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IMAGE PROCESSING SYSTEM

Abstract

An image processing system includes a target image acquiring unit, an instruction object detecting unit, an instruction determining unit, and a replacement processing unit. The target image acquiring unit acquires as a target image a document image of a document. The instruction object detecting unit detects a first instruction object and a second instruction object in the target image among handwritten objects additionally written to the document, the first instruction object specifying a process target object, and the second instruction object specifying data used for a replacement process of the process target object. The instruction determining unit determines the process target object specified by the detected first instruction object and determines the data specified by the detected second instruction object. The replacement processing unit performs a replacement process of the determined process target object with the determined data in the target image.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application relates to and claims priority rights from Japanese Patent Applications Nos. 2024-023407, 2024-023408, and 2024-023411 filed on Feb. 20, 2024, the entire disclosures of which are hereby incorporated by reference herein.

BACKGROUND

1. Field of the Present Disclosure

[0002] The present disclosure relates to an image processing system.

2. Description of the Related Art

[0003] Regarding a document image obtained by scanning a document that includes a process list of process items “Delete”, “Acquire” and “Restrict”, an image processing apparatus determines a process item specified with a specific color in the process list, and performs the specified process item for a part surrounded by the specific color or a part filled in with the specific color in the document image.

[0004] Further, an image processing apparatus (a) separates a handwritten part from a document image of a document, (b) determines whether the handwritten part is a surrounding line that surrounds a target area or a classification symbol that classifies a target area, and (c) classifies an image of the target area with the classification symbol.

[0005] It is conceivable to determine a target area of an arbitrary shape specified with a handwritten instruction object such as a surrounding line as mentioned, and replaces the target area with another content. In such a case, if the instruction object is a handwritten object, there is fluctuation on a shape or the like of the instruction object, and therefore, the instruction object may not be properly detected in the target image.

SUMMARY

[0006] An image processing system according to an aspect of the present disclosure includes a target image acquiring unit, an instruction object detecting unit, an instruction determining unit, and a replacement processing unit. The target image acquiring unit is configured to acquire as a target image a document image of a document. The instruction object detecting unit is configured to detect a first instruction object and a second instruction object in the target image among handwritten objects additionally written to the document, the first instruction object specifying a process target object, and the second instruction object specifying data used for a replacement process of the process target object. The instruction determining unit is configured to determine the process target object specified by the detected first instruction object and determine the data specified by the detected second instruction object. The replacement processing unit is configured to perform a replacement process of the determined process target object with the determined data in the target image.

[0007] These and other objects, features and advantages of the present disclosure will become more apparent upon reading of the following detailed description along with the accompanied drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** shows a block diagram that indicates a configuration of an image processing system

in Embodiment 1 of the present disclosure;
[0009] FIG. **2** shows a diagram that indicates an example of a target image that includes a first instruction object and a second instruction object;
[0010] FIG. **3** shows a diagram that explains objects determined in the target image shown in FIG. **2**;
[0011] FIG. **4** shows a diagram that indicates an example of a target image after a replacement process;
[0012] FIG. **5** shows a flowchart that explains a behavior of the image processing system shown in FIG. **1**;
[0013] FIG. **6** shows a block diagram that indicates a configuration of an image processing system in Embodiment 2 of the present disclosure;
[0014] FIG. **7** shows a diagram that indicates an example of a target image that includes a first instruction object and a second instruction object;
[0015] FIG. **8** shows a diagram that explains instruction objects determined in the target image shown in FIG. **7**;
[0016] FIG. **9** shows a diagram that explains character objects (character areas) determined in the target image shown in FIG. **7**;
[0017] FIG. **10** shows a diagram that indicates an example of a target image after a replacement process performed for the target image shown in FIG. **7**;
[0018] FIG. **11** shows a diagram that indicates another example of a target image that includes a first instruction object and a second instruction object;
[0019] FIG. **12** shows a flowchart that explains a behavior of the image processing system shown in FIG. **6**;
[0020] FIG. **13** shows a diagram that indicates another example of a target image that includes a first instruction object and a second instruction object;
[0021] FIG. **14** shows a diagram that explains instruction objects determined in the target image shown in FIG. **13**; and
[0022] FIG. **15** shows a diagram that indicates an example of a target image after a replacement process performed for the target image shown in FIG. **13**.

DETAILED DESCRIPTION

[0023] Hereinafter, embodiments according to an aspect of the present disclosure will be explained with reference to drawings.

Embodiment 1

[0024] FIG. **1** shows a block diagram that indicates a configuration of an image processing system in an embodiment of the present disclosure. The image processing system shown in FIG. **1** includes a processing server **1** and an image forming apparatus **2** (multi function peripheral or the like), capable of communication through a network with each other.
[0025] The processing server **1** includes a processor **11**, a storage device **12**, and a communication device **13**.
[0026] The processor **11** includes a computer, and executes a program with the computer and thereby, acts as sorts of processing units. Specifically, the computer includes a CPU (Central Processing Unit), a ROM (Read Only Memory), a RAM (Random Access Memory) and the like, loads a program stored in the ROM or the storage device **12**, executes the program with the CPU, and thereby acts as sorts of processing units. Further, the processor **11** may include an ASIC (Application Specific Integrated Circuit) that performs as a specific processing unit.
[0027] The storage device **12** is a non-volatile storage device such as flash memory, and stores the image processing program and data required for a process mentioned below. In the storage device **12**, system setting data is stored. The system setting data includes parameters of a learner mentioned below.
[0028] The communication device **13** such as network interface or a peripheral device interface is a

device that performs data communication with an external device such as the image forming apparatus **2**.
[0029] Meanwhile, the image forming apparatus **2** includes an image scanning device, a communication device, an operation panel and the like, generates as a target image a document image from a document using the image scanning device, and using the communication device, transmits the target image to the processing server **1** and receives the processed target image.
[0030] In the processing server **1**, the processor **11** acts as a target image acquiring unit **21**, an instruction object detecting unit **22**, an instruction determining unit **23**, a replacement processing unit **24**, a user edit processing unit **25**, and an output processing unit **26**, as the aforementioned processing units.
[0031] The target image acquiring unit **21** acquires as a target image (image data of) a document image of a document from the storage device **12**, the communication device **13** or the like, and stores the target image into the RAM or the like. For example, this document is a print product outputted by a printing device, and this document image is an image obtained by scanning such document using an image scanning device. For example, this document is a business form or a flyer.
[0032] The instruction object detecting unit **22** detects a first instruction object and a second instruction object in the document image among handwritten objects additionally written to the document using object detection with a learner for which machine learning has been performed (such as YOLO (You Only Look Once), SSD (Single Shot MultiBox Object Detector), FasterR-CNN (Regions with Convolutional Neural Networks) or the like), the first instruction object specifies a process target object, and the second instruction object specifies data used for a replacement process of the process target object.
[0033] The handwritten objects are individual foreground images other than a background. Further, the machine leaning may be performed using training data that includes a document image in which each instruction object variously handwritten overlaps a movable-type object, and thereby even if the instruction object overlaps a movable-type object in the target image, the instruction object is properly detected. Further, if a size of the document image is different from a size of input data of this learner (i.e. objection detection model), the document image is converted to get the same size as the input data size of the leaner (i.e. objection detection model). For example, if a size of the document image is an A4 size of 300 dpi, i.e. 2480 pixels by 3507 pixels, and the input data size is 640 pixels by 640 pixels, then resolution of the document image is converted, and thereby a size of the document image becomes 640 pixels by 640 pixels. Further, for each of the detected objects, output data of this learner includes a classification (which one of the first instruction object, the second instruction object and an object other than them), a bounding box (i.e. a position and a size of it), and a confidence of the classification (any value from 0 to 1).
[0034] FIG. **2** shows a diagram that indicates an example of a target image that includes a first instruction object and a second instruction object.
[0035] Here, the first instruction object and the second instruction object have different shapes from each other. In this embodiment, as shown in FIG. **2**, for example, the first instruction object **111** is a strikethrough line (e.g. two lines of straight line shapes, or the like), and the second instruction object **112** is a surrounding line (any closed curved line of a circular shape, or the like).
[0036] As shown in FIG. **2**, for example, in the target image **101**, the first instruction object **111** is described over an object **113** to be changed in the replacement. Further, as shown in FIG. **2**, for example, in the target image **101**, data **114** used in the replacement (in FIG. **2**, “20%”) is described in an area specified by the second instruction object **112** (here, an area inside of the surrounding line).
[0037] For the aforementioned learner, the machine learning has been performed using as training data that includes the first and second instruction objects having plural colors, plural line width, and plural shapes. Consequently, a writing implement used to write the first and second instruction

objects on a document is not limited, and even if there is fluctuation of a shape of it due to handwriting, the first and second instruction objects are properly detected.

[0038] FIG. **3** shows a diagram that explains objects determined in the target image shown in FIG. **2**. FIG. **4** shows a diagram that indicates an example of a target image after a replacement process.

[0039] As shown in FIG. **3**, for example, the instruction determining unit **23** determines a process target object **113** specified by the detected first instruction object **111** and determines data **114** for the replacement process mentioned below, specified by the detected second instruction object **112**. As shown in FIG. **4**, for example, the replacement processing unit **24** performs a replacement process of the determined process target object **113** with the determined aforementioned data **114** in the target image **101**.

[0040] Specifically, as shown in FIG. **3**, for example, the aforementioned object detection indicates a bounding box **111***a* of the first instruction object **111** (i.e. a position and a size of the object **111**), a bounding box **112***a* of the second instruction object **112** (i.e. a position and a size of the object **112**), a bounding box **113***a* of the process target object **113** (i.e. a position and a size of the object **113**), and a bounding box **114***a* of the data **114** (i.e. a position and a size of the data **114** as an object); and on the basis of relative positional relationships of them, the instruction determining unit **23** determines the process target object **113** specified by the first instruction object **111**, determines the data **114** specified by the second instruction object **112**, and associates the first instruction object **111** and the second instruction object **112** with each other in the target image **101**.

[0041] Further in this embodiment, the instruction object detecting unit **23** performs a character recognition process for an image area specified by the second instruction object and thereby determines text data described in the image area, and the replacement processing unit **24** deletes the process target object and adds an object based on the determined text data at a position of the process target object in the target image (i.e. arranges the object as a foreground image. In this process, the added object (specifically, a text as an object) is generated such that the added object has the same font type, the same color, and the same size as them of the process target object.

[0042] Specifically, as show in FIG. **4**, the replacement processing unit **24** converts the process target object **113** and the data **114** from raster images to text data (here, “15%” and “20%”) using the character recognition process, deletes the first instruction object **111**, the second instruction object **112**, the process target t object **113**, and the data **114** (specifically, foreground images inside of the bounding boxes **111***a*, **112***a*, **113***a* and **114***a*), converts the data **114** from text data to a raster image, and adds it at a position of the bounding box **113***a*.

[0043] The user edit processing unit **25** performs edit based on a user operation for the target image after the replacement process. Specifically, the user edit processing unit **25** (a) performs changing the process target object or the data in accordance with the user operation, and (b) performs edit of the target image correspondingly to the changing.

[0044] Furthermore, the output processing unit **26** outputs the target image after the aforementioned process. For example, the output processing unit **26** transmits image data of the target image to the image forming apparatus **2**, causes the image forming apparatus **2** to print the target image or stores the target image into a predetermined storage device (the image forming apparatus **2**, another server or the like).

[0045] The following part explains a behavior of the aforementioned image processing system. FIG. **5** shows a flowchart that explains a behavior of the image processing system shown in FIG. **1**.

[0046] The target image acquiring unit **21** acquires a target image (in Step S**1**). Here, the aforementioned first and second instruction objects and the data **114** are additionally described by handwriting on a document printed by the image forming apparatus **2**, and thereafter, a document image is obtained by scanning an image of the document, and the document image (image data) is transmitted as the target image from the image forming apparatus **2** to the processing server **1**.

[0047] In the processing server **1**, upon obtaining the target image, the object detecting unit **22** detects the first instruction object **111** and the second instruction object **112** with the process target

object **113** and the data **114** in the target image **101** using object detection (in Step S**2**).
[0048] On the basis of a result of the objection detection, the instruction determining unit **23** determines the process target object **113** specified by the detected first instruction object **111**, and determines the data **114** specified by the detected second instruction object **112** (in Step S**3**). Here, determined are a relationship between the first instruction object **111** and the process target image **113**, a relationship between the second instruction object **112** and the data **114**, and a relationship between the first instruction object **111** and the second instruction object **112**.
[0049] Subsequently, the replacement processing unit **24** performs the replacement process of the determined process target object **113** with the determined aforementioned data **114** in the target image **101** on the basis of the relationships determined by the instruction determining unit **23** (in Step S**4**).
[0050] After the replacement process is finished, the user edit processing unit **25** transmits to the image forming apparatus **2** the target image for which the replacement process has been performed, and causes the image forming apparatus **2** to display it. The image forming apparatus **2** displays on a display device or the like the target image for which the replacement process has been performed (in Step S**5**).
[0051] The user visually confirms the displayed target image, determines whether the replacement process has been properly performed or not, and performs a user operation that indicates the determination result, to the image forming apparatus **2** (an input device of an operation panel of it). Further, if the user determined that the replacement process has not been properly performed, then the user performs a user operation for edit to the image forming apparatus **2** (an input device of an operation panel of it). The image forming apparatus **2** informs the user edit processing unit **25** of the processing server **1** of these user operations.
[0052] The user edit processing unit **25** determines whether the replacement process has been properly performed or not on the basis of the information (in Step S**6**). If it is determined that the image process has been properly performed, then the output processing unit **26** outputs the target image for which the replacement process has been performed.
[0053] Contrarily, if it is determined that the image process has not been properly performed, then the user edit processing unit **25** (a) performs changing the process target object **113** or the data **114** in accordance with the informed user operation, and (b) performs edit of the target image correspondingly to the changing (in Step S**7**). Afterward, the output processing unit **26** outputs the edited target image.
[0054] For example, an EDIT key (soft key) is displayed so as to be adjacent to the data **114** added by the replacement process in the target image; and if the EDIT key is pressed, a dialog is displayed, a user operation to input edit details is performed to the dialog, and in accordance with the user operation, changing the process target object **113** or the data is performed.
[0055] As shown in FIG. **4**, for example, when “15%” was replaced with “20%”, if a user wants to change it to another value (“35%” or the like) or if “26%” is misdetected as “20%” in the character recognition process, then a proper value (“35%” or “26%” as mentioned) for the user is inputted, and the user edit processing unit **25** changes a part corresponding to the data **114** in the target image to an image of the inputted value.
[0056] Further, as shown in FIGS. **3** and **4**, if the process target object 113 should be recognized as “15%” but is recognized as “15” in error and the replacement process changes “15%” to “20%” for example, then in accordance with a user operation, a range of the process target object **113** (i.e. a range of an object specified by the first instruction object **111**) is changed (here, enlarged) to “15%” and then the user edit processing unit **25** causes the replacement processing unit **24** to perform the replacement process again on the basis of the changed process target image **113** and thereby causes to properly replace “15%” with “20%”.
[0057] As mentioned, in Embodiment 1, the instruction object detecting unit **22** detects a first instruction object and a second instruction object in the target image among handwritten objects

additionally written to the document, and here the first instruction object specifies a process target object, and the second instruction object specifies data used for a replacement process of the process target object. The instruction determining unit **23** determines the process target object **113** specified by the detected first instruction object **111**, and determines the data **114** specified by the detected second instruction object **112**. The replacement processing unit **24** performs a replacement process of the determined process target object **113** with the determined data **114** in the target image **101**.

[0058] Consequently, using object detection removes limitation on a writing implement used to write the first and second instruction objects **111** and **112** on a document, and the instruction objects **111** and **112** to specify targets used for the replacement process are properly detected in the target image.

Embodiment 2

[0059] FIG. **6** shows a block diagram that indicates a configuration of an image processing system in Embodiment 2 of the present disclosure. The image processing system shown in FIG. **6** includes a processing server **201** and an image forming apparatus **202** (multi function peripheral or the like) similar to the image forming apparatus **2**, capable of communication through a network with each other.

[0060] The processing server **201** includes a processor **211** identical or similar to the processor **11**, a storage device **212** identical or similar to the storage device **12**, and a communication device **213** identical or similar to the communication device **13**.

[0061] In the processing server **201**, the processor **211** acts as a target image acquiring unit **221**, an instruction object detecting unit **222**, a character area detecting unit **223**, an instruction determining unit **224**, a replacement processing unit **225**, and an output processing unit **226**.

[0062] The target image acquiring unit **221** is a processing unit identical or similar to the target image acquiring unit **21**.

[0063] The instruction object detecting unit **222** detects a first instruction object and a second instruction object in the target image among handwritten objects additionally written to the document, as well as the instruction object detecting unit **22**. Here, the first instruction object specifies a process target object, and the second instruction object specifies a replacement object used for a replacement process of the process target object.

[0064] A handwritten object, and input data and output data of the learner in Embodiment 2 are identical or similar to the handwritten object, and the input data and the output data of the learner in Embodiment 1.

[0065] FIG. **7** shows a diagram that indicates an example of a target image that includes a first instruction object and a second instruction object. FIG. **8** shows a diagram that explains instruction objects determined in the target image shown in FIG. **7**.

[0066] Here, the first instruction object and the second instruction object have different shapes from each other. In this embodiment, as shown in FIG. **7**, for example, the first instruction object **311** is a strikethrough line (e.g. two lines of straight line shapes, or the like), and the second instruction object **312** is a surrounding line (any closed curved line of a circular shape, or the like).

[0067] As shown in FIG. **7**, for example, the first instruction object **311** is described over an object **313** (in FIG. **7**, “14”) to be changed in the replacement process in a target image **301**. Further, as shown in FIG. **7**, for example, in the target image **301**, a replacement object **314** (in FIG. **7**, “13”) is described in an area specified by the second instruction object **312** (here, an area inside of a surrounding line).

[0068] Furthermore, as shown in FIG. **8**, for example, using the aforementioned object detection, the instruction object detecting unit **222** determines a bounding box **311***a* of the first instruction object **311** (i.e. a position and a size of the object **311**) and a bounding box **312***a* of the second instruction object **312** (i.e. a position and a size of the object **312**).

[0069] FIG. **9** shows a diagram that explains character objects (character areas) determined in the

target image shown in FIG. **7**.
[0070] Further, the character area detecting unit **223** detects character objects **321** (i.e. character areas) of a movable-type character and a handwritten character in the target image **301**, as shown in FIG. **9**, for example, using an existing character recognition process. Specifically, the character area detecting unit **223** determines a bounding box of each of the character objects **321**.
[0071] Further, the instruction determining unit **224** determines a process target object **313** specified by the detected first instruction object **311** and determines a replacement object **314** specified by the detected second instruction object **312**.
[0072] Specifically, a character object **321** nearest to a position of the first instruction object **311** determined as mentioned (i.e. a character object **321** of which a bounding box overlaps a bounding box of the first instruction object **311**) is identified as a process target object **313**, and a character object **321** nearest to a position of the second instruction object **312** determined as mentioned is identified as a replacement object **314**. Further, on the basis of a relative positional relationship between them and/or the like, the instruction determining unit **224** associates with each other the first and second instruction object **311** and **312** adjacent to each other in the target image **301**.
[0073] FIG. **10** shows a diagram that indicates an example of a target image after a replacement process performed for the target image shown in FIG. **7**.
[0074] As shown in FIG. **10**, for example, the replacement processing unit **225** performs a replacement process of the determined process target object **313** with the determined aforementioned replacement object **314** in the target image **301**.
[0075] In Embodiment 2, the replacement processing unit **225** deletes the process target object **313** and adds as an image object the replacement object **314** (i.e. raster image) specified by the detected second instruction object **312** at a position of the process target object in the target image **301**.
[0076] In this process, the replacement processing unit **225** generates a replacement object **314** to be added such that the added object has the same font type, the same color, and the same size as them of the process target object **313**. In this process, a size of the replacement object **314** to be added such that a size of a bounding box of the replacement object **314** to be added (here, a bounding box of the corresponding character object **321**) agrees with a size of a bounding box of the process target object **313** (here, a bounding box of the corresponding character object **321**), namely such that widths and/or heights of the both agree with each other of the both.
[0077] FIG. **11** shows a diagram that indicates another example of a target image that includes a first instruction object and a second instruction object. As shown in FIG. **11**, for example, if another first instruction object **331** overlaps the second instruction object **312** and/or the replacement object **314**, and another second instruction object **332** and another replacement object **333** are included in the target image **301**, then the aforementioned replacement process is performed without the second instruction object **312** and/or the replacement object **314** overlapped by the other first instruction object **331**, on the basis of the other second instruction object **332** and the other replacement object **333**.
[0078] Further, the output processing unit **226** is a processing unit identical or similar to the output processing unit **26**.
[0079] The following part explains a behavior of the image processing system in Embodiment 2. FIG. **12** shows a flowchart that explains a behavior of the image processing system shown in FIG. **6**.
[0080] In the processing server **201**, the target image acquiring unit **221** acquires a target image as well as in Embodiment 1 (in Step S**201**).
[0081] In the processing server **201**, upon obtaining the target image, the object detecting unit **222** detects the first instruction object **311** and the second instruction object **312** in the target image **301** using object detection (in Step S**202**). Further, the character area detecting unit **223** detects a character object **321** in the target image **301**.
[0082] On the basis of a result of the objection detection and detection result of the character

object, the instruction determining unit **224** determines the process target object **313** specified by the detected first instruction object **311**, and determines the replacement object **314** specified by the detected second instruction object **312** (in Step S**203**). Here, determined are a relationship between the first instruction object **311** and the process target image **313**, a relationship between the second instruction object **312** and the replacement object **314**, and a relationship between the first instruction object **311** and the second instruction object **312**.

[0083] Subsequently, the replacement processing unit **225** performs the replacement process of the determined process target object **313** with the determined aforementioned replacement object **314** in the target image **301** on the basis of the relationships determined by the instruction determining unit **224** (in Step S**204**).

[0084] After the replacement process is finished, the output processing unit **226** performs displaying or the like of the target image for which the replacement process has been performed (in Step S**205**).

[0085] Other parts of the configuration and behaviors of the image processing system in Embodiment 2 are identical or similar to those in Embodiment 1, and therefore not explained here.

[0086] As mentioned, in Embodiment 2, the instruction object detecting unit **222** detects a first instruction object **311** and a second instruction object **312** in a target image **301** among handwritten objects additionally written to a document of the target image, and here the first instruction object specifies a process target object, and the second instruction object specifies a replacement object used for a replacement process of the process target object. The instruction determining unit **224** determines a process target object **313** specified by the detected first instruction object **311** and determines a replacement object **314** specified by the detected second instruction object **312**. The replacement processing unit **225** performs a replacement process of the determined process target object **313** with the determined replacement object **314** in the target image **301**.

[0087] In particular, in Embodiment 2, the process target object **313** is replaced with an image object (raster image) of the replacement object **314**.

[0088] Consequently, using object detection removes limitation on a writing implement used to write the first and second instruction objects **311** and **312** on a document, and the instruction objects **311** and **312** to specify targets used for the replacement process are properly detected in the target image **301**.

Embodiment 3

[0089] FIG. **13** shows a diagram that indicates another example of a target image that includes a first instruction object and a second instruction object. FIG. **14** shows a diagram that explains instruction objects determined in the target image shown in FIG. **13**. FIG. **15** shows a diagram that indicates an example of a target image after a replacement process performed for the target image shown in FIG. **13**.

[0090] For example, in a target image **401** shown in FIG. **13**, the instruction object detecting unit **222** detects a first instruction object **411** (a bounding box **211***a*) and a second instruction object **412** (a bounding box **212***a*), and the character area detecting unit **223** detects a character object **421**. The instruction determining unit **224** determines a process target object **413** specified by the detected first instruction object **411** and determines a replacement object **414** specified by the detected second instruction object **412**.

[0091] In Embodiment 3, the replacement processing unit **225** performs a character recognition process for the replacement object **414** and thereby converts the replacement object **44** (here, a raster image of “20%”) to text data. Further, the replacement processing unit **225** deletes the process target object **413** (and the first instruction object **411**, the second instruction object **412**, and the replacement object **414**), and adds an image object based on the text data (i.e. a raster image obtained by rasterizing the text data) at a position of the process target object **413** (i.e. arranges this object as a foreground image). In this process, the replacement processing unit **225** generates the image object to be added such that this image object (specifically, a character in the image object)

has the same font type, the same color, and the same size as them of the process target object **413**.
[0092] In Embodiment 3, if a font type of the process target object **413** can not be determined or if the process target object **413** is a handwritten character, then the replacement processing unit **225** may determine a font type nearest to the process target object **413** on the basis of a character shape of it and generate the image object corresponding to the replacement object **414** with the determined font type. Alternatively, if a font type of the process target object **413** can not be determined or if the process target object **413** is a handwritten character, then the replacement processing unit **225** may generate the image object corresponding to the replacement object **414** with a font type specified by a user (i.e. by a user setting or a user operation).
[0093] Other parts of the configuration and behaviors of the image processing system in Embodiment 3 are identical or similar to those in Embodiment 1 or 2, and therefore not explained here.

Embodiment 4

[0094] In Embodiment 4, the replacement object **314** used for the replacement process is selectable as any one of text data and image data by a user.
[0095] In Embodiment 4, the replacement processing unit **225** determines an operation mode specified by a user (a user setting stored in advance or a user operation).
[0096] If the determined operation mode is a first mode, then as well as in Embodiment 2, the replacement processing unit **225** deletes the process target object and adds as an image object the replacement object (i.e. raster image) specified by the detected second instruction object at a position of the process target object in the target image.
[0097] Contrarily, if the determined operation mode is a second mode, then as well as in Embodiment 3, the replacement processing unit **225** (a) performs a character recognition process for the replacement object specified by the second instruction object and thereby converts the replacement object to text data, and (b) deletes the process target object and adds an image object based on the text data at a position of the process target object in the target image.
[0098] Other parts of the configuration and behaviors of the image processing system in Embodiment 4 are identical or similar to those in any of Embodiments 1 to 3, and therefore not explained here.
[0099] It should be understood that various changes and modifications to the embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the present subject matter and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.
[0100] For example, in Embodiment 1, the user edit processing unit **25** may be installed in the image forming apparatus **2**, rather than in the processing server **1**.
[0101] Further, in Embodiment 1, the replacement process is performed after the data **114** is converted to text data. Alternatively, the replacement process may be performed using image data (raster image data) of the data **114**. In the aforementioned example, a character (number or the like) is described as the data **114** by handwriting, but the data **114** may be a handwritten figure or the like.
[0102] Furthermore, in the aforementioned embodiments 1 to 4, the processing server **1** or **201** may be installed in the image forming apparatus **2** or **202**.
[0103] Furthermore, in Embodiments 1 to 4, the first instruction object is a strikethrough line but may be an underline, a band-shaped line by a light transparency marker such as fluorescent marker, or the like. A writing implement used to add the aforementioned instruction objects to a document may be a light transparency marker, a ballpoint pen, a pencil or the like, and may be a writing implement of which a writing color is an achromatic color or may be a writing implement of which a writing color is a chromatic color.
[0104] Furthermore, in Embodiments 2 to 4, the character area detecting unit **223** may convert

character objects in a target image to a series of text data using a character recognition process, perform a morphological analysis for the series of the text data, and set as a target of the aforementioned replacement process a part or all of morphemes in text data of the process target object corresponding to morphemes of text data of the replacement object.
[0105] Furthermore, in Embodiments 2 to 4, when the first and second instruction objects, the process target object, and the replacement object are deleted, for example, in accordance with an existing image inpainting technique, these objects are replaced with a background image on the basis of a surrounding background of these objects such that an area of these objects are matched to the surrounding background after the deletion.
[0106] Furthermore, in Embodiments 2 to 4, the replacement object may be extracted as a character object detected by the character area detecting unit **223**, and otherwise may be extracted as a remaining object in a bounding box of the second instruction object (surrounding line or the like) after deleting the second instruction object from a foreground image in the bounding box.
[0107] Furthermore, in Embodiments 2 to 4, the character area detecting unit **223** detects a character object. Alternatively, the instruction object detecting **222** may detect the character object together with the instruction objects in a target image.

Claims

1. An image processing system, comprising: a target image acquiring unit configured to acquire as a target image a document image of a document; an instruction object detecting unit configured to detect a first instruction object and a second instruction object in the target image among handwritten objects additionally written to the document, the first instruction object specifying a process target object, and the second instruction object specifying data used for a replacement process of the process target object; an instruction determining unit configured to determine the process target object specified by the detected first instruction object and determine the data specified by the detected second instruction object; and a replacement processing unit configured to perform a replacement process of the determined process target object with the determined data in the target image.
2. The image processing system according to claim 1, wherein the first instruction object and the second instruction object have different shapes from each other.
3. The image processing system according to claim 2, wherein the first instruction object is a strikethrough line; and the second instruction object is a surrounding line.
4. The image processing system according to claim 1, wherein for the learner the machine learning has been performed using as training data plural document images that include the first and second instruction objects having plural colors, plural line width, and plural shapes.
5. The image processing system according to claim 1, wherein for each of the detected objects, the learner outputs at least classifications including the first and second instruction objects, and a bounding box of each of the detected objects; on the basis of the bounding boxes, the instruction determining unit determines the process target object specified by the detected first instruction object, and determines the data specified by the detected second instruction object.
6. The image processing system according to claim 1, wherein the instruction determining unit performs a character recognition process for an image area specified by the second instruction object and thereby determines text data described in the image area; and the replacement processing unit deletes the process target object and adds an object based on the determined text data at a position of the process target object in the target image.
7. The image processing system according to claim 1, further comprising a user edit processing unit configured to perform edit based on a user operation for the target image after the replacement process; wherein the user edit processing unit (a) performs changing the process target object or the data in accordance with the user operation, and (b) performs edit of the target image

correspondingly to the changing.

8. The image processing system according to claim 1, wherein the instruction object detecting unit detects a first instruction object and a second instruction object in the target image among handwritten objects additionally written to the document, the first instruction object specifying a process target object, and the second instruction object specifying a replacement object used for a replacement process of the process target object; the instruction determining unit determines the process target object specified by the detected first instruction object and determine the replacement object specified by the detected second instruction object; and the replacement processing unit performs a replacement process of the determined process target object with the determined replacement object in the target image.

9. The image processing system according to claim 8, wherein the replacement processing unit (a) performs a character recognition process for the replacement object specified by the second instruction object and thereby converts the replacement object to text data, and (b) deletes the process target object and adds an image object based on the text data at a position of the process target object in the target image.

10. The image processing system according to claim 8, wherein the replacement processing unit deletes the process target object and adds as an image object the replacement object specified by the detected second instruction object at a position of the process target object in the target image.

11. The image processing system according to claim 8, wherein the replacement processing unit determines an operation mode specified by a user; if the operation mode is a first mode, the replacement processing unit deletes the process target object and adds as an image object the replacement object specified by the detected second instruction object at a position of the process target object in the target image; and if the operation mode is a second mode, the replacement processing unit (a) performs a character recognition process for the replacement object specified by the second instruction object and thereby converts the replacement object to text data, and (b) deletes the process target object and adds an image object based on the text data at a position of the process target object in the target image.

12. The image processing system according to claim 9, wherein the replacement processing unit generates the image object so as to make a size of the image object agree with a size of the process target object.