Introduction

1.1   Introduction

This chapter discusses about the background of the project to stress the importance of the problem. It also briefly describes the approach followed throughout this project. And finally aim and the objectives are presented along with the hardware and software requirements.

1.2   Introduction to Brahmi Optical Character Recognition System

Epigraphy deals with study of inscriptions that are graved in rocks, stones, caves. Recognizing the content in these ancient inscriptions could reconstruct the history by undiscovered historical events. Most of the carved characters in these inscriptions are partially or fully erased due to various reasons such as wars, weather conditions. And also the background shades and patterns on the stone itself has been a great obstacle for identification of the characters. The content of these inscriptions are translated to regional language manually by an expert epigraphist, who is specialized in understanding the ancient scripts. However these expert epigraphists are few and could become extinct in future. In addition to the dearth of specialized knowledge, the considerable amount of noise in the inputs and lack of resources are identified as major issues in ancient inscription reading. Therefore developing a system for optical character recognition for Sri Lankan ancient inscriptions is a significant task.

In recent past, substantial amount of research effort has been applied for optical character recognition in various languages such as English, Tamil, Bengali, and Sinhala. Unfortunately there are no published similar systems developed to recognize the Brahmi characters in ancient Sri Lankan inscriptions.

This project is an attempt to build a system which would recognize the Brahmi characters in ancient Sri Lankan inscriptions and convert to mapping Unicode characters in the currently standard Sinhala alphabet. The digital photographs of ancient inscriptions found in Sri Lankan archaeological sites – Mihintale , Handagala Vihara and Wessagiriya were used for the experiments of this system. This project

only focuses on the inscriptions that were carved during the period 3rd Century B.C. The Brahmi alphabet in this period contains about 17 characters.

The system proposed by this thesis has special condition where there are considerable amount of noise in the given input. Therefore some of the noisy patches on the stones are identified as characters and produce incorrect result. The neural network technology together with the multi agent technology [3] is used to develop the proposed system. Figure 1.1 represents a sample input image of ancient inscription.
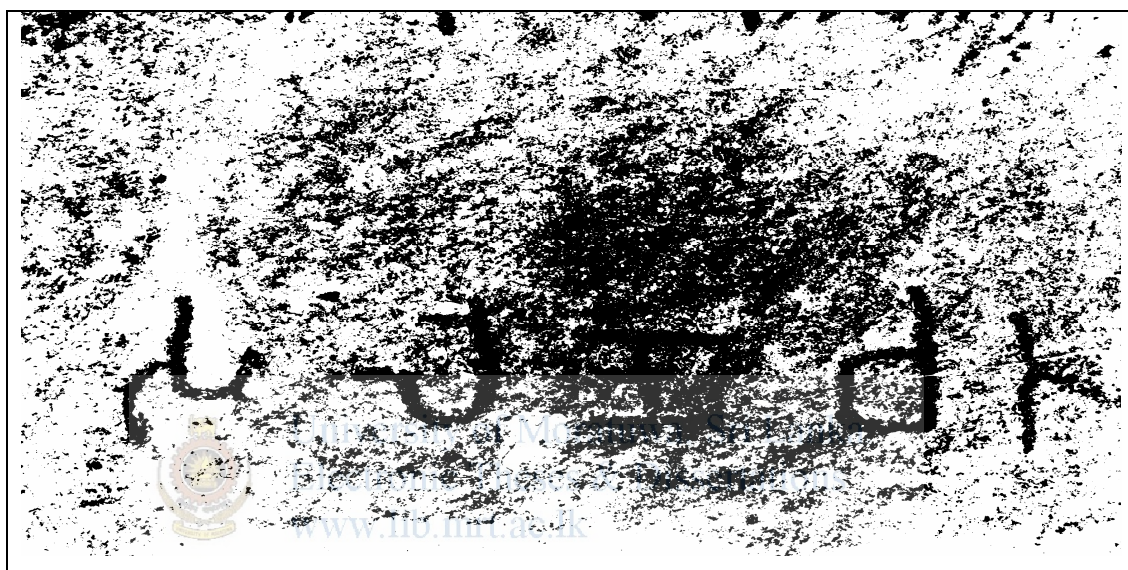

Figure 1.1 : Sample Input Inscription Image

As a standard optical character system the propose system is also based on three main stages, namely pre processing, recognition and post processing.

The input for the system is a Brahmi inscription image which is pre processed by several image processing techniques. On the pre processing phase the Brahmi characters are segmented into isolated characters, resized into 30 X 30 pixel wide characters and extract the relevant features. The recognition and the post processing phases together operate as a multi agent system. It is evident from the literature that neural network [2] is one of the best approaches for pattern classification. Therefore artificial neural network technology is used in the recognition phase. The recognition phase consists of ANN agent, which uses the extracted features in the pre processing to identity the particular Brahmi character. After the recognition phase the recognized character string is generated. Due to the high noise rate some of the patches in the

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stone were identified as characters. A multi agent system is used to solve this problem in the post processing phase.

In the post processing phase the recognized character string is evaluated to locate the incorrectly identified characters. For the incorrectly identified characters, the lexical agent provides suggestions and based on those suggestions sentences are constructed by the lexical agent itself. The structure analyst agent analysis the words in these sentences and assign mark for each and every word based on the located position. The score for a sentence is calculated by summing up the marks given for the word set in the particular sentence. The sentences which have scored more than the threshold mark are considered as valid sentences. The Structure Analyst Agent accepts the valid sentences and rejects the invalid sentences. Semantic Agent also accepts or rejects the sentence base on the context. Base on the responses that received through the communication and the negotiation of the agents the particular sentence is considered as the inscription character string and accepts as the final output or reject the sentence and reconsider another sentence that was generated by the lexical agent.

This system will be very useful for the archaeologists and students who are studying the archaeological field.

1.3 Aim

The aim of this project is to develop a system to recognize the characters in ancient Sri Lankan Inscriptions by using the Artificial Neural Network and Multi Agent Systems technology.

1.4 Objectives

- To study about the stone inscriptions of ancient Sri Lanka in general.
- To study about the ancient Brahmi letters in one particular era and study the mapping between Brahmi letters and Sinhala letters.
- To critically study about the techniques that could be used to recognize the characters.
- To study about the image processing techniques.
- To study how the Neural Network technology that could be used in character recognition process.

- To study how the Multi – Agent Systems are used in problem solving.
- To design and develop the prototype of optical character recognition system that is used to recognize the characters in the ancient Sri Lankan inscriptions.
- To evaluate the prototype developed to recognize the characters in the ancient Sri Lankan slab inscriptions.
- To document the final thesis.

1.5 Resource Requirements

Hardware -   Scanner, Digital camera with high resolution, Personal computer with minimum 2 GHz processor and 1 GB RAM.

Software -   NetBeans , Java programming language, GNU Image Manipulation Program (GIMP), Neuro Solutions , MS – Access.

This thesis is organized as follows: The Chapter 02 critically reviews the technologies that are used by the other similar systems and Chapter 03 elaborates on the technologies that are adapted for this project. The approach is describes in terms of the input, output, process, users and technology in the Chapter 04. The design of the system is explained under Chapter 05. Chapter 06 states the implementation details of the project. The Chapter 07 describes how the system is evaluated. Finally the conclusion section summarizes the details mention under other chapters and highlights the future work of the project.

1.6 Summary

This chapter elaborate on the background information and the motivation behind the project. It also describes the approach in terms of input, output, processes and users. And finally the aim and the objectives of the project are presented followed with the resource requirements.

The next chapter elaborate on the conducted literature survey by reviewing others work.