CHAPTER II

THEORETICAL CONSIDERATION AND LITERATURE REVIEW

Creating and reviewing proofs are important throughout the entire process of graphic production. Proofing allows you to catch and correct mistakes in one stage before moving on to the next, saving you time and resources. Laser printer outputs are mainly used to review the text and layout before producing films or plates used for printing.

Errors occur during the process of text proofing by prepress staff who use naked eyes in proofing text on the printout. In Digital Image Analysis this process is uses an algorithm a tool to prevent the error occuring in this stage.

In digital image processing the analysis operation is used in applications that typically require the measurement and classification of image information.

Generally, the procedure of analyzing an object in an image begins with image segmentation and enhancement or restoration. These operations are used to isolate highlights of interest. This yields objects' outlines as well as other measurements. As a group they serve to describe and characterize the objects of interest in image. Finally these measurements are used to place the objects under consideration into specific categories.

2.1 Theoretical Background

2.1.1 Proofs

Proofs are used to assure that prepress work is accurately executed, and provide an opportunity to make necessary corrections before the printing plate is produced. Three different things that need to be checked in the proofing process are Proofing Text, Proofing Images and Proofing Pages.

2.1.1.1 Proofing Text

The process of proofing text begins by reviewing the text of your document for content and correctness, first on screen, and again on printed format. After this point, there should be no further changes made to the text. Changes to the text in the later stages of production will be both time consuming and expensive. So it is essential to make sure that you get final approval of the text before moving on.

2.1.2 Image Analysis

The process of image analysis differs from all image processing procedures because it usually produce nonpictorial results. The mission of image analysis is to understand an image by quantifying its elements. Those of interest are generally objects such as cells, bolts, a whole aircraft, or individual characters on a page of text. Their quantification includes measures of size, indicators of shape, and descriptions of outlines. Other elements of interest may include brightness, color, and texture. Image interpretation is the first essential step in image analysis which leads to automated machine vision. The sequence of image analysis start from, breaking an image into individual objects, then measuring these objects, and finally classifying objects based on these measurements.[1-2]

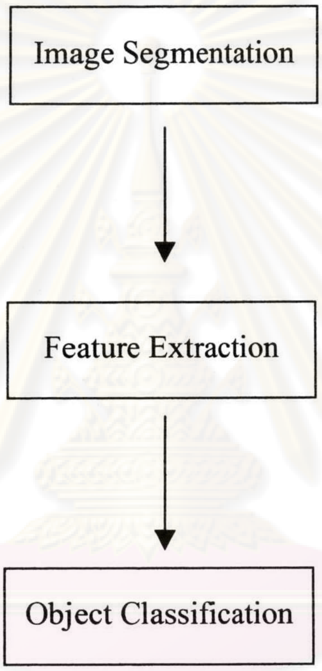

Figure 2-1 A flow diagram for the image analysis operation

2.1.2.1 Image Segmentation

The first step in any image analysis endeavor is to simplify the image by reducing it to its basic elements or objects. This is the domain of the image segmentation operation. Image segmentation is any procedure that highlights, or in someway isolates individual objects without discarding important image features. An exact definition of "important image features" must depend on the particular requirements of a given operation. [2-3]

2.1.2.2 Feature Extraction

Once an image has been segmented into discrete objects of interest, the next step in the image analysis operation is to measure the individual features of each object. Many features can be used to describe an object. Frequently, the best to use is the most easily measured and requires the fewest operations. We can compare this information with known data to classify an object into one of many categories. [2-3]

2.1.2.2.1 Boundary Descriptions

Object shapes come in a variety of forms and can be extended to include others as needed. The most precise way to define the outline of an object is to examine it and record specifically how it behaves. There are numerous techniques for doing this. From the most fundamental method of explicitly listing boundary pixel locations to various methods of more precise boundary description.

2.1.2.2.1.1 Explicit Descriptions

Fundamentally, an outline is composed of a single-pixel-wide sequence of pixels that follow the perimeter of an object. Each pixel adjoins a neighboring pixel either to its left, right, top, or bottom, or on one of its four diagonals. In this way, we can say that the outline is fully connected into an unbroken progression of boundary pixels. As in any image, each pixel has an (x,y) location that defines its position within the image.

By creating a sequential list of the (x,y) boundary pixel locations, we can create a description of an object boundary, as shown in figure 2-2 .

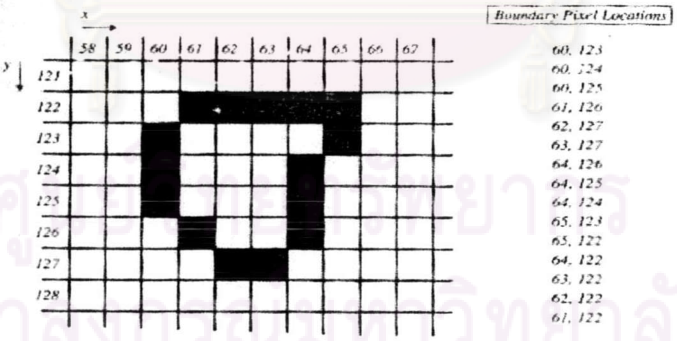

Figure 2-2 The explicit description of an object boundary listed as the sequential (x,y) boundary pixel locations.

This boundary description can be stored, and later used to recreate the outline by simply going through the list and plotting the points. In this way, the list of (x,y) boundary locations can be said to uniquely characterize the shape of an object's perimeter. This is the most fundamental and precise representation of an object's shape.[2]

2.1.2.2.2 Chain Codes

Object boundaries can be described in more precise terms than the explicit (x,y) pixel location list. The boundary can be followed and recorded using a chain code. First, we pick a starting pixel location anywhere on the object boundary. The goal is to find the next pixel in the boundary. From the earlier definition of an outline, we know that there must be an adjoining boundary pixel locations surrounding the current boundary pixel. By looking at each of the three adjoining pixels, we will find at least one that is also a boundary pixel. Depending on which one it is, we assign a numeric code of a range between 1 and 3 . This code is assigned based on the illustration shown below.

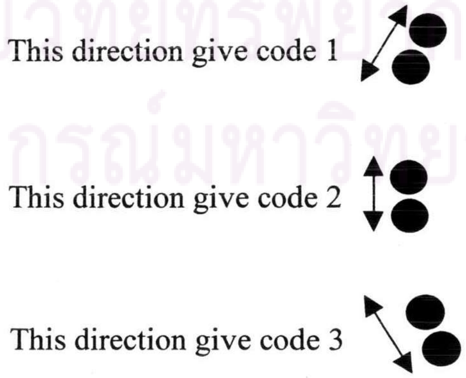

Figure 2-3 Chain code direction assignments

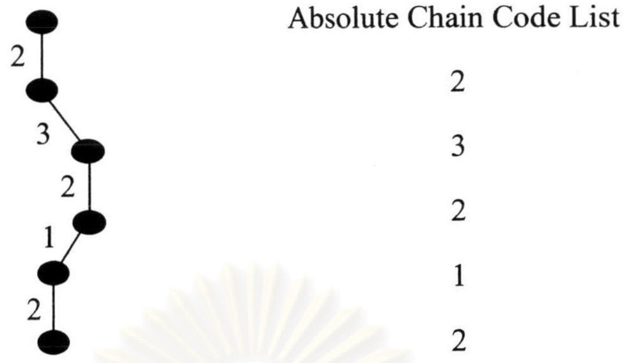

Figure 2-4 The absolute chain code boundary tracking process

For instance, if the pixel found is directly to the right of the current location, a code of " 3 " is recorded. If the adjoining pixel is to the upper right, a " 1 " is recorded, and so on. Once the code is recorded, we repeat the process by looking for the next boundary pixel, as shown in figure 2-4. The result is a list of codes showing which direction was taken in going from each boundary pixel to the next. The resulting chain code list describes the object's boundary and no information is lost between the chain code list and the (x,y) pixel location list. This is because each of the boundary pixels is still fully represented.

The outline of the object can be recreated by simply going through the chain code list and repeating the original movements found when the boundary was followed. In this way, the chain code represents the object boundary and can be said to characterize exactly the perimeter of the object.

The chain code described above is referred to as an absolute chain code. Each code represents the absolute direction, taken from one boundary pixel to the next boundary pixel.[2-3]

2.1.2.3 Object Classification

To complete the image analysis process, we must also classify the measurements. This means that we must compare the measurements of a new object with those of a known object or other known criteria. In this manner, we can determine whether an object belongs to a particular category of objects.

We usually know the exact characteristics of the objects that we are interested in classifying. These cases include applications such as machine vision and image interpretation where we know the precise feature details of the objects of interest. In these cases we categorize the objects based on known characteristics, such as their outline traits or their precise length or size.

In either case, the object classification process involves comparing a set of measured features of an object with some established criteria. How close the comparisons are determines whether an object is considered a part of a class. This classification process is done in three steps.

First, we determine the object features that we wish to use to classify the object. Second, we set tolerances, establishing how close the feature measurements must be to match the established criteria. And third, we create classification groups, or categories, to which an object will be assigned depending on its feature measurements in comparison with the established criteria.[2-5]

2.2 Literature Review

Casey and Wong [1] explained image analysis theoretically and how to use the extracted information from an image. They discussed the document analysis operation as a part of image segmentation.

Gregory [2] applied the techniques of explicit description and absolute chain code to determine the code of each object or character in a document. He then studied the information acquired from feature extraction comparing with known features that had been isolated in object classification.

Weeks [3] explained the method used after an image has been segmented into different objects. It is often desirable to describe these objects using a small set of descriptors, thus reducing the complexity of the image recognition process.

Lay [4] designed mapping algorithm software and studied the feasibility of an active machine vision system for distance measurement task, for example, a car accident compared with using a tape measure.

Chen et al [5] used a Euclidean model in image synthesis when matching an images. They constructed a three-dimensional scene from the machine image derived from the Euclidean model.