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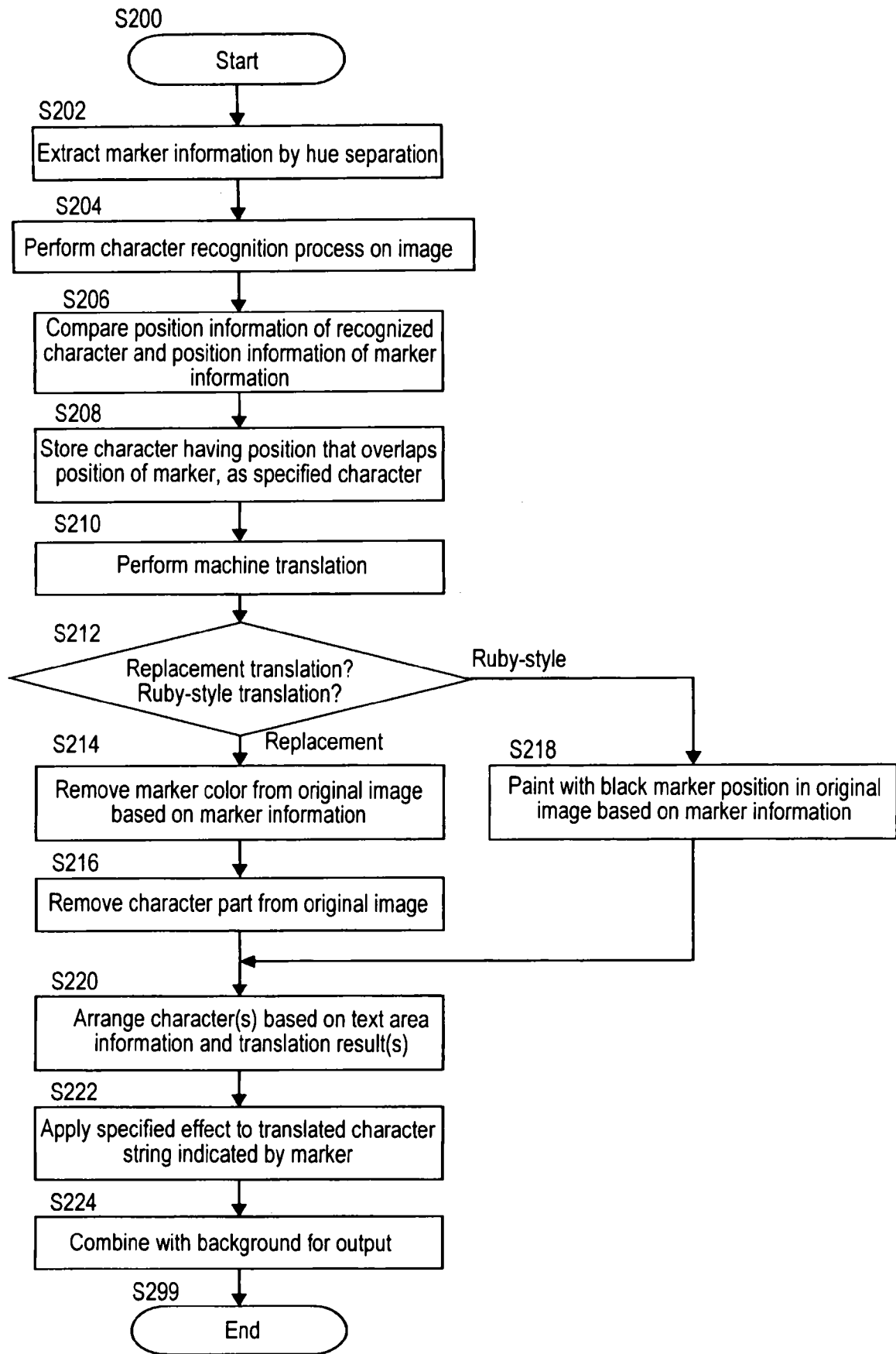
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ABSTRACT

5 An image processing method includes receiving an image including a
writing, detecting a position of the writing in the received image, detecting a
position of a character image in the received image, performing character
recognition on the detected character image, comparing the position of the
detected writing with the position of the detected character image to associate
the writing with a result of the character recognition, translating the result of the
0 character recognition so as to be recognizable as a translation of the result of the
character recognition associated with the writing, generating an image of the
translation result associated with the writing, so as to be output in a format
different from a format of an image of a translation result that is not associated
with the writing, and outputting the image of the translation result associated
5 with the writing.

FIG. 2



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COMPLETE SPECIFICATION

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ORIGINAL

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Invention Title: IMAGE PROCESSING APPARATUS, IMAGE PROCESSING
METHOD AND IMAGE PROCESSING PROGRAM

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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IMAGE PROCESSING APPARATUS, IMAGE PROCESSING METHOD AND
IMAGE PROCESSING PROGRAM

BACKGROUND

5 1. Technical Field

The invention relates to an image processing apparatus, an image processing method and an image processing program.

2. Related Art

Any discussion of the prior art throughout the specification should in no way be
10 considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

There is a technology of performing character recognition on a character image in a document image and then translating it into a different language.

There is also a technology of processing a document based on a writing that has
15 been made on the document.

For example, Japanese Patent No.3636490 describes one of technologies related thereto. An object of Japanese Patent No.3636490 is to provide an image processing apparatus that, in response to a simple operation of inputting an original document image, can translate a character image that is based on one language into another
20 language and print it in some layout or allocate it to both surfaces of the same recoding medium to perform duplex-printing. Japanese Patent No.3636490 describes an image processing apparatus including an original document input means, a separation means, a recognition means, a translation means, a data generation means and a printing means. The original document input means inputs an image of an original document containing
25 a first character based on a first language and an image. The separation means analyzes

original document image data input from the original document input means to separate it into a document data area and an image data area. The recognition means cuts out a character image from the document data area separated by the separation means and recognizes the first character. The translation means translates character data
5 corresponding to the first character recognized by the recognition means into second character data based on a second language. The data generation means generates printing data that is laid out based on information of the document data area area-separated by the separation means and the second character data. The printing means allocates the second character data and the original document image data to respective
10 surfaces of a recording medium based on the printing data generated by the data generation means, and duplex-prints them.

Moreover, for example, JP Hei.2-253377 A describes an image editing apparatus that can performed to specify an processing (for example, extracting, deleting or reversing an area) area of an original document by using a mark and combine images of
15 plural original documents on which area processing is to be performed. The image editing apparatus includes a reading means, a specification means, a generation means, a processing means, a plurality of storage means, a control means and a combining means. The reading means reads an original document image and generates image information. The specification means specifies a desired area of the original document by using a
20 mark. The generation means generates an area signal representative of the desired area according to the area specification by the specification means. The processing means processes the image information generated by the reading means, according to the area signal generated from the generation means. The plurality of storage means can store plural pieces of image information. The control means controls the writing and reading
25 of the plural storage means. The combining means combines the pieces of image

information read from the plural storage means. In the image editing apparatus, plural original document images is read, a desired area is specified in each of the plural original documents by the specification means, the generated image information is processed by the processing means according to the area signal obtained by the area generation means, 5 the processed image information is stored in the plural storage means, plural pieces of processed image information are read from the storage means storing them, and the pieces of image information being read are combined and output by the combining unit.

SUMMARY

The invention provides an image processing apparatus, an image processing 10 method and an image processing program that performs character recognition on an image, translates the character recognition result and further generates an image of the translation result, and when a writing has been made in the original image, reflects an image portion of the writing into the image of the translation result with the image portion of the writing being distinguished from an image portion in which no writing is 15 made.

[1] According to an image processing apparatus includes an image receiving unit, a writing detection unit, a character position detection unit, a character recognition unit, an association unit, a translation unit, a translation image generation unit and a translation image output unit. The image receiving unit receives an image including image 20 information and a writing added to that image information. The writing detection unit detects a position and type of the writing in the image received by the image receiving unit. The character position detection unit detects a position of a character image in the image received by the image receiving unit. The character recognition unit performs character recognition on the character image detected by the character position detection

unit. The association unit compares the position of the writing detected by the writing detection unit with the position of the character image detected by the character position detection unit to associate the writing with a result of the character recognition performed by the character recognition unit. The translation unit translates the result of the character recognition performed by the character recognition unit so as to be recognizable as a translation of the result of the character recognition associated with the writing by the association unit. The translation image generation unit generates an image of the translation result associated with the writing, so as to be output in a format based on the type of writing and different from a format of an image of a translation result that is not associated with the writing. The translation image output unit outputs the image generated by the translation image generation unit.

With this configuration, when character recognition is performed on an image, the result of the character recognition is translated and an image of the translation result is generated and when a writing has been made in the original image, the image portion of the writing can be reflected into the image of the translation result with the image portion of the writing being distinguished from an image portion in which no writing is made.

[2] The image processing apparatus of [1] may further include an original image conversion unit and a combining unit. The original image conversion unit converts the character image in the image received by the image receiving unit, based on the position of the writing detected by the writing detection unit, after the translation by the translation unit is performed. The combining unit combines the image converted by the original image conversion unit and the image generated by the translation image generation unit.

With this configuration, after the image portion in which the writing has been

made is translated, the image into which the original image is converted and the translation image can be both presented.

[3] In the image processing apparatus of [2], the original image conversion unit may convert the character image into an image that hides the character image, based on the
5 position of the writing detected by the writing detection unit.

With this configuration, the writing portion of the original image can be hidden.

[4] In the image processing apparatus of any one of [1] to [3], the translation image generation unit may generate an image that hides the translation result associated with the writing.

10 With this configuration, the translation result corresponding to the writing can be hidden while a degradation in quality of the translation of the image portion to be hidden in which the writing has been made is suppressed.

[5] In the image processing apparatus of any one of [1] to [4], the translation image generation unit may generate the image of the translation result associated with the
15 writing, based on the type of the writing detected by the writing detection unit.

With this configuration, a translation image according to the type of the writing can be presented.

[6] In the image processing apparatus of any one of [1] to [2], the translation image generation unit may add a writing having a same type as the type of the writing detected
20 by the writing detection unit, to the image of the translation result associated with the writing.

With this configuration, a writing having the same type as that of the original image can be added to the corresponding translation image.

[7] According to another aspect of the invention an image processing method includes:
25 receiving an image including image information and a writing added to that image

information; detecting a position and type of the writing in the received image; detecting a position of a character image in the received image; performing character recognition on the detected character image; comparing the position of the detected writing with the position of the detected character image to associate the writing with a result of the character recognition; translating the result of the character recognition so as to be recognizable as a translation of the result of the character recognition associated with the writing; generating an image of the translation result associated with the writing, so as to be output in a format based on the type of writing and different from a format of an image of a translation result that is not associated with the writing; and outputting the image of the translation result associated with the writing.

With this method, when character recognition is performed on an image, the result of the character recognition is translated and an image of the translation result is generated and when a writing has been made in the original image, the image portion of the writing can be reflected into the image of the translation result with the image portion of the writing being distinguished from an image portion in which no writing is made.

[8] According to further another aspect of the invention, an image processing program causes a computer to function as: an image receiving unit that receives an image including image information and a writing added to that image information; a writing detection unit that detects a position and type of the writing in the image received by the image receiving unit; a character position detection unit that detects a position of a character image in the image received by the image receiving unit; a character recognition unit that performs character recognition on the character image detected by the character position detection unit; an association unit that compares the position of the writing detected by the writing detection unit with the position of the character image

detected by the character position detection unit to associate the writing with a result of the character recognition performed by the character recognition unit; a translation unit that translates the result of the character recognition performed by the character recognition unit so as to be recognizable as a translation of the result of the character recognition associated with the writing by the association unit; a translation image generation unit that generates an image of the translation result associated with the writing, so as to be output in a format based on the type of writing and different from a format of an image of a translation result that is not associated with the writing; and a translation image output unit that outputs the image generated by the translation image generation unit.

With this program, when character recognition is performed on an image, the result of the character recognition is translated and an image of the translation result is generated and when a writing has been made in the original image, the image portion of the writing can be reflected into the image of the translation result with the image portion of the writing being distinguished from an image portion in which no writing is made.

Unless the context clearly requires otherwise, throughout the description and the claims, the words “comprise”, “comprising”, and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of “including, but not limited to”.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiment(s) of the invention will be described in detail based on the following figures, wherein:

Fig. 1 is a conceptual module block diagram of a structure example according to

an exemplary embodiment of the invention;

Fig. 2 is a flowchart showing a processing example 1 according to the exemplary embodiment of the invention;

Fig. 3 is an explanatory view showing an example of the data structure of a
5 specified portion table;

Fig. 4 is an explanatory view showing an example of the data structure of a character position table;

Figs. 5A and 5B are explanatory views showing a processing example 1-1 according to the exemplary embodiment of the invention;

10 Figs. 6A and 6B are explanatory views showing a processing example 1-2 according to the exemplary embodiment of the invention;

Fig. 7 is a flowchart showing a processing example 2 according to the exemplary embodiment of the invention;

15 Figs. 8A and 8B are explanatory views showing a processing example 2-1 according to the exemplary embodiment of the invention;

Figs. 9A and 9B are explanatory views showing a processing example 2-2 according to the exemplary embodiment of the invention; and

Fig. 10 is a block diagram showing an example of the hardware structure of a computer that implements the exemplary embodiment of the invention.

20

DETAILED DESCRIPTION

Hereinafter, exemplary embodiments of the invention will be described with reference to the drawings.

Fig. 1 is a conceptual module block diagram of a structure example according to this exemplary embodiment.

A module generally refers to a logically separable part such as software (computer program) or hardware. Therefore, the modules in this exemplary embodiment refer not only to modules in computer programs but also to modules in hardware structures. Therefore, the description of this exemplary embodiment is also description
5 of a computer program, a system, and a method. Here, for convenience of explanation, “store”, “stored”, and a word equivalent thereto are used, and these words mean, when the exemplary embodiment is a computer program, storing something in a storage or controlling so that something is stored in a storage. While the modules correspond to functions on a substantially one to one basis, in implementation, one module may be
10 constituted by one program, plural modules may be constituted by one program, or one module may be constituted by plural programs. Moreover, plural modules may be executed by one computer, or one module may be executed by plural computers in a distributed or parallel environment. One module may include another module. Moreover, hereinafter, “connection” is used to mean a logical connection (data
15 transmission and reception, instruction, reference relationship between pieces of data) as well as a physical connection.

Moreover, a system or an apparatus is constituted by plural computers, pieces of hardware, apparatuses or the like connected by a communication device such as a network (including a one-to-one correspondence communication connection). When it
20 is implemented by one computer, piece of hardware, apparatus or the like is also included. “Apparatus” and “system” are used as words synonymous with each other. “Predetermined” refers to being before processing in interest, and is used to have meanings including being determined not only before start of processing of this exemplary embodiment but also according to a situation or condition at that time or
25 according to a situation or condition up to that time even after the start of the processing

of this exemplary embodiment.

This exemplary embodiment includes, as shown in Fig. 1, an image receiving module 110, an extraction/recognition processing module 120, an association module 130, a translation module 140, an image generation module 150, and an output module
5 160.

The image receiving module 110 is connected to the extraction/recognition processing module 120, receives an image, and passes the image to the extraction/recognition processing module 120. Receiving an image includes reading an image with a scanner, receiving an image by fax, and reading an image from an image
10 database or the like. The image includes a writing made by a user as well as a character image. The number of images may be one or more than one. Contents of the image may be a business document, an advertising brochure, or the like. This image is an image to be translated. Specifically, the writing included in the image refers to, for example, an image that is added to indicate a portion where information described in a document
15 should be hidden when the document is made open to public or an image that is added to indicate that a portion is important among information described in a document and to attract attention. The writing includes an underline or a box drawn with a colored pen or a portion filled with a translucent marker (highlighter, etc.) irrespective of whether or not the writing is handwriting. When a character image in an image is to be painted out,
20 the character image is painted out to the extent that the character image can be read (to the extent that character recognition is possible).

The extraction/recognition processing module 120 is connected to the image receiving module 110 and the association module 130, and has a writing detection module 121 and a character processing module 122. The extraction/recognition
25 processing module 120 receives the image from the image receiving module 110, detects

a position of the writing in the image, detects a position of the character image, and recognizes the character image. Then, the extraction/recognition processing module 120 passes the detection results and the character recognition result to the association module 130.

5 The writing detection module 121 detects the position of the user's writing in the image received by the image receiving module 110. To detect the position of the writing, for example, the received image is separated in hue to thereby extract an image having a predetermined color and detect coordinates of the extracted image. Alternatively, a linear image such as an underline may be recognized, and coordinates of
10 the recognized linear image may be detected. Then, the writing detection module 121 passes the result of the detection to the association module 130. Further, the writing detection module 121 may detect a type of the writing. Examples of the type of the writing include a color of the writing, a shape (a line, an area or the like) of the writing, and a relationship between the writing and a character(s) (an area including a
15 character(s), an underline drawn under a character(s), or the like). The detection processing may include an analysis of a color after the hue separation, an analysis of an aspect ratio, an analysis of a positional relationship between the writing and the character(s) detected by a layout detection module 123, or the like.

Fig. 3 is an explanatory view showing an example of the data structure of a
20 specified portion table 300 representative of the writing detected by the writing detection module 121. The specified portion table 300 includes an ID column 310, a color column 320, and a position information column 330. The ID column 310 stores an identifier for uniquely identifying the writing. The color column 320 stores a color as the type of the writing. The position information column 330 stores the position of the writing, and
25 includes an x-coordinate column 331, a y-coordinate column 332, a width column 333,

and a height column 334. The x-coordinate column 331 and the y-coordinate column 332 store the coordinates of an upper left position of an area (for example, a rectangle) where the writing is present, the width column 333 stores the width of the area, and the height column 334 stores the height of the area. The coordinates may be absolute
5 coordinates (the upper left position of the image is defined as the origin point, the rightward direction corresponds to the x-axis and the downward direction corresponds to the y-axis) in the image, or may be relative coordinates.

The character processing module 122 receives the image from the image receiving module 110, detects layout including the position of a character image that is
10 present in the image, and recognizes the character image. Then, the character processing module 122 passes the position of the character image and the result of the character recognition to the association module 130. The character processing module 122 includes the layout detection module 123 and a character recognition module 124.

The layout detection module 123 detects the position of the character image in
15 the image received by the image receiving module 110. For the detection of the character image position, a character image extraction process that is generally known in the character recognition technology may be used. For example, a histogram of black pixels (the frequency distribution of black pixels) in the horizontal or vertical direction in the image is generated, a line is extracted by extracting an area where the frequency is
20 equal to or higher than a predetermined threshold value, and a histogram of black pixels in the vertical or horizontal direction in the line is generated, thereby extracting a character image. Alternatively, a character image may be extracted by using the sizes of a blank area and a predetermined character image. Further alternatively, the position of the character image may be detected by using a technology to extract a layout in an
25 image. In that case, the process can be performed not only on text areas constituted by

character images but also on figures, tables, and the like. Then, the layout detection module 123 passes the position of the character image, which is the detection result, to the character recognition module 124.

The character recognition module 124 performs character recognition on the character image detected by the layout detection module 123. For the character recognition process, a generally known character recognition technology may be used. For example, it may be performed to extract features (the number of lines, etc.) of the character image, compare a position in the feature space with characters in a dictionary and perform the character recognition (associate with a character code). Then, the character recognition module 124 associates the position of the character image with the character recognition result, and passes them to the association module 130.

Fig. 4 is an explanatory view showing an example of the data structure of a character position table 400 that is the result of the process performed by the character processing module 122. The character position table 400 includes a text area ID column 410, a text area position column 420, a character ID column 430, a character code column 440, and a character position column 450. The text area ID column 410 stores an identifier for uniquely identifying a text area in the image. The text area position column 420 stores the position of the text area, and includes an x-coordinate column 421, a y-coordinate column 422, a width column 423, and a height column 424. The x-coordinate column 421 and the y-coordinate column 422 store coordinates of the upper left position of the text area (for example, a rectangle), the width column 423 stores the width of the text area, and the height column 424 stores the height of the text area. The character ID column 430 stores an identifier for uniquely identifying a character image that is present in the text area. The character code column 440 stores a result (character code) of the character recognition performed by the character recognition module 124,

corresponding to the character image. The character position column 450 stores the position of the character image, and includes an x-coordinate column 451, a y-coordinate column 452, a width column 453, and a height column 454. The x-coordinate column 451 and the y-coordinate column 452 store coordinates of the upper left position of the character image (for example, a rectangle), the width column 453 stores the width of the character image, and the height column 454 stores the height of the character image. Contents in the text area ID column 410, the text area position column 420, the character ID column 430, and the character position column 450 are mainly generated by the layout detection module 123, and contents of the character code column 440 are mainly generated by the character recognition module 124. Moreover, contents in the character position column 450 may be modified by re-extracting the character image according to the result of the character recognition performed by the character recognition module 124.

The association module 130 is connected to the extraction/recognition processing module 120 and the translation module 140. The association module 130 compares the position of the writing detected by the writing detection module 121 with the position of the character detected by the layout detection module 123, and associates the writing with the result of the character recognition performed by the character recognition module 124. Then, the association module 130 passes the character recognition result and the association result to the translation module 140.

That is, the association module 130 searches for the position of the character corresponding to the position of the writing. This search process includes searching for not only the position of the character that coincides with the position of the writing, but also a position of a character that is in the neighborhood of the position of the writing when a writing area and a character area overlap each other. The "neighborhood"

includes the periphery of the position of the target writing, specifically, within a predetermined distance from the position of the target writing. The distance may be measured, for example, based on a distance from a center of the writing to a center of the character, a distance from the periphery of the writing to the periphery of the character
5 (the shortest distance therebetween), or the like.

Then, the character recognition result (character where the writing is made) corresponding to the position of the character is extracted. For example, specifically, when the character recognition result is expressed in a description language such as HTML (hypertext markup language), the character where the writing is made may be
10 surrounded by tags (that are reserved words representing that a writing is made). When a table format like the character position table 400 shown in the example of Fig. 4 is adopted, a column representative of whether or not a character is one where a writing is made may be provided.

Moreover, it may be determined as to whether or not characters where the
15 writing is made constitute a character string having a meaning in that language. Examples of the character string having a meaning include a word, a phrase, and a sentence. Moreover, the determination is made, for example, according to whether or not the characters are stored in a word dictionary that is prepared in advance or whether or not the characters can be extracted by parsing or the like. When it is determined that
20 the character(s) do not constitute a character string having a meaning, it may be performed to add or delete a preceding or succeeding character until a character string having a meaning is obtained and regard it as the character where the writing is made. When the character where the writing is made is modified, the result of the detection by the writing detection module 121 may be modified as well according to the modification
25 of the character.

The translation module 140 is connected to the association module 130 and the image generation module 150. The translation module 140 translates the result of the character recognition performed by the character recognition module 124 so as to be recognizable as a translation of the result of the character recognition associated with the writing by the association module 130. Then, the translation module 140 passes the translation result to the image generation module 150.

That is, the translation module 140 translates the result of the character recognition passed from the association module 130. For the translation processing, a generally known (machine) translation technology may be used. For example, the result of the character recognition is parsed, and by using a dictionary in which words in a first language and words in a second language are associated with each other, it is translated into the second language.

In the translation, the association result passed from the association module 130 is reflected also in the translation result. For example, specifically, when the translation result is expressed in a description language such as HTML, the result of translation of a character(s) where the writing is made may be surrounded by tags (that are reserved words representing that a writing is made).

The image generation module 150 is connected to the translation module 140 and the output module 160, and includes an original image conversion module 151, a translation image generation module 152, and a combining module 153. The image generation module 150 receives the translation result from the translation module 140, generates an image including the translation result, and passes it to the output module 160. The image generated by the image generation module 150 may be a file described in a page description language or the like.

The original image conversion module 151 is connected to the combining

module 153, and after the translation module 140 performs the translation, the original image conversion module 151 converts the character image in the image received by the image receiving module 110, based on the position of the writing detected by the writing detection module 121. For example, specifically, the original image conversion module
5 151 may convert into an image that hides the character image where the writing is made, based on the position of the writing detected by the writing detection module 121. More specifically, this conversion includes painting out of the character image with black called sanitizing or converting into a predetermined character image that is prepared as a substitute for the character image. Then, the original image conversion module 151
10 passes the converted image to the combining module 153.

The translation image generation module 152 is connected to the combining module 153, and generates an image of the translation result associated with the writing, so as to be output in a format different from that of an image of a translation result that is not associated with a writing. Then, the translation image generation module 152 passes
15 the generated image to the combining module 153. For example, specifically, the translation image generation module 152 may generate an image that hides the translation result associated with the writing. This is used in the case where it is intended to hide the translation image while ensuring the quality of the translation result. For example, if a character of the original image is hidden, the character is eliminated
20 from a process target, so that when character recognition and translation are performed, the quality of the translation result would be degraded. However, in this exemplary embodiment, character recognition and translation are also performed on a part where the original image is to be hidden, and a part of the translation result corresponding to the part to be hidden is hidden.

25 Moreover, the translation image generation module 152 may generate an image

of the translation result associated with the writing, based on the type of the writing detected by the writing detection module 121. For example, specifically, when the writing is red, the translation result associated with the writing is painted out with black, and when the writing is blue, the translation result associated with the writing is replaced
5 by a predetermined character.

Moreover, the translation image generation module 152 may add a writing having the same type as that of the writing detected by the writing detection module 121, to the image of the translation result associated with the writing. For example, specifically, when the writing is made by a red marker, an image that is painted out with
10 an equivalent red marker is added to the translation result associated with the writing. Likewise, when the writing is a blue underline, an equivalent underline is added to the translation result associated with the writing. This process is performed when the association relation between the original image and the translation image is to be clarified.

15 The combining module 153 is connected to the original image conversion module 151 and the translation image generation module 152, and combines the image converted by the original image conversion module 151 and the image generated by the translation image generation module 152. The combining module 153 passes the combined image to the output module 160.

20 When only the translation image is output, the original image conversion module 151 and the combining module 153 are unnecessary. In that case, the image generated by the translation image generation module 152 is passed to the output module 160.

The output module 160 is connected to the image generation module 150. The output module 160 receives the image from the image generation module 150, and
25 outputs the image. Outputting an image includes printing it with a printing machine

such as a printer, displaying it on a display, transmitting it with an image transmission apparatus such as a fax, and writing it into an image storage such as an image database.

Fig. 2 is a flowchart showing a processing example 1 according to this exemplary embodiment. A target of this processing example 1 is an image where a writing has
5 been made for hiding, and the processing example 1 hides a corresponding character image in a translation image. This is used, for example, in the case where a piece of information described in a document is hidden when the document is made open to the public in a different language.

At step S202, the writing detection module 121 performs the hue separation on
10 an image received by the image receiving module 110 to thereby extract marker information including a position of a marker that is a writing made by a user. The marker information may include a color of the marker in addition to the position thereof.

At step S204, the layout detection module 123 extracts a text area from the image received by the image receiving module 110, and extracts a position of a character
15 image. Then, the character recognition module 124 performs the character recognition process on the character image located in the position of the character image.

At step S206, the association module 130 compares the position information of the character image, which recognized as a character(s) at step S204, with position information that is contained in the marker information extracted at step S202.

20 At step S208, the association module 130 stores, as a specified character, a character having a position that overlaps the position of the marker. For example, more specifically, the character painted out with the marker is surrounded by tags, and the character recognition result is described in HTML.

At step S210, the translation module 140 executes the machine translation.
25 Herein, the translation module 140 passes the result of the machine translation to a next

process in a format that is clearly recognized as a translation result of the character, which is painted out with the marker. For example, more specifically, the translation result of the character, which is painted out with the marker, is surrounded by tags, and the translation result is described in HTML.

5 At step S212, the image generation module 150 determines as to which to choose as an output format (i) replacement translation (an output in which the character image of the original image is not left but overwritten with the translation result, see Fig. 5B) or (ii) ruby-style translation (an output in which the character image of the original image is left as it is and the translation result is associated like ruby characters, see Fig. 6B). This
10 determination is made according to a user's operation or a predetermined output format in this exemplary embodiment.

 At step S214, using the marker information extracted at step S202, the original image conversion module 151 removes an area having the color of the marker from the image received by the image receiving module 110.

15 At step S216, the original image conversion module 151 further removes a character part from the image. That is, by the processes of steps S214 and S216, the character image part is removed from the image. Thereby, images other than the character image (for example, a figure and a photo image) are left in the image.

 At step S218, using the marker information extracted at step S202, the original
20 image conversion module 151 paints out with black or the like the character image located in the marker position in the image received by the image receiving module 110. That is, since this is a case where the original image is output as well, the character painted with the marker is hidden. It is to be noted that this includes replacing the character, which is painted with the marker, by an image of a predetermined character
25 string instead of painting it out with black.

At step S220, the translation image generation module 152 arranges the character images of the translation result so as to correspond to the text area of the original image. In doing this, in the case where the output format is the replacement translation, the translation image generation module 152 arranges the character images of the translation result in the text area according to the language of the translation result. In the case where the output format is the ruby-style translation, since the original character image is present in the text area, the translation image generation module 152 arranges the character images of the translation result between lines.

At step S222, the translation image generation module 152 provides a specified effect to the translation character string indicated by the marker (that is, the result of translation of the character painted out with the marker). Here, the specified effect is to hide the translation character string according to a type of the marker, and examples thereof include painting it out with black and replacing it by an image of a predetermined character string.

At step S224, the combining module 153 combines the background image generated at step S216 (the image from which the character image has been removed) or the image generated at step S218 (the image from which the character image painted out with the marker has been removed) and the image generated at step S222 (translation image). Then, the output module 160 outputs the combined image.

Figs. 5A and 5B are explanatory views showing the processing example 1-1 according to this exemplary embodiment. Specifically, Figs. 5A and 5B show a processing example when the replacement translation is chosen at step S212 of the flowchart shown in the example of Fig. 2. An original image 510 shown in the example of Fig. 5A is the image received by the image receiving module 110 of this exemplary embodiment, and a translation image 520 shown in the example of Fig. 5B is an image

output by the output module 160 of this exemplary embodiment. It is noted that Japanese characters are left in Fig. 5A intentionally because Fig. 5B shows a result of translating the Japanese document shown in Fig. 5A into English.

The original image 510 shown in the example of Fig. 5A includes a marker area
5 511 and a marker area 512. That is, character strings “watashitachi ga mezasu mono”
(511; means that the thing which we aim at) and “watashitachi ga taisetunisuru koto”
(512; means that we value) that a user does not want to disclose are painted out with
markers. It is assumed that the marker area 511 and the marker area 512 are writings
that are made with markers having different colors.

10 The translation image 520 shown in the example of Fig. 5B in which the original
image 510 is translated after character recognition includes a masking area 521 and
masking areas 522A and 522B. In the masking area 521, the translation part of the
marker area 511 is hidden with black according to the color of the marker area 511, and
in the masking areas 522A and 522B, the translation part of the marker area 512 is
15 hidden by replacing it by “words A” that is associated with the color.

Figs. 6A and 6B are explanatory views showing a processing example 1-2
according to this exemplary embodiment. Figs. 6A and 6B show a processing example
when the ruby-style translation is chosen at step S212 of the flowchart shown in the
example of Fig. 2. An original image 610 shown in the example of Fig. 6A is an image
20 received by the image receiving module 110 of this exemplary embodiment, and a
translation image 620 shown in the example of Fig. 6B is an image output by the output
module 160 of this exemplary embodiment. It is noted that Japanese characters are left
in Figs. 6A and 6B intentionally because Fig. 6B shows a result of translating the
Japanese document shown in Fig. 6A into English.

25 The original image 610 includes a marker area 611 and a marker area 612. These

are equivalent to the original image 510 shown in the example of Fig. 5A.

In the translation image 620 in which the original image 610 is translated after character recognition, translations are shown between lines of character strings in the original image 610. The translation image 620 includes a masking area 621, masking areas 622A and 622B, a masking area 631, and a masking area 632. That is, the masking area 631 and the masking area 632 hides the marker area 612 and the marker area 611 of the original image 610, and the masking area 621 and the masking areas 622A and 622B hide the translation part of the marker area 612 and the translation part of the marker area 611. The formats of the masking area 621 and the masking areas 622A and 622B are made different from each other according to the colors of the marker area 612 and the marker area 611.

Fig. 7 is a flowchart showing a processing example 2 according to this exemplary embodiment. A target of this processing example 2 is an image where a writing is made for indicating that that part is important, attracting attention, or the like, and the processing example 2 displays a corresponding character image in a translation image differently from a character image where no writing is made. This processing example 2 is used, for example, in a case where a writing in a document is shown in association with a translated document when the document is translated.

Comparing the flowchart shown in the example of Fig. 7 with the flowchart shown in the example of Fig. 2, the processes of steps S702 to S716 are similar to those of steps S202 to S216, the processes of steps S718 to S722 are similar to those of steps S220 to S224, and no process corresponding to step S218 is present. This is because a part where a writing has been made on an original image with a marker is left as it is in the processing example 2 shown in Fig. 7, while the processing example 1 shown in Fig. 2 is to hide a writing part and it is necessary for the processing example 1 to hide a part

where a writing has been made on an original image with a marker.

When it is determined that the ruby-style translation is chosen at step S712, since the process shifts to step S718, that is, since no process corresponding to step S218 is required, the process performed by the original image conversion module 151 is
5 unnecessary.

Figs. 8A and 8B are explanatory views showing a processing example 2-1 according to this exemplary embodiment. This is a processing example when the replacement translation is chosen at step S712 of the flowchart shown in the example of Fig. 7. An original image 810 shown in the example of Fig. 8A is an image received by
10 the image receiving module 110 of this exemplary embodiment, and a translation image 820 shown in the example of Fig. 8B is an image output by the output module 160 of this exemplary embodiment. It is noted that Japanese characters are left in Fig. 8A intentionally because Fig. 8B shows a result of translating the Japanese document shown in Fig. 8A into English.

15 The original image 810 shown in the example of Fig. 8A includes a marker area 811 and a marker area 812. These are similar to the original image 510 shown in the example of Fig. 5A. That is, a writing with a marker is made by a user on each of the character strings “watashitachi ga mezasu mono” (811; means that the thing which we aim at) and “watashitachi ga taisetunisuru koto” (812; means that we value). The
20 marker area 811 and the marker area 812 are writings with markers having different colors. These character strings are not objects to be hidden but objects to be recognized as important or to which attention should be paid.

The translation image 820 shown in the example of Fig. 8B in which the original image 810 is translated after character recognition includes a character modification 821
25 and character modifications 822A and 822B. In the character modification 821, an

image of the writing, that is, an area having an equivalent color to that of the marker area 812 is added according to the color of the marker area 812. In the character modifications 822A and 822B, according to the color of the marker area 811, a writing image of an underline associated with that color is added.

5 Figs. 9A and 9B are explanatory views showing a processing example 2-2 according to this exemplary embodiment. This is a processing example when the ruby-style translation is chosen at step S712 of the flowchart shown in the example of Fig. 7. An original image 910 shown in the example of Fig. 9A is an image received by the image receiving module 110 of this exemplary embodiment, and a translation image 920
10 shown in the example of Fig. 9B is an image output by the output module 160 of this exemplary embodiment. It is noted that Japanese characters are left in Figs. 9A and 9B intentionally because Fig. 9B shows a result of translating the Japanese document shown in Fig. 9A into English.

The original image 910 shown in the example of Fig. 9A includes a marker area
15 911 and a marker area 912. These are similar to the original image 810 shown in the example of Fig. 8A.

In the translation image 920 shown in the example of Fig. 9B in which the original image 910 is translated after character recognition, translations are shown between lines of character strings in the original image 910. The translation image 920
20 includes a character modification 921, character modifications 922A and 922B, a character modification 931, and a character modification 932. That is, the character modification 931 and the character modification 932 are the marker area 912 and the marker area 911 of the original image 910 as they are, and the character modification 921 and the character modifications 922A and 922B are present in the corresponding
25 translation parts. The formats of the character modification 921 and the character

modifications 922A and 922B are made different according to the colors of the marker area 912 and the marker area 911.

Referring to Fig. 10, a hardware structure example of this exemplary embodiment will be described. The structure shown in Fig. 10 is constituted by, for example, a personal computer (PC), and a hardware structure example is shown that includes a data reading section 1017 such as a scanner and a data output section 1018 such as a printer.

A CPU (central processing unit) 1001 is a control section that executes processings according to computer programs describing execution sequences of the modules described in the above-described embodiment, that is, the modules such as the extraction/recognition processing module 120, the association module 130, the translation module 140, and the image generation module 150.

A ROM (read only memory) 1002 stores programs, operation parameters, and the like used by the CPU 1001. A RAM (random access memory) 1003 stores programs used in the execution of the CPU 1001, parameters that appropriately varies in the execution, and the like. These are interconnected through a host bus 1004 constituted by a CPU bus or the like.

The host bus 1004 is connected to an external bus 1006 such as a PCI (peripheral component interconnect/interface) bus through a bridge 1005.

A keyboard 1008 and a pointing device 1009 such as a mouse are input devices operated by the operator. A display 1010 examples of which include a liquid crystal display and a CRT (cathode ray tube) display displays various pieces of information as text and image information.

An HDD (hard disk drive) 1011 incorporates a hard disk, and drives the hard disk to record or reproduce programs executed by the CPU 1001 and information. The

hard disk stores images received by the image receiving module 110, the translation results by the translation module 140, and the like. Further, the hard disk stores other various data processing programs and various computer programs.

A drive 1012 reads data or a program recorded on an attached removable
5 recording medium 1013 such as a magnetic disk, an optical disk, a magneto-optical disk, or a semiconductor memory, and supplies the data or the program to the RAM 1003 connected through an interface 1007, the external bus 1006, the bridge 1005, and the host bus 1004. The removable recording medium 1013 can also be used as a data recording area similar to the hard disk.

10 A connection port 1014 is for connecting an external connection device 1015, and includes connection sections such as USB and IEEE1394. The connection port 1014 is connected to the CPU 1001 and the like through the interface 1007, the external bus 1006, the bridge 1005, the host bus 1004, and the like. A communication section 1016 is connected to a network, and executes the processing of data communication with the
15 outside. A data reading section 1017 is, for example, a scanner, and executes the processing of document reading. A data output section 1018 is, for example, a printer, and executes the processing of document data output.

The hardware structure shown in Fig. 10 is a structure example, and this exemplary embodiment is not limited to the structure shown in Fig. 10 but may adopt
20 any hardware structure that is capable of executing the modules described in this exemplary embodiment. For example, some of the modules may be constituted by dedicated hardware such as an ASIC (application specific integrated circuit), some of the modules may be present in an external system and connected by a communication line, and further, a plurality of the systems shown in Fig. 10 may be interconnected by a
25 communication line so as to operate in cooperation with each other. Moreover, this

exemplary embodiment may be incorporated in a copier, a fax, a scanner, a printer, a multifunction apparatus (an image processing apparatus having two or more of the scanner, printer, copier, and fax functions), and the like.

The described programs may be provided by being stored in a recording medium, 5 or the programs may be provided through a communication device. In that case, for example, the described programs may be regarded as an invention of a “computer-readable recording medium recording a program”.

The “computer-readable recording medium recording a program” refers to a computer-readable recording medium recording a program which recording medium is 10 used for installing and executing a program, distributing a program, or the like.

Examples of the recording medium include: DVDs (digital versatile disks) such as “DVD-R, DVD-RW, DVD-RAM” which are standards developed by the DVD forum and “DVD+R, DVD+RW” which are standards developed by DVD+RW; compact disks (CDs) such as a read-only memory (CD-ROM), a CD-recordable (CD-R), and a CD- 15 rewritable (CD-RW); a blue-ray disk; a magneto-optical disk (MO); a flexible disk (FD); a magnetic tape; a hard disk; a read only memory (ROM); an electrically erasable and rewritable read only memory (EEPROM); a flash memory; and a random access memory (RAM).

The programs or some of them may be stored or distributed in a state of being 20 recorded in the recording medium. Moreover, they may be transmitted through communication by using a transmission medium such as a wire network used for a local area network (LAN), a metropolitan area network (MAN), a wide-area network (WAN), the Internet, an intranet, and an extranet, a wireless communication network, or a combination thereof, or may be conveyed on a carrier wave.

25 Further, the programs may be part of other programs, or may be recorded in a

recording medium with another program. Moreover, they may be recorded in a state of being divided to a plurality of recording media. Moreover, they may be recorded in any form such as a compressed form or an encrypted form as long as they are restorable.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An image processing apparatus comprising:
 - an image receiving unit that receives an image including image information and a writing added to that image information;
 - 5 a writing detection unit that detects a position and type of the writing in the image received by the image receiving unit;
 - a character position detection unit that detects a position of a character image in the image received by the image receiving unit;
 - a character recognition unit that performs character recognition on the character
 - 10 image detected by the character position detection unit;
 - an association unit that compares the position of the writing detected by the writing detection unit with the position of the character image detected by the character position detection unit to associate the writing with a result of the character recognition performed by the character recognition unit;
 - 15 a translation unit that translates the result of the character recognition performed by the character recognition unit so as to be recognizable as a translation of the result of the character recognition associated with the writing by the association unit;
 - a translation image generation unit that generates an image of the translation result associated with the writing, so as to be output in a format based on the type of
 - 20 writing and different from a format of an image of a translation result that is not associated with the writing; and
 - a translation image output unit that outputs the image generated by the translation image generation unit.
2. The image processing apparatus according to claim 1, further comprising:
 - 25 an original image conversion unit that converts the character image in the image

received by the image receiving unit, based on the position of the writing detected by the writing detection unit, after the translation by the translation unit is performed; and

a combining unit that combines the image converted by the original image conversion unit and the image generated by the translation image generation unit.

5 3. The image processing apparatus according to claim 2, wherein the original image conversion unit converts the character image into an image that hides the character image, based on the position of the writing detected by the writing detection unit.

10 4. The image processing apparatus according to any one of claims 1 to 3, wherein the translation image generation unit generates an image that hides the translation result associated with the writing.

 5. The image processing apparatus according to any one of claims 1 to 2, wherein the translation image generation unit adds a writing having a same type as the type of the writing detected by the writing detection unit, to the image of the translation result associated with the writing.

 6. The image processing apparatus according to any one of the preceding claims wherein the writing indicates a portion of the image where information should be hidden or emphasized.

20 7. An image processing method comprising:
 receiving an image including image information and a writing added to that image information;
 detecting a position and type of the writing in the received image;
 detecting a position of a character image in the received image;
25 performing character recognition on the detected character image;

comparing the position of the detected writing with the position of the detected character image to associate the writing with a result of the character recognition;

translating the result of the character recognition so as to be recognizable as a translation of the result of the character recognition associated with the writing;

5 generating an image of the translation result associated with the writing, so as to be output in a format based on the type of writing and different from a format of an image of a translation result that is not associated with the writing; and

outputting the image of the translation result associated with the writing.

8. An image processing program that causes a computer to function as:

10 an image receiving unit that receives an image including image information and a writing added to that image information;

a writing detection unit that detects a position and type of the writing in the image received by the image receiving unit;

15 a character position detection unit that detects a position of a character image in the image received by the image receiving unit;

a character recognition unit that performs character recognition on the character image detected by the character position detection unit;

20 an association unit that compares the position of the writing detected by the writing detection unit with the position of the character image detected by the character position detection unit to associate the writing with a result of the character recognition performed by the character recognition unit;

a translation unit that translates the result of the character recognition performed by the character recognition unit so as to be recognizable as a translation of the result of the character recognition associated with the writing by the association unit;

25 a translation image generation unit that generates an image of the translation

result associated with the writing, so as to be output in a format based on the type of writing and different from a format of an image of a translation result that is not associated with the writing; and

a translation image output unit that outputs the image generated by the translation
5 image generation unit.

9. An image processing apparatus substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

10. An image processing method substantially as herein described with
10 reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

11. An image processing program substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

FIG. 1

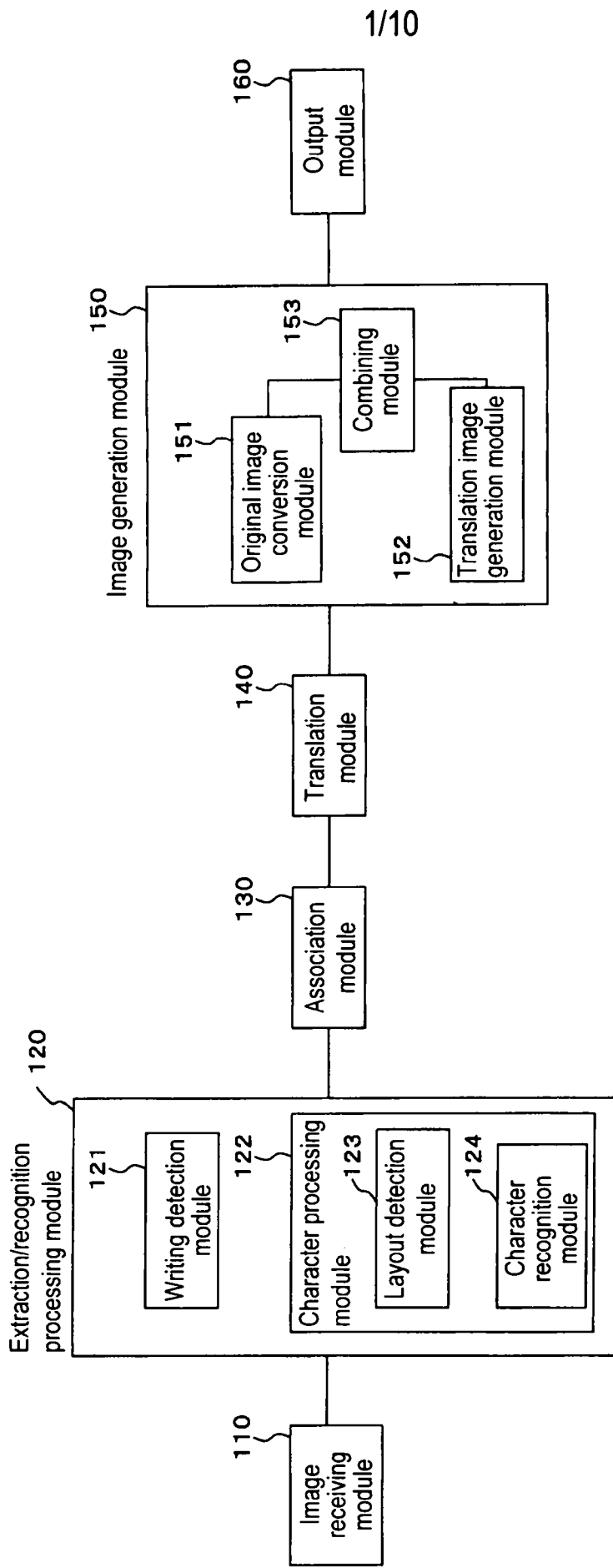


FIG. 2

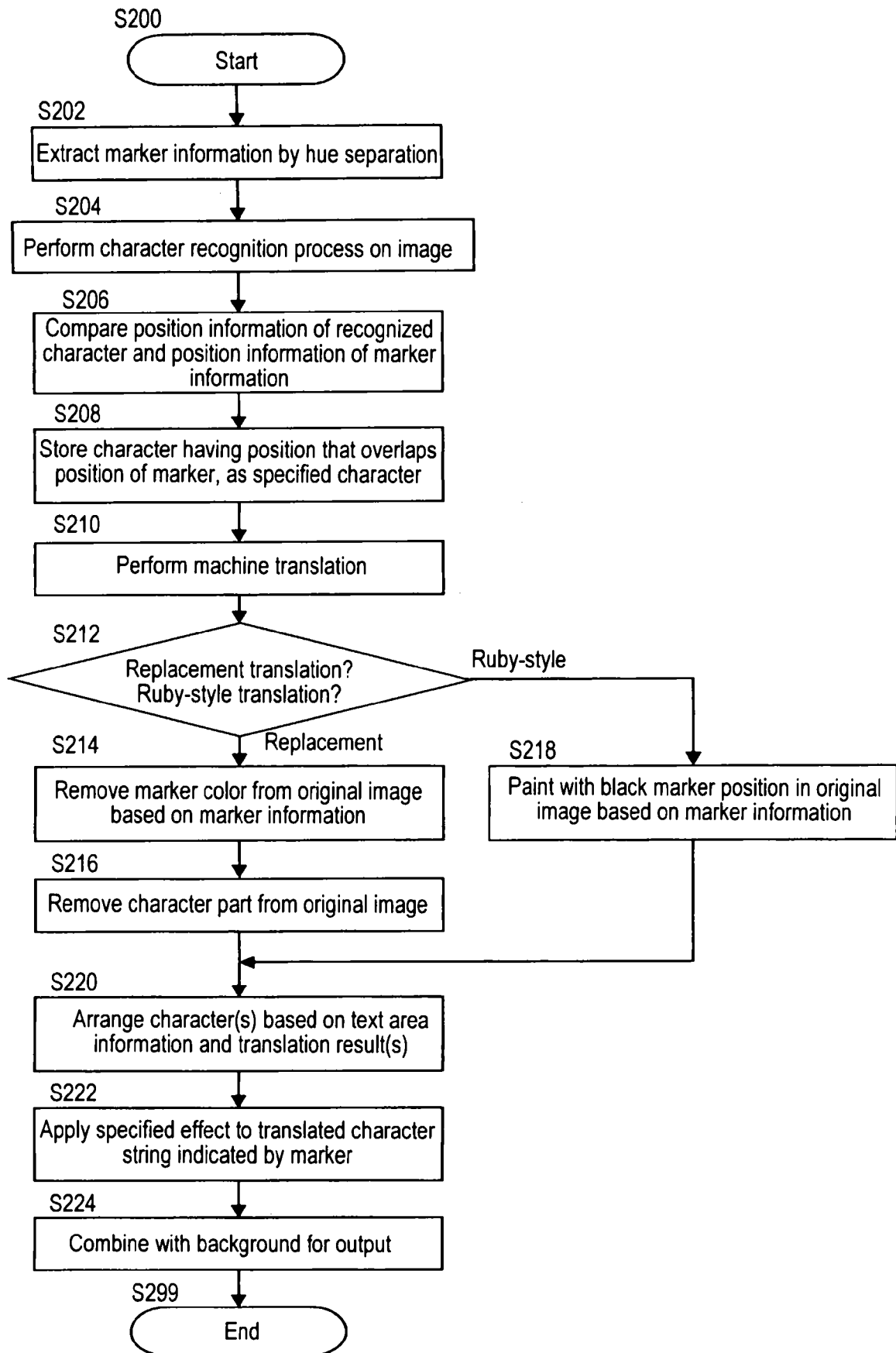


FIG. 3

The diagram shows a table with two rows and four columns. The first row contains the labels 'ID', 'Color', 'X coordinate', and 'Y coordinate'. The second row contains 'X coordinate', 'Y coordinate', 'Width', and 'Height'. Brackets on the left side group the columns: 310 for the first column, 320 for the second, 330 for the third and fourth, 331 for the first of the second row, 332 for the second, 333 for the third, and 334 for the fourth. A bracket labeled 'Position information' spans the third and fourth columns of the second row. An arrow labeled '300' points to the top-right corner of the table.

ID	Color	X coordinate	Y coordinate
X coordinate	Y coordinate	Width	Height

FIG. 5A

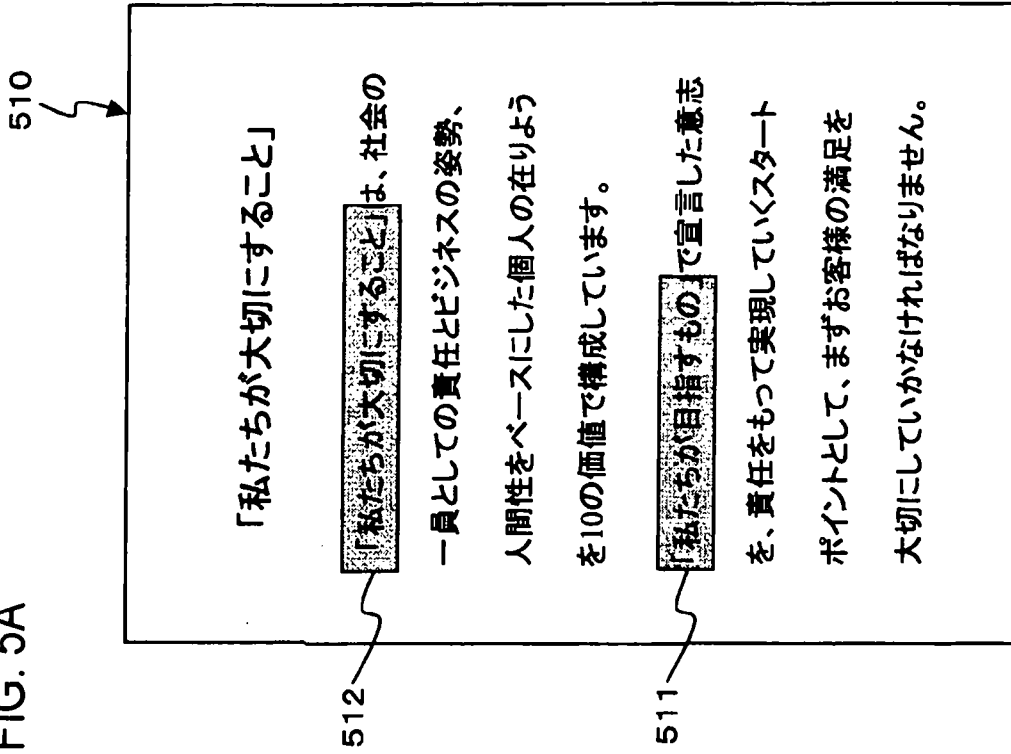


FIG. 5B

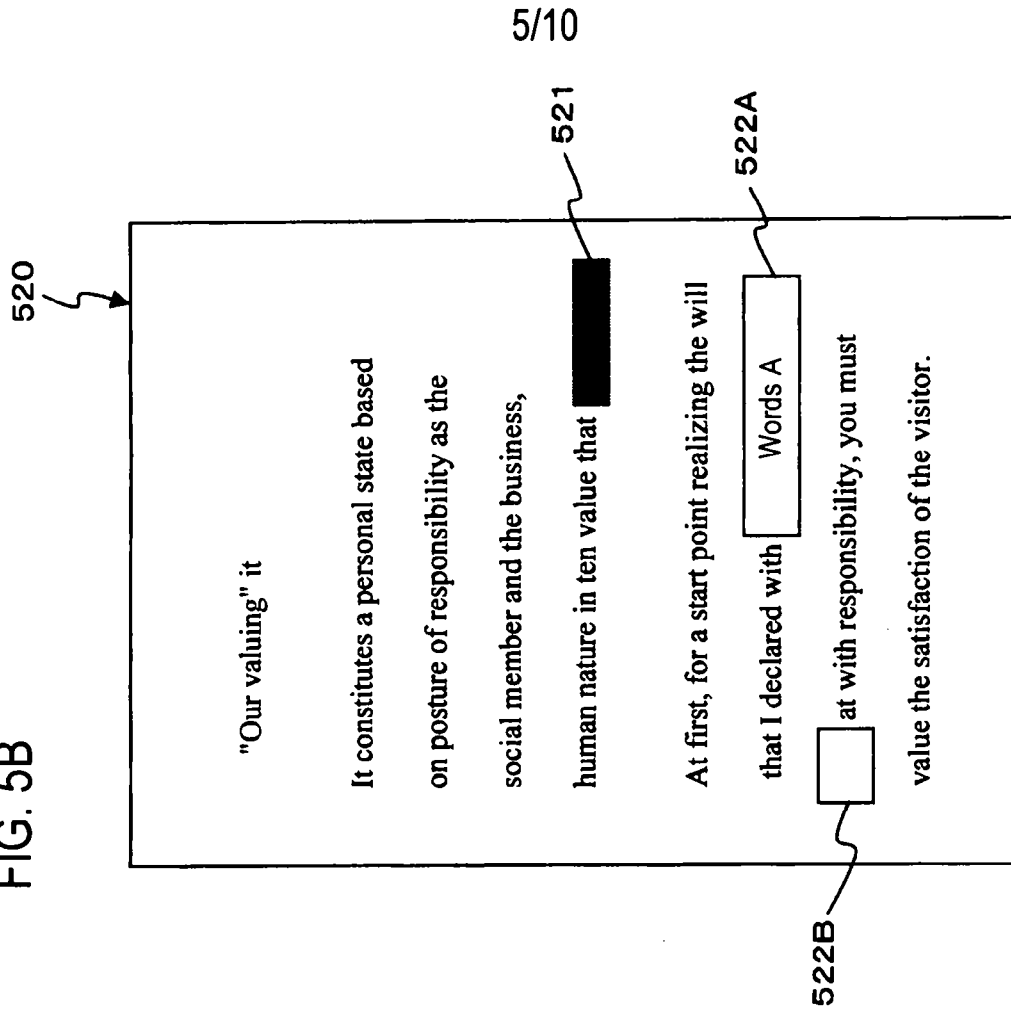


FIG. 6A

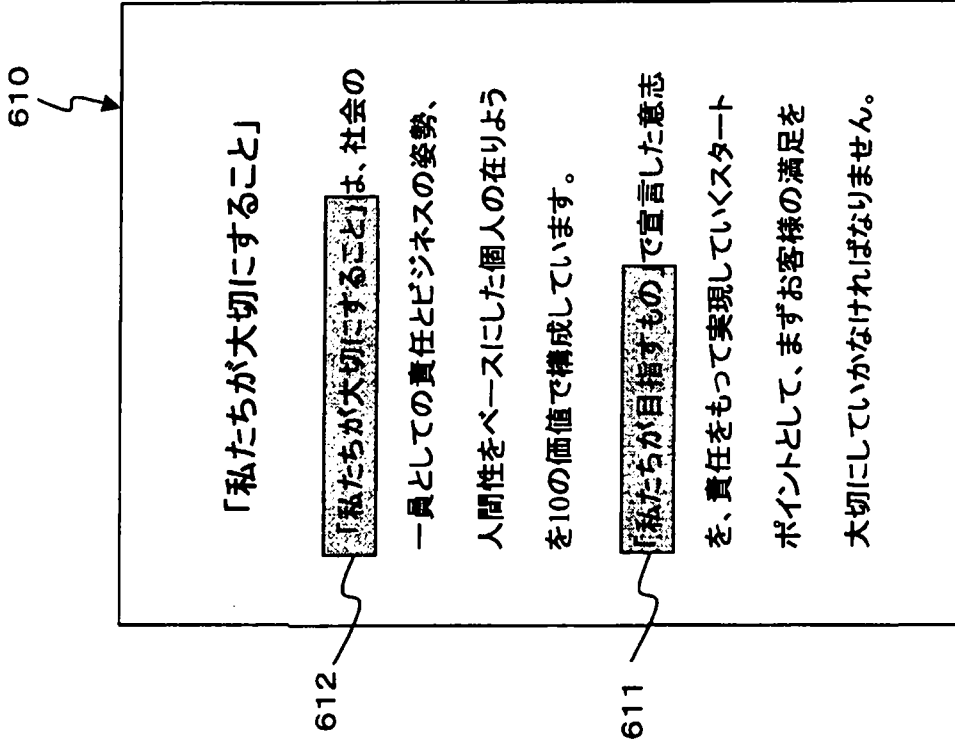


FIG. 6B

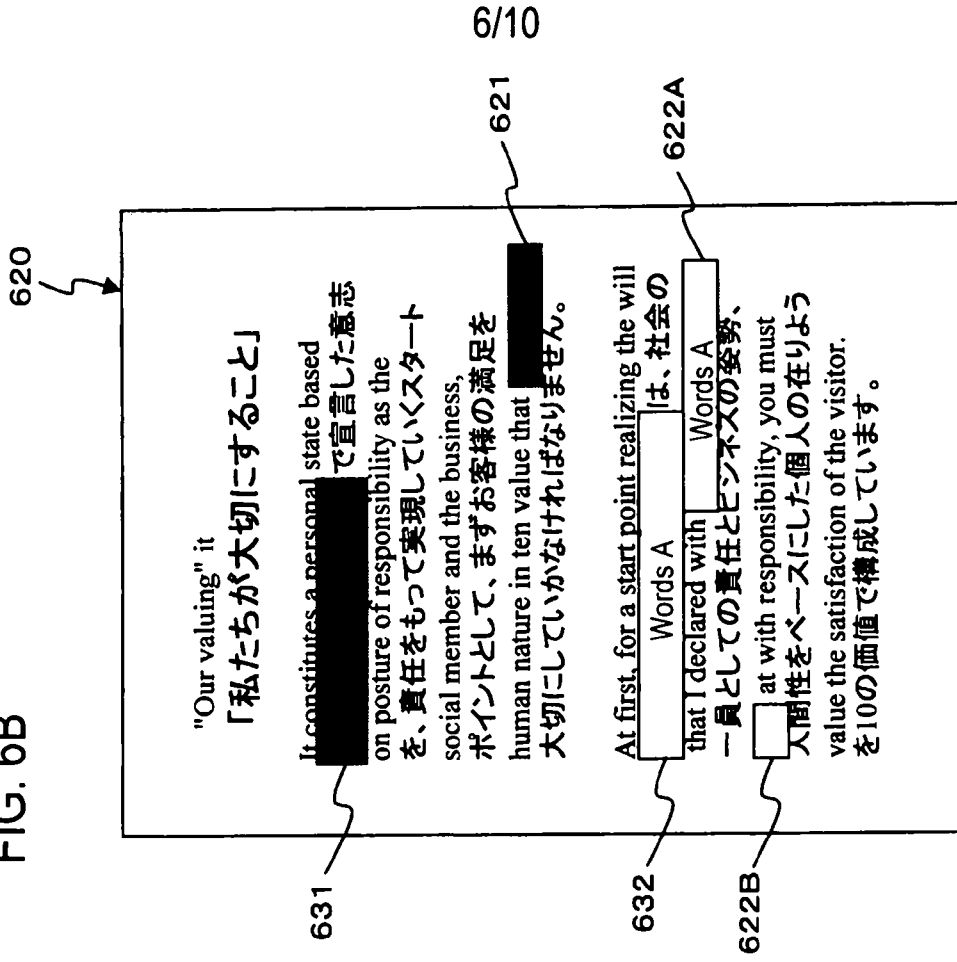


FIG. 7

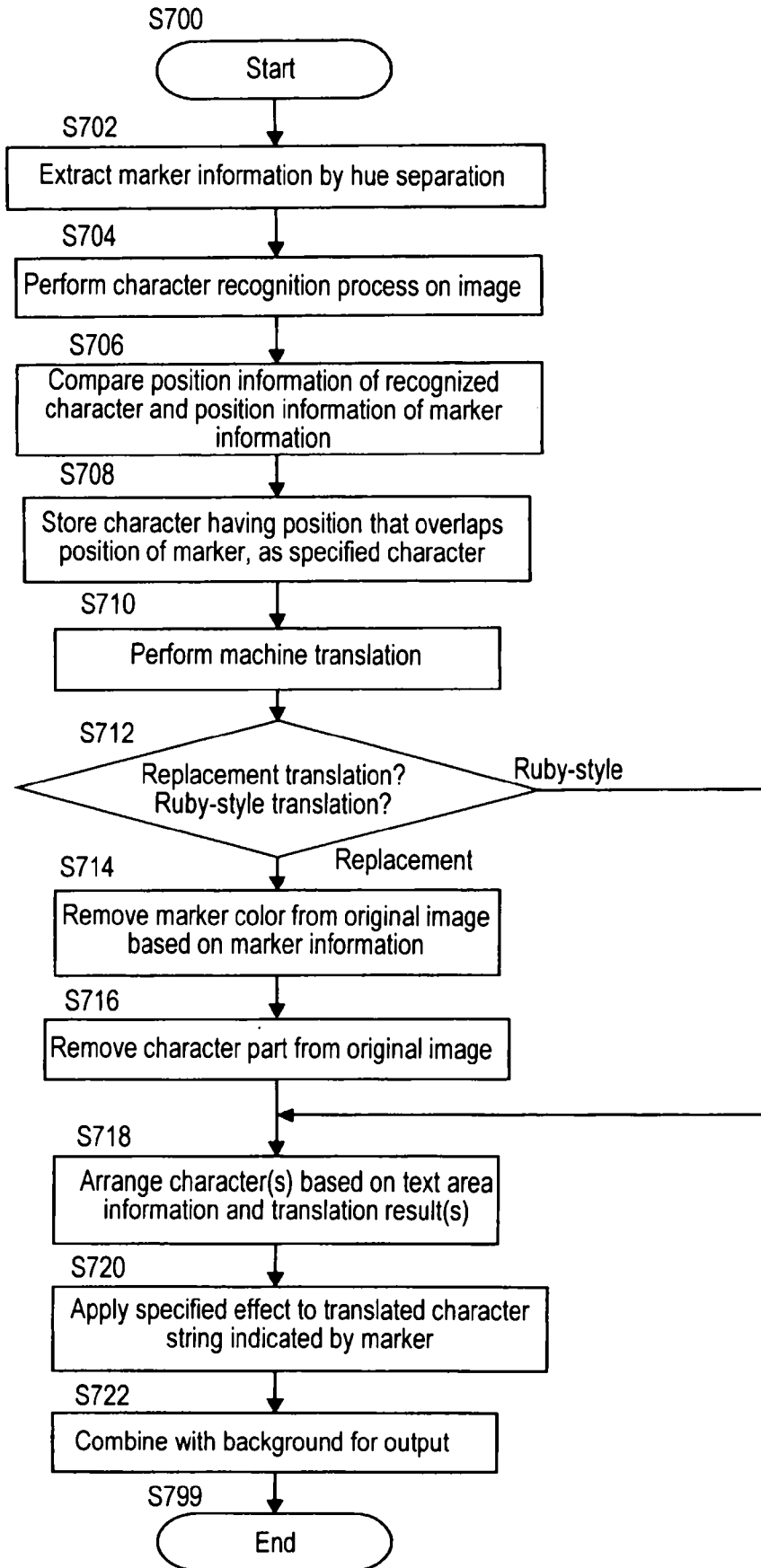


FIG. 8A

810



「私たちが大切にすること」

「**私たちが大切にすること**」は、社会の

一員としての責任とビジネスの姿勢、

人間性をベースにした個人の在りよう

を10の価値で構成しています。

「**私たちが目指すもの**」で宣言した意志

を、責任をもって実現していくスタート

ポイントとして、まずお客様の満足を

大切にしていかなければなりません。

812

811

FIG. 8B

820



"Our valuing" it

It constitutes a personal state based

on posture of responsibility as the

social member and the business,

human nature in ten value that **"we value"**.

At first, for a start point realizing the will

that I declared with **"the thing which we**

aim" at with responsibility, you must

value the satisfaction of the visitor.

822B

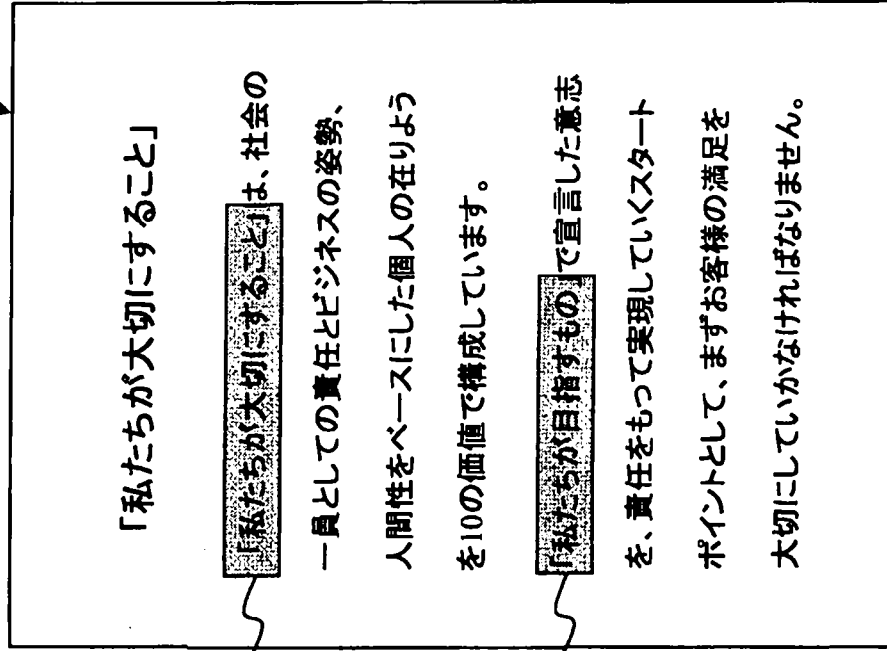
8/10

821

822A

FIG. 9A

910

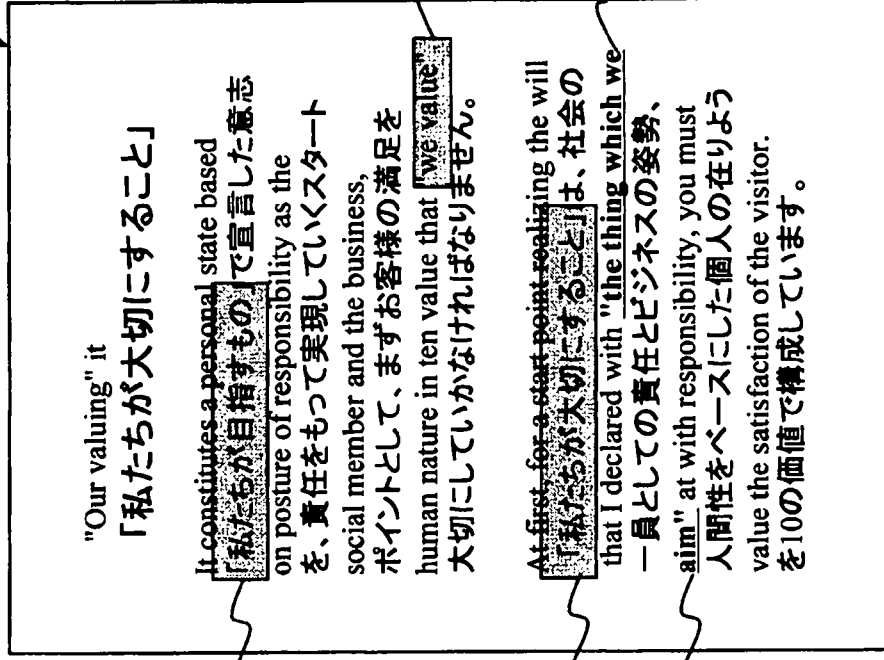


912

911

FIG. 9B

920



931

932

922B

922A

FIG. 10

