IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

Study of Improved Parallel Thinning Algorithm for Numeral Patterns: A Review

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Abstract: Computer vision is a field that includes methods for acquiring, processing, analyzing, and understanding images and, in general, high-dimensional data from the real world in order to produce numerical or symbolic information, e.g., in the forms of decisions. A theme in the development of this field has been to duplicate the abilities of human vision by electronically perceiving and understanding an image. Understanding in this context means the transformation of visual images (the input of retina) into descriptions of world that can interface with other thought processes and elicit appropriate action. A number of image processing and pattern recognition application demand that are raw digitized binary pattern array be normalized, so that the constituents components of that array are of uniform thickness. This wide range of application shows the usefulness of reducing the patterns to thin line representations, which can be attributed to the need to process a reduced amount of data as well as to the fact that shape analysis can be more easily made on line. This Paper has been proposed and reviews the thinning steps and algorithms.

Keywords: Image Processing, Thinning, Computer Vision.

I. INTRODUCTION

Digital image processing deals with manipulation of digital images through a digital computer. It is a subfield of signals and systems but focus particularly on images. DIP focuses on developing a computer system that is able to perform processing on an image. The input of that system is a digital image and the system process that image using efficient algorithms, and gives an image as an output. The most common example is Adobe Photoshop. It is one of the widely used applications for processing digital images.

Image Features

In computer vision and image processing the concept of feature detection refers to methods that aim at computing abstractions of image information and making local decisions at every image point whether there is an image feature of a given type at that point or not. The resulting features will be subsets of the image domain, often in the form of isolated points, continuous curves or connected regions.

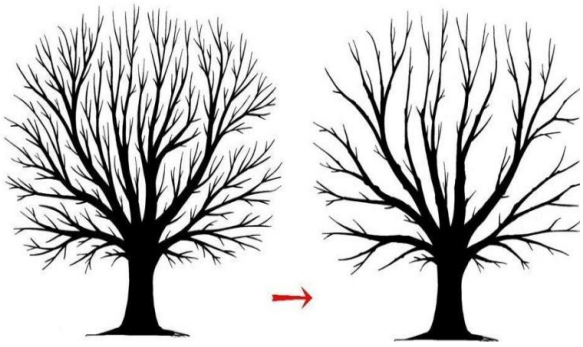

Figure 1: Image Thinning in Image Processing

The purpose of image processing is divided into 5 groups. They are:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image.

Thinning in Digital Image

Thinning is an image processing operation in which binary valued image regions are reduced to lines that approximate the center skeletons of the regions. It is usually required that the lines of the thinned result are connected for each single image region, and then these can be used to infer shape and topology in the original image.

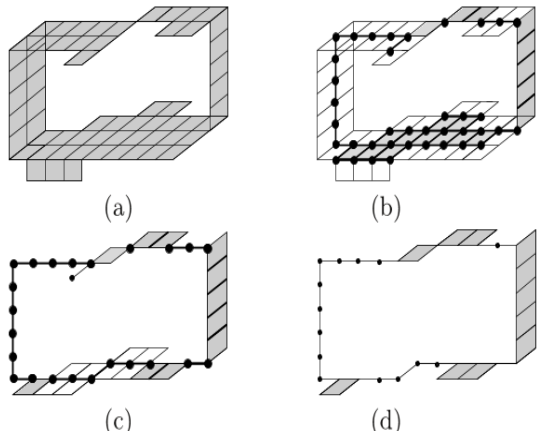

Figure 2: Image Thinning in 2-D Images

A common use of thinning is in the pre-processing stage to facilitate higher level analysis and recognition for such

DOI 10.17148/IJARCCE.2016.55228

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

applications as Optical Character Recognition, diagram understanding, fingerprint analysis, and feature detection for computer vision. The skeleton of a binary image is an important representation for the shape analysis and is useful for much pattern recognition application. The skeleton of an object is a line connecting points midway between the boundaries Thinning techniques have been applied in many fields such as automated industrial inspection, pattern recognition, biological shape description and image coding etc. the main objective of thinning is to improve efficiency, to reduce transmission time.Thinning or skeletonization is a process by which a one-pixel-width representation (or the skeleton) of an object is obtained, by preserving the connectedness of the object and its end points. Thinning algorithms should also preserve topological and geometric properties of the original object as much as possible. This includes connectedness of components, no spurious endpoints, and no excessive erosion of the original object. Thinning algorithms can be classified as one of two broad categories: 1) Iterative thinning algorithms
2) Non-iterative thinning algorithms.

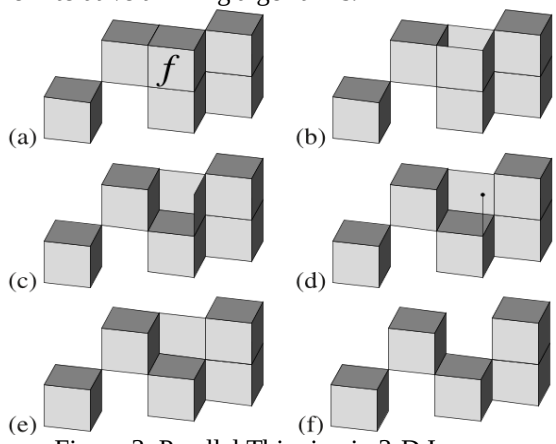

Figure 3: Parallel Thinning in 3-D Images

In Iterative parallel thinning algorithms, the decision for individual pixel deletion is based on the results of the previous iteration. In parallel thinning, the value of a pixel at the nth iteration depends on the values of the pixel and its neighbours at the (n-1)th iteration. The Classifications of the thinning algorithms has been elaborated as shown in the image.

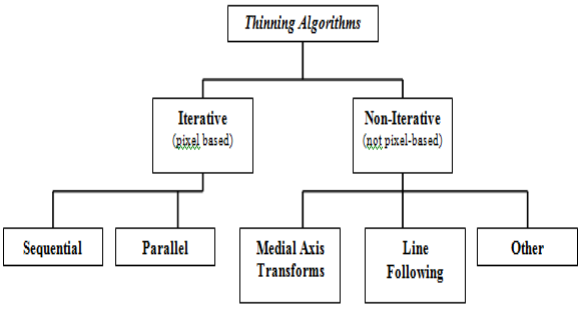

Figure 4: Image Thinning Topology

II. LITERATURE REVIEW

Author has been assimilated the knowledge about image thinning. A critical step in fingerprint recognition is to skeletonize the fingerprint image for minutiae extraction. This process is referred to as "thinning" in image processing. Thinning is the main preprocessing stage in the fingerprint recognition process. The speed and reliability of the thinning process are important for the whole fingerprint identification system. To accelerate the thinning process, an improved fast thinning algorithm is proposed and implemented in MATLAB and on FPGA. In this paper, an improved fast thinning algorithm is proposed for thinning fingerprint images. The algorithm is implemented both in Matlab and on FPGA. Experimental results show that the algorithm is more efficient than the referred algorithm. Fingerprint recognition process consists of series of image enhancement and minutiae extraction processes. Out of seven processes only two processes namely image binarization and image thinning are presented. Further the remaining five processes can be implemented and finally an attempt can be made to integrate all seven processes into one which completes the finger print recognition process [1].This works proposes a thinning algorithm suitable for offline handwritten Tamil character recognition. The proposed method is a modification of post processing step in Stentiford Thinning (ST) algorithm. In ST algorithm, for the removal of spurious line segments, a set of matrices are defined, which remove only vertical and horizontal line segment. We defined eight more matrices such that unwanted line segment in all the direction are removed. The visual quality of the thinned output given by the proposed algorithm is found to be better than given by a set of prominent thinning algorithms. Further we carried out character recognition experiments using character images thinned with the proposed algorithm. The results show that there is increasing recognition accuracy in comparison to the result obtained when thinning is performed with other prominent algorithms. Thinning is a most important technique for achieving efficient HCR system. This work proposes a new thinning algorithm for offline handwritten Tamil character recognition. The proposed thinning algorithm is implemented and applied on a set of handwritten character images. The performance of the algorithm is analyzed in terms of image shapes, execution time and classification performance. In comparison with the performance of a set of six prominent thinning algorithms, the proposed method gives better performance [2].Thinning is basically reducing a 'thick' digital object to 'thin' skeleton. Thinning is one of the most frequently used methods to know the geometrical feature of objects.

For example, the tree structure of the bronchus is determined by using the thinned result of it. Implement the morphological dilation operator with thin parameter to retrieve the result image. We apply purposed method on some artificial images. Results of applying the purposed method on the variety of images will be shown. We calculate the time and PSNR values and also compare with some existing algorithms [3].This research article paper discusses the enhancement of a fingerprint impression with the help of anisotropic filter. The main aim of this paper is to discuss a fingerprint recognition system by extracting the minutiae of a fingerprint impression after

applying the thinning and the minutiae extraction algorithm. The result provides better fingerprint impression with higher matching accuracy.From the study and analysis of matching fingerprint impressions after enhancing the poor quality fingerprint impression and after obtaining the result of binarization, thinning and minutiae extraction process, we have come to the conclusion that it helps in providing an efficient output with higher accuracy [4].As we know that image thinning plays an important role in image processing, It is also equally important to propose an efficient image thinning algorithm with an objective, to minimize the amount of information to be processed by preserving the important information required to preserve the topological and geometrical properties of the thinned image, thereby enhancing the later processing procedure. This can be achieved by an efficient image independent thinning algorithm. This algorithm process the image in two-passes, in first pass of this algorithm, the entire image is thinned to two pixels thick and in second pass; the two pixel width image is further thinned to one pixel thick without any discontinuities in the resultant image.

Author has proposed an efficient image independent parallel thinning algorithm. Implementation of this algorithm has been carried out and we have also compared its results with other standard thinning algorithms in terms of thinning time, thinning ratio, excessive erosion, connectivity, endpoint preservation, and visual quality. Results indicate that the proposed algorithm is efficient. The robustness of the proposed thinning algorithm has been established across heterogeneous image examples [5]

III.OBJECTIVES

There are many goals of the of the Image Thinning technique. In this paper we have been explained the main objectives which are as follows:

a. Identify the Existing Techniques of Image Thinning Algorithm.
b. Understanding the Steps of the Algorithm.
c. Research on algorithm of the Image Thinning.
d. To Study on improvement Steps of parallel thinning algorithm.
e. Implement the Proposed Approach in Simulation Tool.
f. To visualize and compare the performance of given alternative algorithm in terms of information loss and skeleton.
g. Generate Results.

Problem Statement

The different parallel Thinning algorithms give different results in terms of maintaining the connectivity and generating the spurious branches. Analysis of these parallel thinning algorithms prompted the development and testing of a ”hybrid” algorithm consisting of both the distance and peeling approaches. In the “hybrid” algorithm the distance algorithm would be used to locate the approximate “centerline” and remove the bulk of unwanted pixels in a fixed number of passes. Peeling algorithm would be used to remove remaining extraneous pixels. When we implement the discussed alternative parallel Thinning algorithm we observe that it provides better connectivity of pixels in the thinned image for almost all the test images. In the proposed algorithm we apply the single template in each pass and the output of each pass is passed onto the next pass, the connectivity and one- pixel width is guaranteed. The reduction of image can eliminate some counter distortions while maintaining significant topological and geometric properties. In practical terms, thin-line representations of elongated patterns would be more suitable for extraction of critical features such as end-points, junction-points, and connection among the components. The vectorization algorithms often used in pattern recognition tasks also require one-pixel-wide lines as input.

IV.PROPOSED METHODOLOGY

a. Study the Image Thinning Concepts in Images and analyze the techniques.
b. Study the steps of existing algorithms.
c. Research on these Techniques for identification of issues.
d. Apply Improved Concept to work with Algorithm.
e. Implement Parallel Thinning Technique and iterating the thinning algorithm until convergence.
f. Flow Development of new proposed efficient technique improved the performance parameters such as PSNR or MSE.
g. Implementation in MATLAB Language.
h. Generate Results.

V. CONCLUSION AND FUTURE WORK

This Paper has been proposed the Image Thinning Concept and algorithm that can be used to generate the skeleton of an image. The algorithm will enhanced using the different concept of image thinning.

In future we will implement the proposed algorithm in the MATLAB Simulation Tool. The accuracy will be calculated suing the performance parameters such as PSNR or MSE.

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