

# IMAGE RECOGNITION METHOD AND APPARATUS USING IMAGE ROTATION INFORMATION

## CROSS REFERENCES TO RELATED APPLICATIONS

This application claims priority to Japanese Patent Application 8-46093 filed Mar. 4, 1996 and is related to U.S. patent application Ser. No. 08/354,878 filed Dec. 14, 1994, now abandoned, both of which are incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an image recognition method and apparatus for extracting and recognizing a specific image such as disclosed in U.S. patent application Ser. No. 08/354,878. This invention is more particularly related to an image recognition method and apparatus which examines a characteristic of an image indicating whether it is difficult to determine whether the image is rotated during a recognition process.

### 2. Discussion of Background

In recent years there has been a development in the recognition of specific color images using a color image processing apparatus such as a personal computer system with an image scanner. In order to accomplish color image recognition, several techniques which recognize and detect specific images in an object image are provided in a color image processing apparatus. Once the specific image is detected in the object image, the color image processing apparatus generates a recognition result indicating that the object image matches image information in a recognition dictionary for the specific image. Such a color image processing apparatus is disclosed in U.S. patent application Ser. No. 08/354,878.

However, it has been determined through experiments by the present inventors that, if the object image is rotated, there are problems in the recognition process between the object image data and the image information in the recognition dictionary for the specific image. For example, it has been found that in cases where the object images are rotated, consistent recognition results have not been achieved by previous devices.

## SUMMARY OF THE INVENTION

Accordingly, one object of the present invention is to provide a novel and efficient method and apparatus for improving recognition accuracy of a specific image within an object image using characteristics of image rotation.

Another object of the present invention is to provide an image recognition method and apparatus using the characteristics of rotation of the extracted object image in a color image recognition process.

The above and other objects are achieved according to the present invention by providing a new and improved image recognition apparatus and method for recognizing a specific image in an object image using input image signals of the object image, the specific image having a possibility of being rotated. The image recognition apparatus includes an image information extraction unit for extracting an object image from the input image signals as a candidate for recognition of the specific image and for extracting feature values from the object image using the input image signals, and a match determining device coupled to the image

information extraction unit for recognizing the specific image in the object image by a comparison of the extracted feature values from the object image with reference data for the specific image. The match determining device is controlled using the reference data according to an easy to determine rotation characteristic and difficult to determine rotation characteristic in the reference data for the specific image.

The present invention samples the input image provided by an image input device such as a scanner using red, green and blue image signals. An object image data which is represented by a circumscribing quadrangle and an inscribing quadrangle is extracted from the input image signals. The coordinates of the object image are extracted from the image data and are used to determine the size of the object image to be recognized.

The present invention stores characteristics of rotation of the object image in a recognition dictionary as predetermined reference data. The predetermined reference data includes, for example, a flag which indicates a rotation characteristic of the extracted object image. The flag is used to determine whether the object image has an easy to determine rotation characteristic or a difficult to determine rotation characteristic for facilitating the image recognition process.

## BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed descriptions when considered in connection with the accompanying drawings, wherein:

FIG. 1 illustrates a system block diagram of the image recognition apparatus according to the present invention;

FIG. 2a illustrates a detailed block diagram of the image recognition apparatus implemented on the system of FIG. 1 according to the present invention;

FIG. 2b illustrates a data structure used to implement a recognition dictionary of the image recognition apparatus of FIG. 2a according to the present invention;

FIGS. 3a and 3b are examples of scanned images of an outdoor scene used to describe the operation of the image recognition apparatus according to the present invention;

FIGS. 4a and 4b are examples of scanned images of a different outdoor scene than the scene of FIGS. 3a and 3b used to describe the operation of the image recognition apparatus according to the present invention;

FIG. 5a is a diagram of an extracted object image according to the present invention;

FIG. 5b is a diagram of an extracted inscribing quadrangle determined from the extracted object image of FIG. 5a according to the present invention;

FIG. 5c is a diagram of an extracted circumscribing quadrangle determined from the extracted inscribing quadrangle of FIG. 5b according to the present invention;

FIGS. 6a and 6b are diagrams showing inscribing and circumscribing quadrangles of an object image, the inscribing quadrangle divided into small areas, and each small area divided into pixels for vector quantization processing;

FIGS. 7a through 7c illustrate chromaticity and vector quantization histograms of the small areas of FIGS. 6a and 6b extracted during vector quantization processing;

FIGS. 8a through 8c are diagrams used to describe the operation for recognizing inscribing and circumscribing