

IMAGE PROCESSING METHOD AND DEVICE

TECHNICAL FIELD

[0001] The present application relates to the field of image processing technologies, and in particular, to image processing methods and devices.

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BACKGROUND

[0002] With the rapid development of Internet technologies, image recognitions such as face recognition and certificate image recognition are used in more and more network services. However, many images are marked by reticulated patterns and watermarks. As a result, image recognition efficiency reduces and image recognition
10 difficulty increases.

SUMMARY

[0003] A main object of the present application is to provide image processing methods and devices.

[0004] The present application is implemented by using the following technical
15 solutions:

[0005] An image processing method is provided, where the method includes: removing an interference factor from an original image by using a plurality of methods, to obtain a plurality of sample images; segmenting each sample image into a plurality of sample sub-images based on a predetermined segmentation rule;
20 determining a target sub-image from sample sub-images that have the same attributes; and combining a plurality of target sub-images with different attributes into a target image.

[0006] Optionally, the determining a target sub-image from sample sub-images that have the same attributes includes: determining a mathematical parameter of each
25 sample sub-image; dividing the sample sub-images that have the same attributes into a plurality of image sets based on the mathematical parameters by using a clustering

algorithm, where each image set includes one or more sample sub-images; and determining the target sub-image from an image set that includes the maximum number of sample sub-images.

[0007] Optionally, the determining a mathematical parameter of each sample sub-image includes: generating an RGB vector for the sample sub-image based on RGB information of each pixel in the sample sub-image to use the RGB vector as the mathematical parameter of the sample sub-image.

[0008] Optionally, the determining the target sub-image from an image set that includes the maximum number of sample sub-images includes: determining, as the target sub-image from the image set that includes the maximum number of sample sub-images, a sample sub-image that corresponds to the center point in the image set obtained after clustering.

[0009] Optionally, the combining a plurality of target sub-images with different attributes into a target image includes: combining the plurality of target sub-images with different attributes into the target image based on location coordinates of each pixel in the target sub-image.

[0010] An image processing device is provided, where the device includes: an interference removing unit, configured to remove an interference factor from an original image by using a plurality of methods, to obtain a plurality of sample images; an image segmentation unit, configured to segment each sample image into a plurality of sample sub-images based on a predetermined segmentation rule; a target determining unit, configured to determine a target sub-image from sample sub-images that have the same attributes; and a target combination unit, configured to combine a plurality of target sub-images with different attributes into a target image.

[0011] Optionally, the target determining unit includes: a parameter determining subunit, configured to determine a mathematical parameter of each sample sub-image; a set division subunit, configured to divide the sample sub-images that have the same attributes into a plurality of image sets based on the mathematical parameters by using a clustering algorithm, where each image set includes one or more sample sub-images; and a target determining subunit, configured to determine the target sub-image from an image set that includes the maximum number of sample sub-images.

[0012] Optionally, the parameter determining subunit is configured to generate an RGB vector for the sample sub-image based on RGB information of each pixel in the

sample sub-image to use the RGB vector as the mathematical parameter of the sample sub-image.

[0013] Optionally, the target determining subunit is configured to determine, as the target sub-image from the image set that includes the maximum number of sample sub-images, a sample sub-image that corresponds to the center point in the image set obtained after clustering.

[0014] Optionally, the target combination unit is configured to combine the plurality of target sub-images with different attributes into the target image based on location coordinates of each pixel in the target sub-image.

[0015] It can be seen that in the present application, the interference factor in the original image can be removed first by using the plurality of methods, to obtain a plurality of sample images. Each of the plurality of sample images can then be segmented into a plurality of sample sub-images based on the predetermined segmentation rule. The target sub-image can then be determined from the sample sub-images that have the same attributes, so that a target sub-image most similar to a real image can be determined from the plurality of sample sub-images that have the same attributes. The plurality of target sub-images with different attributes can then be combined into the target image. As such, the obtained target image can restore the real image with high precision to improve accuracy of subsequent image recognition.

BRIEF DESCRIPTION OF DRAWINGS

[0016] FIG. 1 is a schematic flowchart illustrating an image processing method, according to an example implementation of the present application;

[0017] FIG. 2 is a schematic diagram illustrating segmentation of a sample image, according to an example implementation of the present application;

[0018] FIG. 3 is a schematic diagram illustrating a procedure for determining a target sub-image from sample sub-images that have the same attributes, according to an example implementation of the present application;

[0019] FIG. 4 is a schematic structural diagram illustrating an image processing device, according to an example implementation of the present application; and

[0020] FIG. 5 is a schematic structural diagram illustrating an image processing device, according to an example implementation of the present application.

DESCRIPTION OF IMPLEMENTATIONS

[0021] Example implementations are described in detail here, and examples of the implementations are presented in the accompanying drawings. When the following description refers to the accompanying drawings, unless specified otherwise, same numbers in different accompanying drawings represent the same or similar elements. Implementations described in the following example implementations do not represent all implementations consistent with the present application. On the contrary, they are only examples of devices and methods described in the appended claims in detail and consistent with some aspects of the present application.

[0022] The terms used in the present application are merely used for the purpose of illustrating implementations, and are not intended to limit the present application. The terms "a", "said" and "the" of singular forms used in the present application and the appended claims are also intended to include plural forms, unless otherwise specified in the context. It should also be understood that, the term "and/or" used here indicates and includes any or all possible combinations of one or more associated items.

[0023] It should be understood that although the terms "first", "second", "third", etc. can be used in the present application to describe various types of information, the information is not limited by the terms. These terms are merely used to differentiate information of the same type. For example, without departing from the scope of the present application, first information may be referred to as second information, and similarly the second information may also be referred to as the first information. Depending on the context, for example, the word "if" used here may be explained as "while", "when", or "in response to determining".

[0024] In the related technology, some image processing algorithms or image processing tools such as Photoshop can be used to remove reticulated patterns or watermarks in an original image. However, in such cases, an image obtained by removing the reticulated pattern or the watermark usually cannot restore the real image of the original image. As a result, image recognition accuracy may be affected.

[0025] FIG. 1 is a schematic flowchart illustrating an image processing method, according to an example implementation of the present application.

[0026] Referring to FIG. 1, the image processing method can be applied to a terminal device. The terminal device can include an intelligent device such as a

smartphone, a tablet computer, a personal digital assistant (PDA), and a PC. The image processing method can also be applied to a server, which is not limited in the present application. The image processing method can include the following steps.

[0027] Step 101: Remove an interference factor from an original image by using a plurality of methods, to obtain a plurality of sample images.

[0028] In the present implementation, the original image is usually an image to be recognized. The original image may include one or more interference factors. The interference factor is usually an interference pattern such as a reticulated pattern or a watermark added to the real image.

[0029] In the present implementation, the interference factor in the original image can be removed by using different interference factor removing methods provided in the related technology to obtain the plurality of sample images. For example, the interference factor in the original image can be removed by using image processing software such as Photoshop.

[0030] Step 102: Segment each sample image into a plurality of sample sub-images based on a predetermined segmentation rule.

[0031] Based on step 101, after the plurality of sample images are obtained, each sample image can be segmented into a plurality of sub-images based on the predetermined segmentation rule. For ease of description, the sub-image obtained after the segmentation can be referred to as a sample sub-image.

[0032] In the present implementation, the predetermined segmentation rule can be set by a developer. In the predetermined segmentation rule, the unit used for segmenting can be the size of the sample sub-image, or a number of sample sub-images, which is not limited in the present application. For example, the predetermined segmentation rule can be segmenting a sample image into 25 sample sub-images, such as segmenting the sample image into 25 sample sub-images based on a 5x5 rule.

[0033] In the present implementation, N sample images can be obtained if the interference factor in the original image is removed by using N different methods in step 101. Further, a total of $N \times M$ sample sub-images can be obtained if each sample image is segmented into M sample sub-images. M and N are natural numbers greater than 1.

[0034] Step 103: Determine a target sub-image from sample sub-images that have

the same attributes.

[0035] In the present implementation, each sample sub-image includes a corresponding attribute. The attribute can be used to indicate location information of the sample sub-image in a sample image that includes the sample sub-image.

5 Referring to FIG. 2, assume that image A is a sample image obtained by removing interference in the original image. The sample image can be segmented into 3x3 sample sub-images based on the predetermined segmentation rule. Attributes of the nine sample sub-images are respectively A11, A12, A13, A21, ..., and A33.

[0036] In the present implementation, the segmentation rule shown in FIG. 2 is used as an example. A total of Nx9 sample sub-images can be obtained if the interference factor in the original image is removed by using N different methods to obtain N sample images. There are N sample sub-images with attributes of one of A11 to A33. In the present step, a target sub-image with attribute A11 can be determined from the N sample sub-images with attributes A11, a target sub-image with attribute
10 A12 can be determined from the N sample sub-images with attribute A12, and nine
15 target sub-images with attributes A11 to A33 can be similarly determined.

[0037] Step 104: Combine a plurality of target sub-images with different attributes into a target image.

[0038] Based on step 103, after the target sub-image is determined from the sample sub-images that have the same attributes, the plurality of target sub-images with different attributes can be combined into the target image. For example, the plurality of target sub-images can be combined into the target image based on the attribute of each target sub-image, or the plurality of target sub-images can be combined into the target image based on location coordinates of each pixel in each
20 target sub-image, which is not limited in the present application.

[0039] For example, the segmentation rule shown in FIG. 2 is used as an example. In the present step, the nine target sub-images with attributes A11 to A33 can be combined into one target image.

[0040] It can be seen from the previous description that in the present application, the interference factor in the original image can be removed first by using the plurality of methods, to obtain a plurality of sample images. Each of the plurality of sample images can then be segmented into the plurality of sample sub-images based on the predetermined segmentation rule. The target sub-image can then be determined from the sample sub-images that have the same attributes, so that a target sub-image most
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similar to the real image can be determined from the plurality of sample sub-images that have the same attributes. The plurality of target sub-images with different attributes can then be combined into the target image. As such, the obtained target image can restore the real image with high precision to improve accuracy of subsequent image recognition.

[0041] Optionally, in an example of the present application, referring to FIG. 3, a process of determining a target sub-image from sample sub-images that have the same attributes can include the following steps.

[0042] Step 301: Determine a mathematical parameter of each sample sub-image.

[0043] In the present implementation, after a sample image is segmented into a plurality of sample sub-images, the mathematical parameter of each sample sub-image can be determined for subsequent calculations.

[0044] Optionally, in an example of the present application, an RGB vector can be generated for the sample sub-image based on RGB information of each pixel in the sample sub-image to use the RGB vector as the mathematical parameter of the sample sub-image. For example, the RGB information such as an RGB value of each pixel in the sample sub-image can be obtained first. Then the RGB vector can be generated based on the RGB information of each pixel. The RGB vector of the sample sub-image can be $\{R_1, R_2, \dots, R_K\}$ if the sample sub-image includes K pixels,

where an RGB value of the i th pixel is R_i , and a value of i is 1 to K.

[0045] Step 302: Divide the sample sub-images that have the same attributes into a plurality of image sets based on the mathematical parameters by using a clustering algorithm, where each image set includes one or more sample sub-images.

[0046] In the present implementation, the plurality of sample sub-images that have the same attributes can be divided into the plurality of image sets based on the mathematical parameters of the sample sub-images by using the clustering algorithm. The clustering algorithm can include a Density-Based Spatial Clustering of Applications with Noise (DBSCAN) clustering algorithm, a K-means clustering algorithm, etc., which are not limited in the present application.

[0047] For example, a scanning radius (eps) and the minimum number of points (minPts) can be predetermined when the DBSCAN clustering algorithm is used. Each sample sub-image corresponds to one point in a clustering process. The minimum

number of points is the minimum number of sample sub-images that can be included in an image set obtained after the division. In the clustering process, related calculation can be performed based on the mathematical parameter of the sample sub-image. For example, a distance between RGB vectors of two sample sub-images can be used as a distance between the two sample sub-images.

[0048] Step 303: Determine the target sub-image from an image set that includes the maximum number of sample sub-images.

[0049] Based on step 302, after the sample sub-images that have the same attributes are divided into the plurality of image sets, the number of sample sub-images included in each image set is determined, and then the target sub-image can be determined from the image set that includes the maximum number of sample sub-images.

[0050] Optionally, in an example of the present application, a sample sub-image that corresponds to the center point in the image set obtained after clustering can be determined as the target sub-image from the image set that includes the maximum number of sample sub-images.

[0051] In the present implementation, the clustering algorithm can be used to determine the target sub-image from the sample sub-images that have the same attributes, to ensure that the determined target sub-image is more similar to a real image.

[0052] Corresponding to the implementation of the image processing method, the present application further provides an implementation of an image processing device.

[0053] The implementation of the image processing device in the present application can be applied to a terminal device or a server. The device implementation can be implemented by using software, hardware, or both. Software implementation is used as an example. As a logical device, the device is formed by reading a corresponding computer program instruction in a non-volatile memory into the memory by a processor of the terminal device or the server where the device is located. From a hardware perspective, as shown in FIG. 4, FIG. 4 is a structural diagram illustrating hardware of a terminal device or a server where an image processing device in the present application is located. In addition to a processor, a memory, a network interface, and a non-volatile memory shown in FIG. 4, the terminal device or the server where the device in the present implementation is located can usually include other hardware based on actual functions of the terminal

device or the server. Details are not repeated here.

[0054] FIG. 5 is a schematic structural diagram illustrating an image processing device, according to an example implementation of the present application.

[0055] Referring to FIG. 5, the image processing device 400 can be applied to the
5 terminal device or the server shown in FIG. 4, and includes an interference removing unit 401, an image segmentation unit 402, a target determining unit 403, and a target combination unit 404. The target determining unit 403 can further include a parameter determining subunit 4031, a set division subunit 4032, and a target determining subunit 4033.

10 **[0056]** The interference removing unit 401 is configured to remove an interference factor from an original image by using a plurality of methods, to obtain a plurality of sample images.

[0057] The image segmentation unit 402 is configured to segment each sample image into a plurality of sample sub-images based on a predetermined segmentation
15 rule.

[0058] The target determining unit 403 is configured to determine a target sub-image from sample sub-images that have the same attributes.

[0059] The target combination unit 404 is configured to combine a plurality of target sub-images with different attributes into a target image.

20 **[0060]** The parameter determining subunit 4031 is configured to determine a mathematical parameter of each sample sub-image.

[0061] The set division subunit 4032 is configured to divide the sample sub-images that have the same attributes into a plurality of image sets based on the mathematical parameters by using a clustering algorithm. Each image set includes one
25 or more sample sub-images.

[0062] The target determining subunit 4033 is configured to determine the target sub-image from an image set that includes the maximum number of sample sub-images.

[0063] Optionally, the parameter determining subunit 4031 is configured to
30 generate an RGB vector for the sample sub-image based on RGB information of each pixel in the sample sub-image to use the RGB vector as the mathematical parameter of the sample sub-image.

[0064] Optionally, the target determining subunit 4033 is configured to determine, as the target sub-image from the image set that includes the maximum number of

sample sub-images, a sample sub-image that corresponds to the center point in the image set obtained after clustering.

[0065] Optionally, the target combination unit 404 is configured to combine the plurality of target sub-images with different attributes into the target image based on
5 location coordinates of each pixel in the target sub-image.

[0066] For implementation process of functions and roles of units in the device, reference can be made to an implementation process of a corresponding step. Details are not described here.

[0067] Device implementation can generally correspond to method
10 implementations. As such, for related descriptions, reference can be made to descriptions of the method implementations. The described device implementations are merely examples. The units described as separate parts may or may not be physically separate, and parts displayed as units may or may not be physical units. They may be located in one position, or may be distributed on a plurality of network
15 units. Some or all of the modules can be selected according to actual needs to achieve the objectives of the solutions of the present application. A person of ordinary skill in the art can understand and implement the implementations of the present invention without creative efforts.

[0068] The foregoing descriptions are merely examples of the implementations of
20 the present application. They are not intended to limit the present application. Any modification, equivalent replacement, or improvement made without departing from the spirit and principle of the present application shall fall within the protection scope of the present application.

CLAIMS

1. A computer-implemented method, comprising:
 - identifying a first image to be processed, the first image including one or more interference factors;
 - removing the one or more interference factors from the first image to obtain one or more sample images;
 - segmenting each sample image of the one or more sample images into a plurality of sample sub-images based on a segmentation rule, wherein at least one sample sub-image of the plurality of sample sub-images is associated with a plurality of attributes;
 - determining one or more target sub-images from the plurality of sample sub-images, wherein each target sub-image comprises a combination of sample sub-images associated with a common attribute among the plurality of attributes, and wherein each target sub-image is associated with a different attribute among the plurality of attributes; and
 - combining the one or more target sub-images into a target image.
2. The computer-implemented method of claim 1, wherein determining the one or more target sub-images comprises, after segmented each sample image of the one or more sample images into the plurality of sample sub-images:
 - determining a mathematical parameter of each sample sub-image of the plurality of sample sub-images;
 - dividing the sample sub-images associated with the common attribute into one or more image sets based on the determined mathematical parameters, wherein each image set includes one or more sample sub-images; and
 - determining target sub-images from an image set that includes a maximum number of sample sub-images.
3. The computer-implemented method of claim 2, wherein determining the mathematical parameter of each sample sub-image of the one or more sample sub-images comprises, for each sample sub-image:
 - generating an RGB vector for the sub-image based on RGB information of each pixel in the sample sub-image; and
 - identifying the RGB vector as the mathematical parameter of the sample sub-image.

4. The computer-implemented method of claim 2, wherein the sample sub-images associated with the common attributes are divided into one or more image sets based on the determined mathematical parameters using a clustering algorithm.

5. The computer-implemented method of claim 4, wherein the determining the target sub-image from an image set that comprises the maximum number of sample sub-images comprises:
determining, as the target sub-image from the image set that comprises the maximum number of sample sub-images, a sample sub-image that corresponds to the center point in the image set generated after clustering.

6. The computer-implemented method of claim 1, wherein the one or more interference factors include at least one of a reticulated pattern or a watermark included in the first image.

7. The computer-implemented method of claim 1, wherein removing the one or more interference factors from the first image comprises using a plurality of interference factor removal techniques to obtain the one or more sample images, wherein each of the one or more sample images is obtained based on a corresponding interference factor removal technique of the plurality of interference factor removal techniques, and

wherein at least one of the plurality of interference factor removal techniques includes removal of the one or more interference factors using an image processing software application.

8. The computer-implemented method of claim 1, wherein the attributes associated with a particular sample sub-image represent a location within the sample image associated with the sample image, and wherein combining the one or more target sub-images associated with different attributes into a target image comprises combining the one or more target sub-images associated with different attributes into the target image based on location coordinates of each pixel in the target sub-image.

9. A non-transitory, computer-readable medium storing one or more instructions executable by a computer system to perform the method of claims 1 to 8.

10. A computer-implemented system, comprising:
one or more computers; and

one or more computer memory devices interoperably coupled with the one or more computers and having tangible, non-transitory, machine-readable media storing one or more instructions that, when executed by the one or more computers, perform the method of claims 1 to 8.