METHOD, NON-TRANSITORY COMPUTER-READABLE STORAGE MEDIUM, AND APPARATUS FOR SEARCHING AN IMAGE DATABASE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. Patent Application No. 17/333,707, filed May 28, 2021, and claims the benefit of U.S. Provisional Patent Application No. 63/032,432, filed May 29, 2020, each of which is incorporated by reference herein in its entirety for all purposes.

BACKGROUND

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates to searching images having labels and annotations.

DESCRIPTION OF THE RELATED ART

[0003] Performing image searches is complicated by reference and/or sample images that include image noise such as annotations and labels. Such image noise can confuse existing image matching algorithms and may degrade their output as similar features of annotations and labels are incorrectly matched. This can be particularly impactful for patent images and patent image searches.

[0004] Accordingly, the present disclosure addresses these complications in order to achieve an image search tool broadly applicable and specifically tuned to patent image searching.

[0005] The foregoing "Background" description is for the purpose of generally presenting the context of the disclosure. Work of the inventors, to the extent it is described in this background section, as well as examples of the description which may not otherwise qualify as prior art at the time of filing, are neither expressly or impliedly admitted as prior art against the present disclosure.

SUMMARY

[0006] The present disclosure relates to searching an image database.

[0007] According to a first aspect of the present invention, there is provided a method for searching an image database, comprising receiving, by processing circuitry, an adulterated image of an object, the adulterated image including object annotations for visual reference, applying, by the processing circuitry, a first neural network to the adulterated image, correlating, by the processing circuitry, a result of the applying the first neural network with

each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object, and selecting, by the processing circuitry and as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value, wherein the method further comprises applying, by the processing circuitry, a masking process to the adulterated image, the step of applying the masking process including:

performing, by the processing circuitry and via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, by the processing circuitry and based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, by the process circuitry and based on the bounding boxes and the detected callout features, a contour mask of the object.

[0008] According to a second aspect of the present invention, there is provided a non-transitory computer-readable storage medium storing computer-readable instructions that, when executed by a computer, cause the computer to perform a method for searching an image database, comprising receiving an adulterated image of an object, the adulterated image including object annotations for visual reference, applying a first neural network to the adulterated image, correlating a result of the applying the first neural network with each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object, and selecting, as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value, wherein the method further comprises applying a masking process to the adulterated image, the step of applying the masking process including:

performing, via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, based on the bounding boxes and the detected callout features, a contour mask of the object.

[0009] According to a third aspect of the present invention, there is provided an apparatus for performing a method for searching an image database, comprising processing circuitry configured to receive an adulterated image of an object, the adulterated image including object annotations for visual reference, apply a first neural network to the adulterated image, correlate a result of the applying the first neural network with each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object, and select, as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value, wherein the processing circuitry is further configured to apply a masking process to the adulterated image by

performing, via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, based on the bounding boxes and the detected callout features, a contour mask of the object.

[0010] The foregoing paragraphs have been provided by way of general introduction, and are not intended to limit the scope of the following claims. The described embodiments, together with further advantages, will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] A more complete appreciation of the disclosure and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

CLAIMS

1. A method for searching an image database, comprising:

receiving, by processing circuitry, an adulterated image of an object, the adulterated image including object annotations for visual reference;

applying, by the processing circuitry, a first neural network to the adulterated image;

correlating, by the processing circuitry, a result of the applying the first neural network with each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object; and

selecting, by the processing circuitry and as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value,

wherein the method further comprises applying, by the processing circuitry, a masking process to the adulterated image, the step of applying the masking process including:

performing, by the processing circuitry and via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, by the processing circuitry and based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, by the process circuitry and based on the bounding boxes and the detected callout features, a contour mask of the object.

2. The method according to claim 1, wherein the applying the first neural network includes

editing, by the processing circuitry, the adulterated image to remove the object annotations, an output of the editing being the edited image of the object.

3. The method according to claim 1, further comprising

editing, by the processing circuitry, the adulterated image based on the result of the applying the first neural network and a result of the applying the masking process, the result of the applying the masking process being the generated contour mask of the object.

4. The method according to claim 1, wherein the first neural network is a convolutional neural network configured to perform pixel-level classification.

5. The method according to claim 1, wherein the generating the contour mask of the object includes

applying, by the processing circuitry, object segmentation to the adulterated image.

6. A non-transitory computer-readable storage medium storing computer-readable instructions that, when executed by a computer, cause the computer to perform a method for searching an image database, comprising:

receiving an adulterated image of an object, the adulterated image including object annotations for visual reference;

applying a first neural network to the adulterated image;

correlating a result of the applying the first neural network with each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object; and

selecting, as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value,

wherein the method further comprises applying a masking process to the adulterated image, the step of applying the masking process including:

performing, via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, based on the bounding boxes and the detected callout features, a contour mask of the object.

7. The non-transitory computer-readable storage medium according to claim 6, wherein the applying the first neural network includes

editing the adulterated image to remove the object annotations, an output of the editing being the edited image of the object.

8. The non-transitory computer-readable storage medium according to claim 6, further comprising

editing the adulterated image based on the result of the applying the first neural network and a result of the applying the masking process, the result of the applying the masking process being the generated contour mask of the object.

9. The non-transitory computer-readable storage medium according to claim 6, wherein the first neural network is a convolutional neural network configured to perform pixel-level classification.

10. The non-transitory computer-readable storage medium according to claim 6, wherein the generating the contour mask of the object includes

applying object segmentation to the adulterated image.

11. An apparatus for performing a method for searching an image database, comprising:

processing circuitry configured to

receive an adulterated image of an object, the adulterated image including object annotations for visual reference,

apply a first neural network to the adulterated image,

correlate a result of the applying the first neural network with each image of a reference database of images, the result including an edited image of the object and each image of the reference database of images including a reference object, and

select, as a matching image, one or more images of the reference database of images having correlation values above a threshold correlation value,

wherein the processing circuitry is further configured to apply a masking process to the adulterated image by

performing, via a second neural network, object recognition on the adulterated image to recognize text-based descriptive features,

applying, based on the performing the object recognition, computer vision to detect callout features relative to bounding boxes containing the recognized text-based descriptive features, and

generating, based on the bounding boxes and the detected callout features, a contour mask of the object.

12. The apparatus according to claim 11, wherein the processing circuitry is further configured to apply the first neural network by

editing the adulterated image to remove the object annotations, an output of the editing being the edited image of the object.

13. The apparatus according to claim 11, wherein the processing circuitry is further configured to

edit the adulterated image based on the result of the applying the first neural network and a result of the applying the masking process, the result of the applying the masking process being the generated contour mask of the object.

14. The apparatus according to claim 11, wherein the processing circuitry is further configured to generate the contour mask of the object by

applying object segmentation to the adulterated image.