

Handwritten Devnagari Script Recognition by Using Phase Correlation

Ms. Poonam M. Ingle

Dept. of Electronics and Telecommunication Engineering
Jayavantrao Sawant College of Engineering
Pune, India

poonamygaikwad@gmail.com

Prof. P. P. Gumaste

Dept. of Electronics and Telecommunication Engineering
Jayavantrao Sawant College of Engineering
Pune, India

p_gumaste@rediffmail

Abstract— In this paper, a system is presented which recognize handwritten script and shows same script in typed character format by using ASCII. This paper includes offline character recognition method for recognizing handwritten text. System consider handwritten text images as input and separates lines, words, characters step by step by using region labeling. Template matching technique is used for text recognition. Template matching is a process of finding location of sub image (template) in input image. After retrieving its location system shows same text in typed character format.

Index Terms—Devnagari script, Recognition, OCR, Phase correlation, Template Matching

INTRODUCTION

In India, Devnagari script is used to write most of the Indian languages like kokani, Hindi, Sanskrit, Maithili etc. Devnagari script contains thirteen vowels and thirty three consonants and fourteen modifiers. A horizontal line is on the top of all characters called 'Shirorekha'. Devnagari script is mostly used for writing and documentation purpose. Devnagari script is written from left to right.

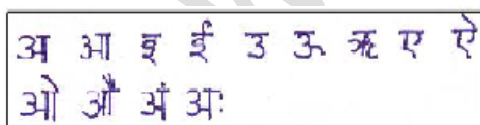


Fig 1.1 Vowels in Devnagari

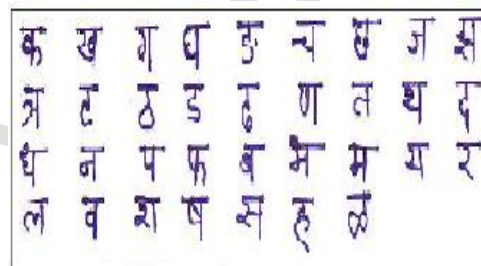


Fig 1.2 Consonants in Devnagari

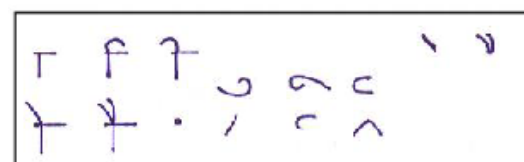


Fig 1.3 Modifiers in Devnagari.

Devnagari script is recognized with the help of Offline character recognition. Offline character recognition is used mostly now days in many fields like bank, airports, postal automation, businesses etc. Offline character recognition software is used with scanners and faxes which allows users to convert from text images to editable documents. Scanned documents give text images which need to separate words, Characters.

After recognition of script that can be separate line, word, character by using region labeling. Region labeling is applied on inverted images only. Region labeling is the process of calculating no of characters in line and same process is applied over script.

Devnagari script recognition is tough task because of 1) various characteristics of these like complex shape, presence of

modifiers, presence of compound character and similarity between some characters. 2) Different people have different styles of writing so it increases complexity while recognition. We have developed handwritten word image databases for Marathi language for the present study as there are no such database was available.

OFFLINE CHARACTER RECOGNITION

Handwritten Character Recognition can be done mostly by two ways first one is online character recognition and second one is Offline character recognition. This classification can be done in the basis of text is machine printed or handwritten.

Documents are in the form of papers which the human can read and understand but it is not possible for the computer to understand this document directly. In order to convert this document in computer readable form, OCR is developed.

Offline Character Recognition is the process of automatic recognition of characters in optically scanned and digitized text pages. OCR is mostly used in pattern recognition with various practical application potentials and Image processing. OCR extracts the relevant information and automatically enters into electronic database instead of conventional way of manually retyping the text. The main disadvantage is that there is no possibility of obtaining information about the type of the input.

Offline Character Recognition is very vast field having many applications such as invoice imaging, legal industry, banking, health care industry, optical music recognition, automatic number plate recognition, address recognition etc.

Offline Character Recognition consists of following steps:

- 1] Image acquisition
- 2] Preprocessing
- 3] Region labeling
- 4] Recognition

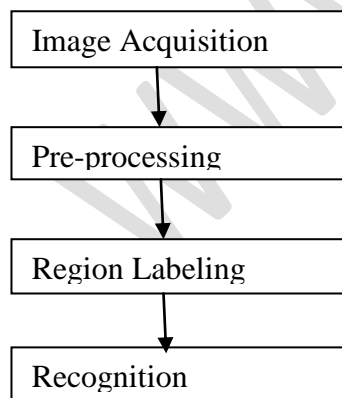


Fig 2.1 Overview of Offline Character Recognition method

[1] Image Acquisition: Image Acquisition is nothing but reading an image. System scan images with 300 dpi and then stores images at some location. While storing images system

ask for file type of images. System can access multiple file types for inversion. Bitmapped Picture is represented as rectangular array of dots. It stores complete digitally encoded images. It is used when the images are in large part created by hand or scanned from an original document using scanner.

Few types of bitmapped graphic files format are:

TIFF (Tagged Input File Format)

GIF (Graphics Interchange Format)

BMP (Bit Map Format)

Mac Point

IMG

TGA (Targa)

JPEG (Joint Photographic Expert Group).

[2] Pre-processing: Pre-processing is necessary when the data or image is capture for further processing. The noise introduced in the image while acquisition of the image or data, while transferring the data, as well as because of changing of some parameter of acquisition system in OCR. The difficulty which introduced is the skew in the handwritten script / word. Skew is a distortion that is often introduced during scanning or copying of a document and it is unavailable. Skew angle is the angle that text line deviates from the x- axis since page decomposition techniques require properly aligned images as input, document skew must be corrected in advance.

It consists of following steps:

2.1] Thresholding: Thresholding is the process of converting a gray scale image into a binary (black and white) image. It is very essential to identify the objects of the interest from the rest. It may be reduce the number of objects and unwanted background information.

2.2] Noise removal: The extraction of the foreground textual matter by removing say, textured background , salt and paper noise and interfering strokes.

2.3] Morphological operation: Morphological operation can be used to remove the noise on the document images due to low quality of the paper and ink as well as erratic movement. We have performed some operation like dilation (this increase s the width of the text), erosion (this reduces the width of the text) etc. to remove noise from the scanned images.

[3] Region labeling: Region labeling involves examining each pixel in a mapping and comparing its value to that of its neighbors. If its value is “close enough” then it is determined as being in the same region as that neighbor. An equivalence table is maintained for the second pass that merges any regions determined to be the same.

Region labeling performs on inverted images. Region labeling moves column wise throughout the image. Region labeling observes white pixels and its x and y positions, assigns different numbers (black pixels are assigned to zeros and white pixels numbers are increased by one like 1, 2, 3....) and

separate out them. When it counts all black pixels then it moves to next line. By following the same process, it separates the lines. After separating lines it follows the same process for word recognition. For word recognition region labeling moves column wise throughout the line. It counts white pixels and assigns different numbers. Then whenever black pixels are found out that separates word. After separating word, it applies same process to separate character.

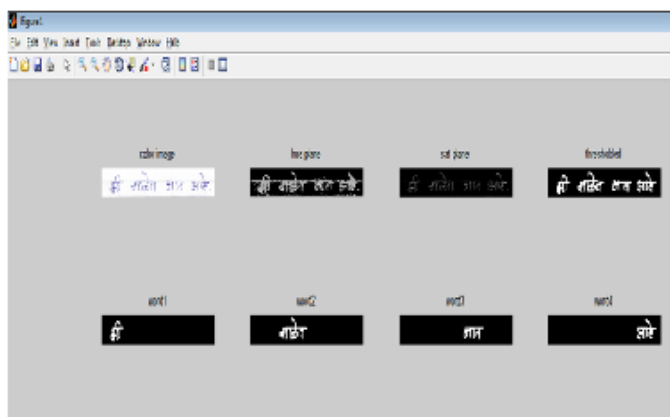


Fig 2.2 Example of region labeling

[4] Recognition: After the extraction of individual character occurs by Region labeling, all character are recognized with help of their location and provide for the further process.

PHASE CORRELATION AND TEMPLATE MATCHING

Phase Correlation

Phase correlation method is used for template matching application.

Phase correlation is given by

$$R = \frac{F(\text{img1}) * \text{conj}(F(\text{img2}))}{\|F(\text{img1}) * \text{conj}(F(\text{img2}))\|}$$

The inverse Fourier Transform of R is the phase correlation.

R – Ratio between two images

F – Fourier Transform

Conj – complex conjugate.

Phase correlation provides straight –forward estimation of rigid translational motion between two images, which is based on the well known Fourier shift property. The highest peak is picked out from phase correlation. Fourier transform is an important image processing tool which is used to decompose an image into its sine and cosine components. The output of the transformation represents the image in frequency domain, while the input image is the spatial domain. In the Fourier

domain image, each point represents a particular frequency contained in the spatial domain image. The Fourier Transform produces a complex number valued output image which can be displayed with two images, either with the real and imaginary part or with magnitude and phase.



Fig 3.1 Template Image and Input Image

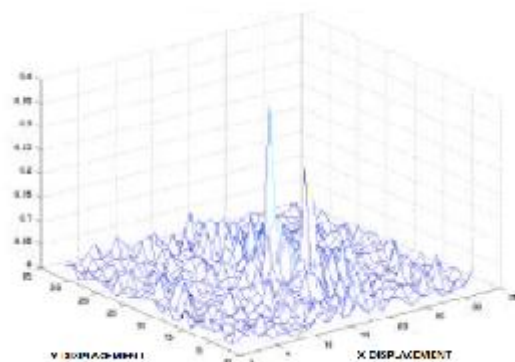


Fig 3.2 Phase correlation between two images

In image processing, often only the magnitude of the Fourier Transform is displayed, as it contains most of the information of the geometric structure of spatial domain image.

The result shows that the image contains component for all frequencies, but their magnitude gets smaller for higher frequencies. Hence, low frequency images contain more information than higher ones.

template matching

Template matching is an important tool in image processing and computer vision. A template is process of finding sub image (template) in original input image. Finding such correspondences is useful for many computer tasks such as object tracking, image editing, medical imaging etc.

Template matching has problem if the image has presence of extreme noise. Therefore noise removal technique is needed.

Template matching technique used to categorize objects. Template matching technique compare portion of images against one another. Sample image may be used to recognize

- [5] Sk Md Obaidullah, Supratik Kundu Das, Kaushik Roy, A System for Handwritten Script Identification from Indian Document, Journal of Pattern Recognition Research 8 (2013) 1-12 Received Dec 27,2012. Accepted May 19,2013.
- [6] Fan YANG , Linlin WEI Zhiwei ZHANG, Hongmei TANG, Image Mosaic Based on Phase Correlation and Harris Operator, Journal of Computational Information System 8:6 (2012).
- [7] Mamoru Miura, Shuji Sakai, Shoichiro Aoyama , Jumpei Ishii, Koichi Ito and Takafumi Aoki, High Accuracy Image Matching Using Phase –only Correlation and Its Applications, SICE Annual Conference 2012 August 20-23,2012 Akita University, Akita, Japan.
- [8] Vikas J. Dongre and Vijay H. Mankar, Development of Comprehensive Devnagari Numeral and Character Database for Offline Handwritten Character Recognition, Hindawi Publishing Corporation Applied Computational Intelligence and Soft Computing Volume 2012, Article ID 871834, 5 pages.
- [9] Tulshiram B. Pisal & Parshuram M. Kamble, Marathi Handwritten Character Recognition by using Probabilistic Neural Network Classification, International Journal of Research in Computer Science and Information Technology (IJRCSIT) Vol. 1 Issue 1(A) I Feb 2013.