

# Digital Image Processing in Optical Character Recognition

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**Abstract**— Digital image processing approaches from two principal application areas that is improved of pictorial information for human interpretation and processing of image data for storage, transmission, and representation for autonomous machine perception. To lay it out in the scope of the field that we call image processing to process the digital image processing in computer vision, to define the stages of steps in fundamentals of digital image processing. Optical character recognition is the main field used in digital image processing for mechanical or electronic conversion of images typed, handwritten or printed text into machine encoded text. **Key words:** Digital Image Processing, Computer Vision, Segmentation, Optical Character Recognition

## I. INTRODUCTION

A digital image is a model of a two dimensional image as a fixed set of digital values, called picture or pixels. Pixel values typically represent gray levels, colours, heights, opacities etc. Digitization implies that a digital image is an approximation of a real scene. Digital image processing is a method to complete image processing on digital images. It has advantages over analog image processing.

### A. Digital image processing focuses on two major tasks

- Improvement of pictorial information for human interpretation
- Processing of image data for storage, transmission and representation for independent machine perception[1]

## II. DIFFERENT STEPS IN DIGITAL IMAGE PROCESSING

[3]Computer vision is to understand different factors such as camera model, lighting, color, texture, shape and motion that affect images and videos from visual inputs. There are three types of processing used in digital image processing

- Low Level Process
- Middle Level Process
- High Level Process

### A. Low Level Process

Low-level image processing is a low-level vision tasks could be performed, such as image matching, optical flow computation and motion analysis. Image matching basically is to find correspondences between two or more images. These images could be the same scene taken from different view points, or a moving scene taken by a fixed camera or both. It takes image as input and image as output

- Examples: Noise removal, image sharpening

### B. Mid-Level Process

There are two major aspects in middle-level vision they are inferring the geometry and inferring the motion. These two aspects are not independent but highly related. It takes image as input and output as attributes.

- Examples: Object recognition and segmentation

### C. High Level Process

High-level vision is to infer the semantics recognize 3D object from different view directions. There have been two approaches for recognition: model-based recognition and learning-based recognition. It takes attributes as input and understanding as output

- Examples:-Scene understanding and object recognition

## III. FUNDAMENTAL STAGES IN DIGITAL IMAGE PROCESSING

The steps that can be applied to images for different purposes in each stages of digital image processing as follows [2].

- Image Acquisition
- Image Enhancement
- Image Restoration
- Morphological Processing
- Segmentation
- Object Recognition
- Representation And Description
- Image Compression
- Color Image Processing

### A. Image Acquisition

Image acquisition is the first process regarding the origin of digital images. Acquisition could be as simple as being given an image that is already in digital form. The image acquisition stage involves preprocessing such as scaling.

### B. Image Enhancement

Image enhancement techniques improve the quality of an image as perceived by a human. It is most useful because many satellite images when examined on a colour display give inadequate information for image interpretation. There is no aware effort to improve the reliability of the image with view to some perfect form of the image.

### C. Image Restoration

Image restoration is an area that also deals with improving the appearance of an image. Image restoration is a objective that restoration techniques to be based on mathematical models of image degradation.

### D. Morphological Processing

Morphological processing deals with tools for extracting image components that are useful in the representation and description of shape. It begins a transition from processes that output images to processes that output image attributes

### E. Segmentation

Segmentation procedures partition an image into its constituent parts or objects. Autonomous segmentation is one of the most difficult tasks in digital image processing. Segmentation is processed towards the result of imaging problems that need objects to be recognized independently.

#### F. Object Recognition

Recognition is the process that assigns a label to an object based on its descriptors. Digital image processing with the development of methods for recognition of individual objects.

#### G. Representation and Description

Representation and description goes after the output of a segmentation stage which usually is pixel data constituting either the boundary of a region or all the points in the region itself. Description is also called feature selection it deals with extracting attributes that result in some quantitative information of interest or are basic for differentiating one class of objects from another.

#### H. Compression

Compression is used to deal with techniques for reducing the storage required to save an image or the bandwidth required to transmit it. Image compression is familiar to most users of computers in the form of image file extensions, such as the jpg file extension used in the JPEG (Joint Photographic Experts Group) image compression standard.

#### I. Color Image Processing

Color image processing is important because of the major increase in the use of digital images over the Internet. Color processing in a digital domain. Color is used also in the basis for extracting features of interest in an image.

### IV. AREAS OF DIGITAL IMAGE PROCESSING

Applications of digital image processing is widely used in different area of fields they are

- Satellite Imagery
- Wire-Photo Standard Conversion
- Medical Imaging
- Videophone
- Optical Character Recognition
- Photograph Enhancement

#### A. Satellite Imagery

Satellite imagery consists of images of earth or other planets collected by satellites. Satellite imaging companies sell images under license. Images and license to governments and business such as Apple maps and Google maps

#### B. Wire-Photo Standard Conversion

The wire gauge size is used to measure of thickness in guitar strings and some electrical wire it is also known as imperial wire guage or British standard guage.

#### C. Medical Imaging

Medical imaging is the process of creating visual representations for clinical analysis and medical intervention and internal structures hidden by the skin bones as well as to treat disease. Medical image process a database of normal anatomy and physiology to make it possible to identify abnormalities [6].

#### D. Videophone

It is used to construct a framework for enhancing telecom operators to achieve enhanced videophone service in media processed on network by multiple pattern working

#### E. Optical Character Recognition

Optical character recognition is the mechanical or electronic change of images like typed handwritten or printed text into machine encoded text from a scanned document. It is a structure of information entry from invoices, passport documents, bank statements, mail or any document.

#### F. Photograph Enhancement

The process of improving the quality of a digitally stored image by manipulating the image Enhancement software also supports many filters for altering images. Programs specialized for Image enhancement are sometimes called image editors.

### V. OPTICAL CHARACTER RECOGNITION IN DIGITAL IMAGE PROCESSING

Optical character recognition is also called as Optical Character Reader [OCR]. It is the mechanical or electronic conversion of images typed, handwritten or printed text into machine encoded text. It is widely used as a form of information entry from printed paper data records, passport document, invoices, bank statements, computerized receipt, business card, mail or any suitable documentation. It is a common method of digitising printed texts so that it can be electronically edited, searched, stored, displayed and used in machine process such as machine translation, text-to-speech, key data and text mining [4].

### VI. A FAST PARALLEL ALGORITHM FOR THINNING DIGITAL PATTERN USING OCR IN DIP

The general problem of pattern recognition lies in the effectiveness and efficiency of extracting the distinctive features from the patterns. The stroke analysis method is a powerful approach to recognizing certain types of digital patterns such as alphanumeric characters and ideographs. It should be noted that the strokes thinned by hardware or software are accompanied by different kinds of distortion [7]

#### A. Two Subiteration

- One aimed at deleting south-east boundary points and north-west corner points
- Another aimed at deleting north-west boundary points and south-east corner points.
- Each pattern is thinned down to a "skeleton" of unitary thickness. It describes a thinning
- Algorithm that determines skeletal pixels by local operation. At that same time, the pixels are labelled so that the original image can be reconstructed from its skeleton

##### 1) First Subiteration

[8] In the first subiteration the contour point p1 is deleted from the digital pattern if it satisfies the following condition.

- $2 \leq B(P1) \leq 6$
- $A(P1) = 1$

Where  $A(P1)$  is the number of 01 pattern in the ordered set  $p2, p3, p4, p5, p6, p7, p8, p9$  the eight neighbors of  $p1$  and  $B(P1)$  is the number of non-zero neighbors of  $p1$  that is

$$B(P1) = p2 + p3 + p4 + p5 + p6 + p7 + p8 + p9$$

If any condition is not satisfied the values of  $p2, p3, p4, p5, p6, p7, p8, p9$  then  $A(P1) = 2$  therefore  $P1$  is not deleted from the picture.

Counting the 01 patterns in orderd set p2, p3, p4, ...  
.....p8,p9

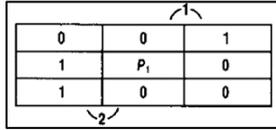


Fig. 1: First Subiteration

2) Second Subiteration

- $p2 * p4 * p6 = 0$
- $p4 * p6 * p8 = 0$

The solution to the set of c and d are  $p2=0$  or  $p4=0$  or  $p6=0$  or  $p8=0$ . P1 which has been removed might be an east or south boundary point or north-west corner point. P1 deleted in second set might be north-west boundary point or south-east corner point.

Points under consideration and their location.

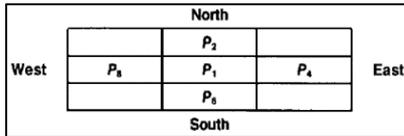


Fig. 2: Points under consideration and their location

VII. SEGMENTATION METHODS FOR HANDWRITTEN CHARACTER RECOGNITION USING OCR IN DIP

Segmentation of hand written text document into individual character or digit is an important phase in document analysis, character recognition and many other areas. Character segmentation has become a crucial step for mail address recognition in the automatic post mail sorting system. In order to segment text from a given input document image, it is necessary to detect all the possible text regions. [5] In the case of printed scripts, segmentation is a relatively simple task. In the case of overlapped scripts, broken characters, connected characters, loosely configured characters, and mixed scripts, segmentation is difficult. Overlapped, broken, connected and loosely configured characters are major causes of segmentation errors.

A. Types of Segmentation

Segmentation of image is used to locate each individual character and its boundaries

- Line Segmentation
- Word Segmentation
- Character Segmentation

1) Line Segmentation

Line segmentation is the first step for text based image segmentation. It includes horizontal scanning of image. Scans pixels row from left to right and top to bottom. [9]

a) Base Line Extraction

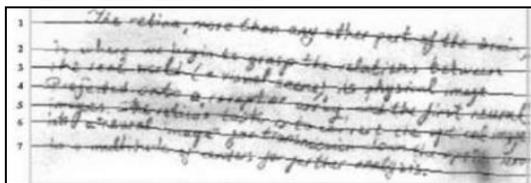


Fig. 3: Base Line Extraction

B. Word Segmentation

Word segmentation is the next level of segmentation. It includes vertical scanning of the image, pixel-row by pixel-

row from left to right and top to bottom. At each pixel the intensity is tested.



Fig. 4: Word segmentation

C. Character Segmentation

Character segmentation is the final level for text based image segmentation. It is similar to in operations as word segmentation. A few precautions should be followed while preforming character segmentation the precaution is of ligatures. If the text image contains a cursive type font then while segmenting the ligature should be separated for better efficiency [10].

VIII. APPLICATIONS USED IN OCR

Optical character recognition have been developed into many kinds of domain specific OCR application such as receipt OCR, invoice OCR, check OCR, legal billing document OCR.

They can be used for

- Data entry for business document
- Automatic number plate recognition
- Automatic insurance documents key information into a contact list
- Extracting business card information into a contact list
- Textual version of printed documents
- Electronic images printed documents searchable
- Converting handwriting in real time to control a computer
- Assistive technology for blind and visually impaired users.

IX. FUTURE SCOPE OF DIGITAL IMAGE PROCESSING

Imaging can be defined as the representation of an objects external form. That definition no longer holds true. More information within an image can be considered. Future imaging systems are expected to be less expensive. They will have to be easier to use. There are various types of imaging systems such as those used for chemical, optical, thermal, medical and molecular imaging. The use of scanning techniques and statistical analyses for image analysis are needed to extract valid image values. The satellite applications programs of the future will be based on extensive research in the area of imaging. A number of different sensors will be used in the satellites orbiting the earth. Scientifically useful information will be extracted from these systems. New techniques will be needed to organize and classify the different sets of data obtainable from the orbiting satellites. The future trend in remote sensing will be based on sensors that can record the same scene in many different ways. Graphics data will be important in image processing applications. Satellite based imaging for planetary exploration as well as military applications will be the future trend.

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