



# **Computer Vision Based Recognition of the Corresponding Sinhala Word from Continuous Finger Spelled Signs**

**W.A.U.D Wijesinghe**

Reg. No.: MS11902980  
M.Sc. in IM

Supervisor: Prof. Samantha Thelijjagoda

January 2021

**Faculty of Graduate Studies and Research  
Sri Lanka Institute of Information Technology**

## Table of Contents

Table of Contents .....	2
List of Figures .....	4
List of Tables .....	5
Chapter 1 Introduction .....	6
1.1 Abstract .....	6
1.2 Project Description Introduction: Context and Background .....	7
1.3 Problem Definition .....	7
1.4 Research Objectives & Research Questions .....	8
1.4.1 Main objective .....	8
1.4.2 Sub objectives .....	8
Chapter 2 Literature Survey .....	9
2.1 Sinhala sign alphabet of Sri Lankan sign language .....	9
2.1.1 Conversational signs .....	9
2.1.2 Number signs .....	9
2.1.3 Fingerspelling sign/Alphabet sign .....	10
2.1.4 Static Signs .....	10
2.1.5 Dynamic signs .....	11
2.2 How does the Sinhala finger spelling system work? .....	11
2.3 Existing sign language datasets .....	12
2.4 Related work -Sign language recognition approaches in Sri Lanka .....	14
2.5 Related work-Finger spelling recognition .....	16
Chapter 3 Methodology .....	20
3.1 Data Acquisition .....	20
3.1.1 Signers .....	21
3.1.2 Camera setup .....	22
3.2 Scope of the dataset .....	22
3.2.1 Sinhala sign alphabet .....	22
3.2.2 Number Signs .....	23
3.2.3 Dynamic Signs .....	24
3.2.4 Fingerspelling sequences .....	25
3.2.5 Folder structure for Fingerspelling recognition, Dynamic sign recognition and static sign recognition .....	26
3.2.6 Manual Validation and segmenting of Video Data .....	27

3.3 Proposed framework .....	28
3.4 Proposed model .....	29
3.4.1 Frame Extraction and pre-processing .....	29
3.4.2 Architecture of the proposed model .....	29
3.4.3 Approach 1- Individual Sinhala Letter Recognition.....	30
3.4.4 Approach 2- Fingerspelling sequence recognition .....	33
Chapter 4 Results and Discussions .....	37
4.1 Results .....	38
4.1.1 Approach 1 Results- Individual Sinhala Letter Recognition.....	38
4.1.2 Approach 2 Results - Fingerspelling sequence recognition .....	39
Chapter 5 Conclusion.....	40
5.1 Future works.....	40
5.2 Conclusion.....	40

## List of Figures

Figure 2.1 Conversational Sign .....	9
Figure 2.2 Number signs .....	9
Figure 2.3 Fingerspelling sign/alphabet sign .....	10
Figure 2.4 Static signs .....	10
Figure 2.5 Dynamic signs .....	11
Figure 2.6 Phonetic pronunciation mechanism of Sinhala alphabet .....	12
Figure 2.7 a decoded Sinhala word.....	12
Figure 3.1 High-level architecture of the proposed system .....	20
Figure 3.2 Signers .....	21
Figure 3.3 Figure- Camera setup. ....	22
Figure 3.4 Sinhala sign alphabet .....	23
Figure 3.5 Folder Structure. ....	26
Figure 3.6 Segmenting video data .....	27
Figure 3.7 Architecture of the proposed model .....	29
Figure3.8 Dynamic alphabet signs dataset .....	33
Figure3.9 Fingerspelling dataset .....	35
Figure 4.1-total accuracy vs. validation accuracy.....	38
Figure 4.2 total loss vs. total validation loss .....	38
Figure 4.3 total accuracy vs. validation accuracy loss of Fingerspelling dataset.....	39
Figure 4.4 the total loss vs. total validation loss of Fingerspelling dataset .....	39

## List of Tables

Table2.1 Comparisons of the important characteristics of the datasets .....	13
Table2.2 Comparison of ChicagoFSWild and ChicagoFSWild+ data sets .....	14
Table 2.3 Comparison of gesture recognition methodologies .....	15
Table 2.4 Vision based fingerspelling recognition summary.....	17
Table2.5 Summary of the data set used in vision based fingerspelling recognition.....	18
Table 3.1 Video Data Set Characteristics- Sinhala sign alphabet and Number signs .....	24
Table 3.2 Video Data Set Characteristics- Dynamic signs and Fingerspelling sequences.	25
Table 3.3 Video Properties letter “ඒ”, “ඔ”, “ඒ” .....	31
Table 3.4-Video characteristics word Ama .....	33
Table 3.5 Video characteristics for Hansi .....	34