong) of each sign to the user. The result will be displayed to the user by a two visual indicators.

Result and Discussion

Sri Lankan Sign Language Tutor was implemented to recognize the correctness of 8 static signs of Sinhala Alphabet (Figure 2). The system is tested with 800 images of signs including 100 images from each sign for scale, rotation, translation and starting point invariance and the obtained accuracy level for each letter is listed in Table 1.

The system is trained by using 200 images of signs including 25 images from each sign. The obtained accuracy level can be increased by increasing the training set. But it requires more time.

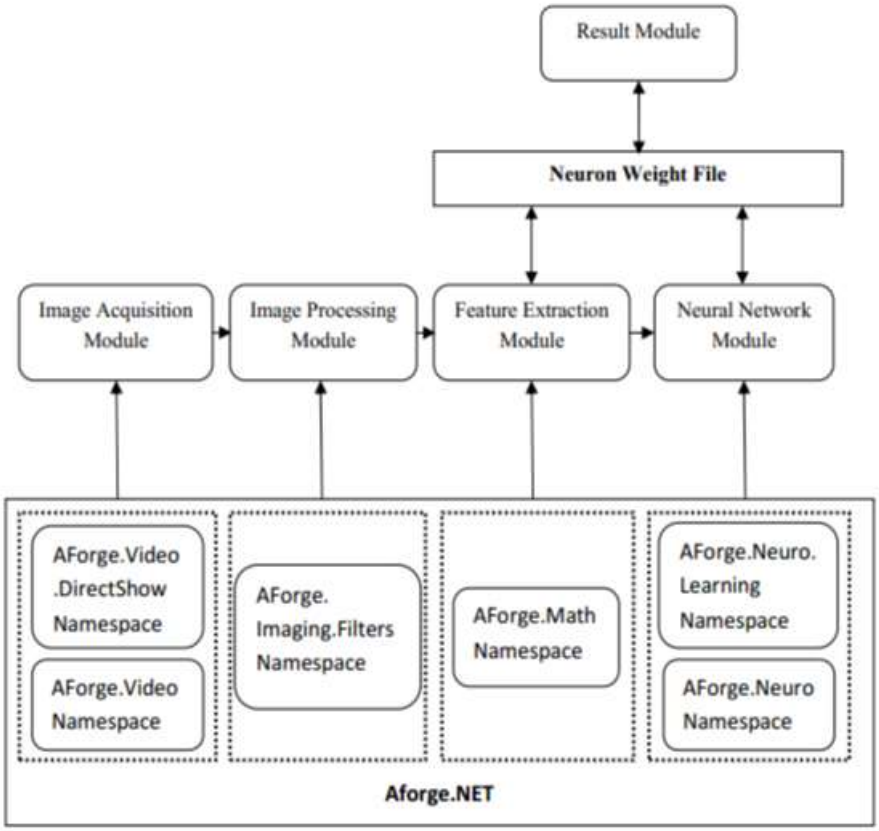

Figure 1.System architecture.

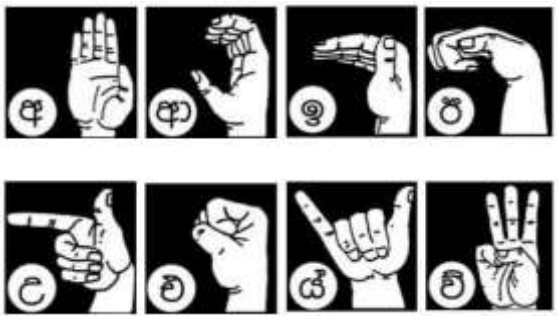

Figure 2.Recognized signs of Sinhala alphabet.

Table 1. Accuracy levels of signs.

Letter	Accuracy
අ	100%
ඇ	100%
ඔ	80%
ඒ	80%
ඊ	70%
ඈ	70%
උ	70%
ඖ	60%

Conclusions

Sri Lankan Sign Language Tutor is capable of recognizing 8 static signs related to 8 Sinhala letters, which are invariant to scale, translation, rotation and starting point using Fourier Descriptors.

References

Nixon, M.S., Aguado, A.S., 2002. Feature Extraction and Image Processing. Oxford : Butterworth-Heinemann.

Rajathi, P., Jothilakshmi, S., 2013. A Static tamil sign language recognition system. International Journal of Advanced Research in Computer and Communication Engineering, 2(4), 1885-1891.