

WHAT IS CLAIMED IS:

1. A computer-implemented multi-model fusion based method for image annotation, the method being executed by a processor and comprising:

acquiring and preprocessing an image to-be-annotated to obtain a plurality of instance images;

inputting the instance images into a DenseNet network-based classification model for binary classification;

connecting binary-classification results corresponding to the instance images to obtain a classification-result image;

inputting the instance images into a Vnet network-FPN network-based segmentation model for binarization segmentation;

connecting binarization-segmentation results corresponding to the instance images to obtain a segmentation-result image;

calculating a binarization fusion image according to the classification-result image and the segmentation-result image; and

extracting a contour of the fusion image, and annotating a region of interest in the image to-be-annotated according to the contour.

2. The multi-model fusion based method for image annotation of claim 1, wherein inputting the instance images into the DenseNet network-based classification model for binary classification comprises:

for each of the instance images:

determining that a binary-classification result corresponding to the instance image is a first-value block, when the DenseNet network-based classification model predicts that the instance image has the region of interest; or

determining that the binary-classification result corresponding to the instance image is a second-value block, when the DenseNet network-based classification model predicts that the instance image has no region of interest.

3. The multi-model fusion based method for image annotation of claim 2, wherein inputting the instance images into the Vnet network-FPN network-based segmentation model for binarization segmentation comprises:

for each of the instance images:

inputting the instance image into a Vnet network of the segmentation model;
performing, based on the Vnet network, non-linear activation, a plurality of
down-sampling, and a plurality of up-sampling on the instance image sequentially;
and

outputting, based on a FPN network of the segmentation model, a
binarization-segmentation result corresponding to the instance image according to a
result of the plurality of up-sampling.

4. The multi-model fusion based method for image annotation of claim 3, wherein
for each of the instance images:

determining that a region of a binarization-segmentation result corresponding
to the region of interest is a first-value region, when the segmentation model predicts
that the instance image corresponding to the binarization-segmentation result has the
region of interest; or

determining that a region of the binarization-segmentation result
corresponding to a region of uninterested is a second-value region, when the
segmentation model predicts that the instance image corresponding to the
binarization-segmentation result has the region of uninterested.

5. The multi-model fusion based method for image annotation of claim 4, wherein
calculating the binarization fusion image according to the classification-result image and the
segmentation-result image comprises:

taking intersection of the classification-result image and the segmentation-result
image to obtain the binarization fusion image.

6. The multi-model fusion based method for image annotation of claim 5, wherein
taking the intersection of the classification-result image and the segmentation-result image to
obtain the binarization fusion image comprises:

setting a pixel in the fusion image to be a first value, when the pixel in the
classification-result image has the first value and the pixel in the segmentation-result image
has the first value;

setting a pixel in the fusion image to be a second value, when the pixel in the
classification-result image has the second value; and

setting a pixel in the fusion image to be the second value, when the pixel in the

segmentation-result image has the second value.

7. The multi-model fusion based method for image annotation of claim 5, further comprising:

dilating the first-value block in the classification-result image, before taking the intersection of the classification-result image and the segmentation-result image; and
taking the intersection of the classification-result image and the segmentation-result image to obtain the binarization fusion image comprising:

taking intersection of the dilated classification-result image and the segmentation-result image to obtain the binarization fusion image.

8. A multi-model fusion based device for image annotation, comprising:

a preprocessing module, configured to acquire and preprocess an image to-be-annotated to obtain a plurality of instance images;

a binary-classification module, configured to input the instance images into a DenseNet network-based classification model for binary classification;

a classification-connecting module, configured to connect binary-classification results corresponding to the instance images to obtain a classification-result image;

a binarization-segmentation module, configured to input the instance images into a Vnet network-FPN network-based segmentation model for binarization segmentation;

a segmentation-connecting module, configured to connect binarization-segmentation results corresponding to the instance images to obtain a segmentation-result image;

a fusion module, configured to calculate a binarization fusion image according to the classification-result image and the segmentation-result image; and

an annotation module, configured to extract a contour of the fusion image and annotate a region of interest in the image to-be-annotated according to the contour.

9. A computer device, comprising:

a memory, configured to store computer programs; and

a processor, configured to execute the computer programs which, when executed by the processor, cause the processor to:

acquire and preprocess an image to-be-annotated to obtain a plurality of instance images;

input the instance images into a DenseNet network-based classification model

for binary classification;

connect binary-classification results corresponding to the instance images to obtain a classification-result image;

input the instance images into a Vnet network-FPN network-based segmentation model for binarization segmentation;

connect binarization-segmentation results corresponding to the instance images to obtain a segmentation-result image;

calculate a binarization fusion image according to the classification-result image and the segmentation-result image; and

extract a contour of the fusion image, and annotate a region of interest in the image to-be-annotated according to the contour.

10. The computer device of claim 9, wherein the processor configured to input the instance images into the DenseNet network-based classification model for binary classification is configured to:

for each of the instance images:

determine that a binary-classification result corresponding to the instance image is a first-value block, when the DenseNet network-based classification model predicts that the instance image has the region of interest; or

determine that the binary-classification result corresponding to the instance image is a second-value block, when the DenseNet network-based classification model predicts that the instance image has no region of interest.

11. The computer device of claim 10, wherein the processor configured to input the instance images into the Vnet network-FPN network-based segmentation model for binarization segmentation is configured to:

for each of the instance images:

input the instance image into a Vnet network of the segmentation model;

perform, based on the Vnet network, non-linear activation, a plurality of down-sampling, and a plurality of up-sampling on the instance image sequentially; and

output, based on a FPN network of the segmentation model, a binarization-segmentation result corresponding to the instance image according to a result of the plurality of up-sampling.

determine that a region of the binarization-segmentation result corresponding to the region of interest is a first-value region, when the segmentation model predicts that the instance image corresponding to the binarization-segmentation result has the region of interest; or

determine that a region of the binarization-segmentation result corresponding to a region of uninterested is a second-value region, when the segmentation model predicts that the instance image corresponding to the binarization-segmentation result has the region of uninterested.

12. The computer device of claim 11, wherein the processor configured to calculate the binarization fusion image according to the classification-result image and the segmentation-result image is configured to:

take intersection of the classification-result image and the segmentation-result image to obtain the binarization fusion image.

13. The computer device of claim 12, wherein the processor configured to take the intersection of the classification-result image and the segmentation-result image to obtain the binarization fusion image is configured to:

set a pixel in the fusion image to be a first value, when the pixel in the classification-result image has the first value and the pixel in the segmentation-result image has the first value;

set a pixel in the fusion image to be a second value, when the pixel in the classification-result image has the second value; and

set a pixel in the fusion image to be the second value, when the pixel in the segmentation-result image has the second value.

14. The computer device of claim 12, wherein the processor is further configured to:

dilate the first-value block in the classification-result image, before taking the intersection of the classification-result image and the segmentation-result image; and the processor configured to take the intersection of the classification-result image and the segmentation-result image to obtain the binarization fusion image is configured to:

take intersection of the dilated classification-result image and the segmentation-result image to obtain the binarization fusion image.

15. A computer readable storage medium, configured to store computer programs which, when executed by a processor, cause the processor to carry out actions, comprising:

- acquiring and preprocessing an image to-be-annotated to obtain a plurality of instance images;
- inputting the instance images into a DenseNet network-based classification model for binary classification;
- connecting binary-classification results corresponding to the instance images to obtain a classification-result image;
- inputting the instance images into a Vnet network-FPN network-based segmentation model for binarization segmentation;
- connecting binarization-segmentation results corresponding to the instance images to obtain a segmentation-result image;
- calculating a binarization fusion image according to the classification-result image and the segmentation-result image; and
- extracting a contour of the fusion image, and annotating a region of interest in the image to-be-annotated according to the contour.

16. The computer readable storage medium of claim 15, wherein the processor configured to carry out the action of inputting the instance images into the DenseNet network-based classification model for binary classification is configured to carry out actions, comprising:

- for each of the instance images:
 - determining that a binary-classification result corresponding to the instance image is a first-value block, when the DenseNet network-based classification model predicts that the instance image has the region of interest; or
 - determining that the binary-classification result corresponding to the instance image is a second-value block, when the DenseNet network-based classification model predicts that the instance image has no region of interest.

17. The computer readable storage medium of claim 16, wherein the processor configured to carry out the action of inputting the instance images into the Vnet network-FPN network-based segmentation model for binarization segmentation is configured to carry out actions, comprising:

- for each of the instance images:

inputting the instance image into a Vnet network of the segmentation model;
performing, based on the Vnet network, non-linear activation, a plurality of
down-sampling, and a plurality of up-sampling on the instance image sequentially;
and

outputting, based on a FPN network of the segmentation model, a
binarization-segmentation result corresponding to the instance image according to a
result of the plurality of up-sampling.

determining that a region of the binarization-segmentation result
corresponding to the region of interest is a first-value region, when the segmentation
model predicts that the instance image corresponding to the binarization-segmentation
result has the region of interest; or

determining that a region of the binarization-segmentation result
corresponding to a region of uninterested is a second-value region, when the
segmentation model predicts that the instance image corresponding to the
binarization-segmentation result has the region of uninterested.

18. The computer readable storage medium of claim 17, wherein the processor configured
to carry out the action of calculating the binarization fusion image according to the
classification-result image and the segmentation-result image is configured to carry out
actions, comprising:

taking intersection of the classification-result image and the segmentation-result
image to obtain the binarization fusion image.

19. The computer readable storage medium of claim 18, wherein the processor configured
to carry out the action of taking the intersection of the classification-result image and the
segmentation-result image to obtain the binarization fusion image is configured to carry out
actions, comprising:

setting a pixel in the fusion image to be a first value, when the pixel in the
classification-result image has the first value and the pixel in the segmentation-result image
has the first value;

setting a pixel in the fusion image to be a second value, when the pixel in the
classification-result image has the second value; and

setting a pixel in the fusion image to be the second value, when the pixel in the
segmentation-result image has the second value.

20. The computer readable storage medium of claim 18, wherein the processor is further configured to carry out actions, comprising:
- dilating the first-value block in the classification-result image, before taking the intersection of the classification-result image and the segmentation-result image.
 - the processor configured to carry out the action of taking the intersection of the classification-result image and the segmentation-result image to obtain the binarization fusion image is configured to carry out actions, comprising:
 - taking intersection of the dilated classification-result image and the segmentation-result image to obtain the binarization fusion image.