Claims

1. A method of training a radiation image recognition model online, the radiation image recognition model being applied to a radiation inspection system, the radiation inspection system being arranged at a radiation inspection site, preset data being pre-stored in the radiation inspection system, the preset data comprising a first radiation image, and the method comprising:

collecting a second radiation image at the radiation inspection site;

labeling the second radiation image online to form on-site collected data having a second labeling information, wherein the second labeling information is an incomplete labeling information of the second radiation image, and the second labeling information is configured to indicate at least one of objects of interest in the second radiation image;

synthesizing the preset data and the on-site collected data online to form a training data set; and

training the radiation image recognition model online using the training data set.

2. The method according to claim 1, wherein the first radiation image in the preset data comprises at least one of following:

the first radiation image in the preset data has a first labeling information, and the first labeling information is configured to indicate all objects of interest in the first radiation image;

the first radiation image in the preset data does not comprise any object of interest; and

the preset data comprises a plurality of first radiation images, at least one of the plurality of first radiation images has the first labeling information, the first labeling information is configured to indicate all objects of interest in the first radiation image, and at least one of the plurality of first radiation images does not comprise any object of interest.

3. The method according to claim 1 or 2, wherein the synthesizing the preset data

and the on-site collected data online to form a training data set comprises:

extracting an object of interest corresponding to the second labeling information from the second radiation image; and

synthesizing the second labeling information and the extracted object of interest into the first radiation image comprised in the preset data to form the training data set.

4. The method according to claim 2, wherein the first labeling information is configured to indicate all objects of interest of all categories in the first radiation image; and

the second labeling information is configured to indicate objects of interest of at least one of categories in the second radiation image, or the second labeling information is configured to indicate at least one of objects of interest of at least one of categories in the second radiation image.

5. The method according to claim 2 or 4, wherein the first labeling information comprises at least one first labeling box labeled in the first radiation image and at least one first tag labeled in the first radiation image, the at least one first labeling box is configured to indicate locations of all objects of interest in the first radiation image, and the at least one first tag is configured to indicate categories of all objects of interest in the first radiation image.

6. The method according to claim 5, wherein the second labeling information comprises at least one second labeling box labeled in the second radiation image and at least one second tag labeled in the second radiation image, the at least one second labeling box is configured to indicate a location of at least one of objects of interest in the second radiation image, and the at least one second tag is configured to indicate a category of at least one of objects of interest in the second radiation image.

7. The method according to claim 6, wherein the synthesizing the second labeling

information and the extracted object of interest into the first radiation image comprised in the preset data to form the training data set comprises:

inserting the extracted object of interest into the first radiation image to form a training radiation image;

generating a third labeling box and a third tag in the training radiation image, wherein the third labeling box is generated according to the second labeling box, and the third tag is identical to the second tag and configured to indicate a category of an object of interest surrounded by the third labeling box; and

forming the training data set according to the training radiation image having the first labeling box, the first tag, the third labeling box and the third tag.

8. The method according to claim 7, wherein the first radiation image comprises a transparent region and an opaque region, and

the inserting the extracted object of interest into the first radiation image to form a training radiation image comprises:

selecting a region meeting an insertion requirement from the transparent region of the first radiation image as at least one candidate insertion region;

selecting one of the at least one candidate insertion region as an insertion region according to a data synthesis rule; and

inserting the extracted object of interest into the insertion region.

9. The method according to claim 8, wherein the meeting an insertion requirement comprises that: an area or a volume of the candidate insertion region is greater than or equal to an area or a volume of a to-be-inserted object of interest.

10. The method according to claim 8, wherein the data synthesis rule comprises that: in the first radiation image, a concealment degree of a surrounding object to the candidate

insertion region meets a specified requirement.

11. The method according to any one of claims 1, 2, 4 and 6 to 10, wherein the method further comprises:

forming a quasi-complete labeling information of the second radiation image according to the incomplete labeling information of the second radiation image; and

determining the second radiation image having the quasi-complete labeling information as a portion of the training data set.

12. The method according to claim 11, wherein the forming a quasi-complete labeling information of the second radiation image according to the incomplete labeling information of the second radiation image comprises:

detecting an unlabeled object of interest in the second radiation image;

calculating a similarity between the unlabeled object of interest and an object of interest corresponding to the second labeling information; and

labeling, in response to the similarity meeting a similarity threshold requirement, the unlabeled object of interest using the second labeling information, so as to form the quasi-complete labeling information of the second radiation image.

13. The method according to any one of claims 8 to 10, wherein the inserting the extracted object of interest into the first radiation image to form a training radiation image comprises:

performing a data augmentation operation on the extracted object of interest to form augmentation data, wherein a number of extracted objects of interest is n, and a number of objects of interest comprised in the augmentation data is N, N=m*n, where n is a positive integer greater than or equal to 1, and m is a positive integer greater than or equal to 2; and

inserting the N objects of interest comprised in the augmentation data into the

first radiation image respectively, so as to form a plurality of training radiation images,

wherein the data augmentation operation comprises at least one selected from: a flip operation, a rotation operation, and a numerical dithering operation.

14. The method according to any one of claims 1, 2, 4, 6 to 10, 12 and 13, wherein the training data set comprises a first training data subset and a second training data subset, the first training data subset and the second training data subset have different data distributions, the first training data subset comprises the preset data, and the second training data subset comprises an unlabeled third radiation image collected at the radiation inspection site,

wherein the method further comprises:

training the radiation image recognition model using the first training data subset; and

training the radiation image recognition model trained by the first training data subset using the second training data subset,

wherein in a process of training the radiation image recognition model trained by the first training data subset using the second training data subset, a distance between the first training data subset and the second training data subset is minimized by adjusting a parameter of a feature layer of the radiation image recognition model,

wherein the preset data comprises a typical sample in a radiation inspection, and the typical sample is screened by a genetic method.

wherein the labeling the second radiation image online comprises:

automatically detecting an object of interest of an unknown category in the second radiation image; and

sending a reminder signal, wherein the reminder signal is configured to remind to label the object of interest of the unknown category in the second radiation image,

wherein the training the radiation image recognition model online using the training data set comprises:

training a plurality of alternative models using the training data set;

screening the plurality of alternative models according to a specified index; and

determining one of the plurality of alternative models meeting the specified index as the radiation image recognition model.

15. A method of recognizing a radiation image, the method of recognizing the radiation image being applied to a radiation inspection system, the radiation inspection system being arranged at a radiation inspection site, and the method comprising:

collecting a to-be-recognized radiation image at the radiation inspection site;

inputting the to-be-recognized radiation image into a radiation image recognition model, wherein the radiation image recognition model is trained according to the method according to any one of claims 1 to 14; and

recognizing the to-be-recognized radiation image using the radiation image recognition model.

16. An apparatus of training a radiation image recognition model online, the radiation image recognition model being applied to a radiation inspection system, the radiation inspection system being arranged at a radiation inspection site, preset data being pre-stored in the radiation inspection system, the preset data comprising a first radiation image, and the apparatus comprising:

a collecting module configured to collect a second radiation image at the radiation inspection site;

an online labeling module configured to label the second radiation image online to form on-site collected data having a second labeling information, wherein the second labeling information is an incomplete labeling information of the second radiation image, and the second labeling information is configured to indicate at least one of objects of interest in the second radiation image;

an online synthesis module configured to synthesize the preset data and the on-site collected data online to form a training data set; and

a training module configured to train the radiation image recognition model online using the training data set.

17. An apparatus of recognizing a radiation image, the apparatus of recognizing the

radiation image being applied to a radiation inspection system, the radiation inspection system being arranged at a radiation inspection site, and the apparatus comprising:

a collecting module configured to collect a to-be-recognized radiation image at the radiation inspection site;

an input module configured to input the to-be-recognized radiation image into a radiation image recognition model, wherein the radiation image recognition model is trained according to the method according to any one of claims 1 to 14; and

a recognition module configured to recognize the to-be-recognized radiation image using the radiation image recognition model.

18. An electronic device, comprising:

one or more processors;

a storage apparatus configured to store one or more programs,

wherein the one or more programs, when executed by the one or more processors, are configured to cause the one or more processors to implement the method according to any one of claims 1 to 14,

wherein the electronic device is a radiation inspection device.

19. A computer-readable storage medium having executable instructions thereon, wherein the instructions, when executed by a processor, are configured to cause the processor to implement the method according to any one of claims 1 to 14.

20. A computer program product comprising a computer program, wherein the computer program, when executed by a processor, is configured to cause the processor to implement the method according to any one of claims 1 to 14.