

DAMAGE IDENTIFICATION RESULT OPTIMIZATION METHOD AND APPARATUS

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TECHNICAL FIELD

[0001] Embodiments of the specification relate to the field of vehicle damage determination, and in particular to method and apparatus for optimizing damage identification result.

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BACKGROUND

[0002] In a conventional auto insurance claim scenario, an insurance company needs to send professional investigation and damage determination staff to a scene of an accident in order to perform on-site investigation and damage determination, provide a repair scheme and a compensation amount for the vehicle, and capture scene photos. Damage determination photos are archived to allow back-end inspectors to perform damage verification and assessment. Because manual inspection and damage determination are needed, the insurance company needs to invest a large amount of labor costs and training costs of professional knowledge. From the point of view of an ordinary user's experience, a claim cycle can last as long as 1-3 days, because a claim process includes waiting for an inspector to take photos on site, damage determination personnel to perform damage determination at a repairing site, damage verification personnel to verify damage at the backend. The waiting period of the user is a long, and the experience is poor.

[0003] Regarding the huge labor costs mentioned in the background, artificial intelligence and machine learning are expected to be applied to the vehicle damage determination scenarios in hope that the computer vision image identification technology in the field of artificial intelligence can be used to

automatically identify, according to on-site damage images captured by an ordinary user, a vehicle damage status reflected in the images, and automatically provide a repair scheme. In this way, manual inspection, damage determination, and damage verification are no longer needed, thereby greatly reducing costs of insurance companies, and improving auto insurance claim experience of ordinary users.

[0004] However, current intelligent damage determination solutions and damage identification accuracy need to be improved. Therefore, an improved solution is needed so as to further optimize a vehicle damage identification result, and improve identification accuracy.

SUMMARY

[0005] In the damage identification result optimization method provided in the specification, on the basis of a recurrent neural network, a previous damage identification result and information of interaction with a user are used as input, so as to realize the optimization of the damage identification result.

[0006] According to a first aspect, a damage identification result optimization method is provided, applied to processing of a single image. The method comprises: acquiring a vehicle damage image inputted by a user; on the basis of a previously trained damage identification model, extracting image feature information, and determining a damage identification result corresponding to the vehicle damage image, the damage identification result comprising at least a damage box; displaying the damage identification result to the user, and receiving a modification made by the user on the basis of the damage identification result; and on the basis of a previously trained long short-term memory (LSTM) network, using the damage identification result, the image feature information, and the modification as input, and acquiring an optimized damage identification result.

[0007] In one embodiment, the damage identification model is previously trained on the basis of the following steps: acquiring a plurality of historical

vehicle damage images labeled with damage identification results; and on the basis of a convolutional neural network (CNN), using the plurality of historical vehicle damage images as training samples, and training the damage identification model.

5 **[0008]** In one embodiment, the damage identification result further comprises a damage classification corresponding to the damage box; the modification comprises modifying the damage box and/or modifying the damage classification; wherein modifying the damage box comprises at least one of deleting, adding, moving, zooming out, and zooming in.

10 **[0009]** Further, according to one aspect, in a specific embodiment, the modification comprises modifying the damage box; acquiring the optimized damage identification result comprises: according to the image feature information, acquiring candidate damage boxes generated by the damage identification model to acquire the damage identification result, the candidate
15 damage boxes comprising the damage box in the damage result; on the basis of the modification, updating the candidate damage boxes; for the updated candidate damage boxes, on the basis of similarities among the candidate damage boxes, determining an optimized damage box, and using the optimized damage box as part of the optimized damage identification result.

20 **[0010]** Further, in a specific embodiment, determining the optimized damage box comprises: determining a plurality of similarities between an arbitrary first candidate damage box in the updated candidate damage boxes and other candidate damage boxes; inputting the plurality of similarities into a predetermined prediction model, and according to an output result of the
25 prediction model, determining whether the first candidate damage box is an abnormal box, the prediction model being comprised in the LSTM; and if the first candidate damage box is not an abnormal box, using the first candidate damage box as part of the optimized damage box.

[0011] Further, in an example, determining the plurality of similarities
30 between an arbitrary first candidate damage box in the updated candidate damage

boxes and the other candidate damage boxes comprises: calculating a dot product of a first feature vector corresponding to the first candidate damage box and each of a plurality of other feature vectors corresponding to a plurality of other candidate damage boxes, and determining a plurality of dot product results as the
5 plurality of similarities.

[0012] In another example, the prediction model is previously trained by means of positive samples and negative samples; the positive samples comprise a plurality of damage regions labeled as true damages; the negative samples comprise a plurality of damage regions labeled as true damages and at least one
10 region labeled as a false damage.

[0013] In another example, the prediction model is a linear regression model.

[0014] According to another aspect, in a specific embodiment, the damage identification result comprises a plurality of damage boxes; the plurality of
15 damage boxes comprise a first damage box; the modification comprises deleting the first damage box; optimizing the damage identification result comprises: determining a plurality of similarities between the first damage box and a plurality of other damage boxes; and using, as part of the optimized damage identification result, a damage box corresponding to a similarity, among the plurality of
20 similarities, that is less than a preset threshold.

[0015] According to a second aspect, a damage identification result optimization method is provided, applied to processing of a plurality of images. The method comprises: acquiring first image feature information of a first vehicle damage image and a first damage identification result corresponding to the first
25 vehicle damage image, and acquiring second image feature information of a second vehicle damage image and a second damage identification result corresponding to the second vehicle damage image; and, on the basis of a previously trained long short-term memory (LSTM) network, using the first damage identification result, the first image feature information, the second image
30 feature information, and the second damage identification result as input, and

acquiring an optimized second damage identification result.

[0016] In one embodiment, the first image feature information and the second image feature information are separately extracted on the basis of a previously trained damage identification model.

5 **[0017]** In one embodiment, the first damage identification result and the second damage identification result are separately determined on the basis of a previously trained damage identification model, or are separately determined on the basis of the method according to claim 1.

10 **[0018]** In one embodiment, the second damage identification result comprises a first damage box; acquiring the optimized second damage identification result comprises: on the basis of a region matching and positioning algorithm, determining, from the first vehicle image, a matching region matching the first damage box; and optimizing a classification of the first damage box according to the matching region.

15 **[0019]** In one embodiment, the method further comprises: using the optimized second damage identification result, the second image feature information, the first damage identification result, and the first image feature information as input, and acquiring an optimized first damage identification result.

20 **[0020]** Further, in a specific embodiment, the second damage identification result comprises a first damage box; acquiring the optimized second damage identification result comprises: on the basis of a region matching and positioning algorithm, determining, from the first vehicle image, a matching region matching the first damage box; and optimizing a classification of the first
25 damage box according to the matching region; wherein acquiring the optimized first damage identification result comprises: optimizing at least one damage box in the first damage identification result according to the matching region.

[0021] According to a third aspect, a damage identification result optimization apparatus is provided, applied to processing of a single image. The
30 apparatus comprises: an acquisition unit, for acquiring a vehicle damage image

inputted by a user; an extraction unit, used to, on the basis of a previously trained damage identification model, extract image feature information; a determining unit, used to determine a damage identification result corresponding to the vehicle damage image, the damage identification result comprising at least a damage box;
5 a display unit, used to display the damage identification result to the user; a receiving unit, used to receive a modification made by the user on the basis of the damage identification result; and an optimization unit, used to, on the basis of a previously trained long short-term memory (LSTM) network, use the damage identification result, the image feature information, and the modification as input,
10 and acquire the optimized damage identification result.

[0022] According to a fourth aspect, a damage identification result optimization apparatus is provided, applied to processing of a plurality of images. The apparatus comprises: an acquisition unit, used to acquire first image feature information of a first vehicle damage image and a first damage identification
15 result corresponding to the first vehicle damage image, and acquire second image feature information of a second vehicle damage image and a second damage identification result corresponding to the second vehicle damage image; and a first optimization unit, used to, on the basis of a previously trained long short-term memory (LSTM) network, use the first damage identification result, the first
20 image feature information, the second image feature information, and the second damage identification result as input, and acquire an optimized second damage identification result.

[0023] According to a fifth aspect, a computer-readable storage medium is provided, on which a computer program is stored, wherein the computer program,
25 when executed by a computer, causes the computer to perform the method according to the first aspect or the second aspect.

[0024] According to a sixth aspect, a computing device is provided, comprising a memory and a processor, characterized in that the memory stores executable code, and the processor, when executing the executable code,
30 implements the method according to the first aspect or the second aspect.

[0025] In the damage identification result optimization method for a single image disclosed by the embodiments of the specification, firstly, image feature information is extracted on the basis of a single damage determination image captured by a user, and a damage identification result is preliminarily identified; then, data of a modification made by the user to the damage identification result is received; further, on the basis of a previously trained LSTM, the extracted image feature information, the preliminarily identified damage identification result, and the data of the modification made by the user are used as input to update the damage identification result. If the user is still not satisfied with the updated damage identification result, another modification can be made until the user is satisfied with a damage determination result.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] To more clearly describe the technical solutions of the plurality of embodiments disclosed by the specification, the following briefly introduces the accompanying drawings for describing the embodiments. It is apparent that the accompanying drawings described below are only the embodiments disclosed by the specification, and a person of ordinary skill in the art can still derive other drawings from these accompanying drawings without creative efforts.

[0027] FIG. 1 shows a time sequence diagram of neurons in an LSTM according to an embodiment;

[0028] FIG. 2 is a schematic diagram of an application scenario according to an embodiment disclosed in the specification;

[0029] FIG. 3 shows a flowchart of a damage identification result optimization method according to an embodiment;

[0030] FIG. 4a shows an example of a vehicle damage image;

[0031] FIG. 4b shows an example of a damage identification result identified by a damage identification model;

[0032] FIG. 4c shows a damage identification result modified by a user;

[0033] FIG. 4d shows an optimized damage identification result;

[0034] FIG. 5 shows a schematic time sequence diagram of an LSTM in operation according to an embodiment;

[0035] FIG. 6 shows a flowchart of a damage identification result optimization method according to an embodiment;

5 [0036] FIG. 7a shows an example of a vehicle damage image;

[0037] FIG. 7b shows an example of a damage identification result identified by a damage identification model;

[0038] FIG. 7c shows an optimized damage identification result;

[0039] FIG. 7d shows an optimized damage identification result;

10 [0040] FIG. 8 shows a structural diagram of a damage identification result optimization apparatus according to an embodiment; and

[0041] FIG. 9 shows a structural diagram of a damage identification result optimization apparatus according to an embodiment.

15 **DETAILED DESCRIPTION**

[0042] A plurality of embodiments disclosed by the specification are described below with reference to the accompanying drawings.

[0043] Embodiments of the specification disclose a damage identification result optimization method. The inventive concept of the method is firstly
20 introduced below.

[0044] In order to perform identification on a damage status in a vehicle damage determination image, a method widely used in the industry is to compare the same with a huge amount of historical data in a database to acquire a similar image similar, so as to determine a damaged component in the image and an
25 extent of damage. However, such a method has a less ideal damage identification success rate. In addition, some damage identification models are trained by using a sample labeling method, so as to perform vehicle damage identification. During the process of damage identification, due to effects of a variety of factors such as illumination, stains, a shooting angle, a distance, a vehicle model, and the like, the
30 damage identification success rate is not high enough. For example, in an

identification result, it is very likely that true damages can be correctly detected, and a small portion of reflecting spots or stains are also detected as damages, thereby resulting in wrong detections.

5 **[0045]** In addition, a damage identification model is usually used in a damage determination client, so that an ordinary user can capture an on-site damage image, and upload the on-site damage image to the damage determination client, thereby implementing automated damage determination. Since an accuracy rate of the existing damage identification model is not high enough, the user may not be satisfied with the damage identification result. In this case, the user usually shoots additional photos or replaces some of photos, and uploads photos to the damage determination client, so that damage determination is performed again. The client usually uses all updated photos as input, and performs damage determination again. Such repeated operations may still fail to satisfy the user. In addition, a large quantity of resources are consumed, and the user needs to spend a large amount of time.

[0046] In order to rapidly acquire a damage identification result satisfying a user, the inventor thinks that feedback data of the user regarding a damage identification result can be acquired by means of interaction with the user, and the damage identification result can be updated with reference to the feedback data.

20 **[0047]** Further, a long short-term memory (LSTM) network can be used to process time sequence information. Specifically, computing units, such as neurons, in the LSTM can memorize previous information, and use the same as subsequent input. Specifically, refer to the time sequence diagram of neurons in the LSTM shown in FIG. 1. For a certain neuron, x_{t-1} , x_t , and x_{t+1} respectively represent input at a time $t-1$, a time t , and a time $t+1$; a_1 , a_2 , and a_3 respectively represent statuses of the neuron at the time $t-1$, the time t , and the time $t+1$; h_{t-1} , h_t , and h_{t+1} respectively represent output at the time $t-1$, the time t , and the time $t+1$.
Wherein:

$$a_t = g(U * x_{t-1} + W * h_{t-1} + b_a) \quad (1)$$

$$h_t = f(V * a_{t-1} + b_h) \quad (2)$$

$$a_{t+1} = g(U * x_t + W * h_t + b_a) \quad (3)$$

$$h_{t+1} = f(V * a_t + b_h) \quad (4)$$

[0048] It can be seen from FIG. 1 that the output h_t at the time t depends
 5 on both the output h_{t-1} of a previous time and the current input x_t . Therefore, the
 damage identification result can be updated by using the characteristic that the
 LSTM can process time sequence information in combination with a feedback of
 the user made by modifying the damage identification result. In this way,
 feedback data of the user is used, and previously determined damage data is also
 10 used, so as to more rapidly and accurately update a damage identification result,
 thereby satisfying the user.

[0049] FIG. 2 is a schematic diagram of an application scenario according
 to an embodiment disclosed in the specification. As shown in FIG. 2, a vehicle
 damage image is firstly inputted to a damage identification model to be subjected
 15 to damage identification. The damage identification model extracts feature
 information of the image. In addition, if the image includes a variety of damage,
 such as deformations, scratches, and the like, the identification model usually
 identifies, from the image, a plurality of candidate damage regions as detection
 results. According to an embodiment of the specification, a modification inputted
 20 by the user is received, and the detection results are updated on the basis of the
 modification data and the image feature information of the vehicle damage image
 extracted by means of the damage identification model, until the user is satisfied.
 A specific damage identification result optimization process is described below.

[0050] FIG. 3 shows a flowchart of a damage identification result
 25 optimization method according to an embodiment. The method is used to process
 a single image, and its executive body can be a device having a processing
 capability: a server, a system, or an apparatus. As shown in FIG. 3, a process of
 the method includes the following steps: step S310, acquire a vehicle damage
 image inputted by a user; step S320, on the basis of a previously trained damage

identification model, extract image feature information, and determine a damage identification result corresponding to the vehicle damage image, the damage identification result including at least a damage box; step S330, display the damage identification result to the user, and receiving a modification made by the user on the basis of the damage identification result; and step S340, on the basis of a previously trained LSTM, use the damage identification result, the image feature information, and the modification made by the user as input to obtain the optimized damage identification result. The following describes execution of each of the aforementioned steps.

10 **[0051]** Firstly, in step S310, a vehicle damage image inputted by a user is obtained. It can be understood that this image can be an image of a vehicle damage scene captured by an ordinary user, and it is an image to be subjected to damage identification.

15 **[0052]** FIG. 4a shows an example of a vehicle damage image. This image is an on-site image captured by an ordinary user, and is not yet processed.

[0053] Then, in step S320, on the basis of a previously trained damage identification model, image feature information is extracted, and a damage identification result corresponding to the vehicle damage image is determined, the damage identification result including at least a damage box.

20 **[0054]** In an embodiment, the damage identification model is previously trained on the basis of the following steps: firstly, acquire a plurality of historical vehicle damage images labeled with damage identification results; and then, on the basis of a convolutional neural network (CNN), use the plurality of historical vehicle damage images as training samples to train the damage identification model. In a specific embodiment, the labeled damage identification result includes a damage box, that is, includes a bounding box and a damage classification of a damaged object, namely the classification of the damaged object in the bounding box. Correspondingly, a damage identification result acquired on the basis of this model includes a damage box and a damage
25 classification. Further, the damage identification result labeled thereby can also
30 classification.

include a damage segmentation result, such as outline information or mask information of the damage. Correspondingly, the damage identification result acquired by this model can further include a damage segmentation result.

5 **[0055]** In an embodiment, after the vehicle damage image is inputted into the damage identification model, the model firstly extracts image feature information, and then generates a damage identification result on the basis of the image feature information. In a specific embodiment, the image feature information can include a feature map generated on the basis of a CNN. Further, on the basis of this feature map, feature information of a region of interest (ROI) can be collected; then, damage classification, bounding box regression, and segmentation are performed; then, a damage identification result is determined. In another specific embodiment, the image feature information can further include, in addition to the feature map, information of other layers in the CNN network, such as feature information of an ROI or feature information of a candidate damage box.

15 **[0056]** According to the above, the damage identification result corresponding to the vehicle damage image can be preliminary determined. Subsequently, in step S330, display the damage identification result to the user, and receive a modification made by the user on the basis of the damage identification result.

20 **[0057]** It should be noted that, after the user reviews the preliminary determined damage identification result, and if the user agrees with the damage identification result, then the user can perform a confirmation operation on the result. In response to the confirmation operation, this result can be directly used as a final result of the corresponding vehicle damage image in the single-image damage identification stage, and the current process ends.

25 **[0058]** According to another aspect, if the user is not satisfied with the damage identification result, then he can modify the damage identification result. In an embodiment, the damage identification result can include a damage box, and a corresponding modification can include modifying the damage box, such as

deleting, adding, moving, zooming out, zooming in, and the like. Further, in a specific embodiment, the damage identification result further includes a damage classification corresponding to the damage box, and the corresponding modification can include modifying the damage classification.

5 **[0059]** According to a specific example, as shown in FIG. 4b, which includes a damage identification result, determined on the basis of a damage identification model, of the vehicle damage image in FIG. 4a, namely three damage boxes and corresponding damage classifications. Further, assuming that the user thinks that the damage box on a right rear vehicle door is actually a light
10 reflection, not deformation damage, so that this damage box can be deleted, and the damage classification corresponding thereto is deleted accordingly. As shown in FIG. 4c, the figure shows an interface of the damage identification result modified by the user. It can be seen that the user's modification includes deleting the damage box of which the damage classification is a moderate deformation on
15 a right rear vehicle door.

[0060] According to the above, the image feature information extracted on the basis of the damage identification model, the damage identification result determined on the basis of the image feature information, and data of the modification made by the user to the damage identification result can be acquired.
20 Then, in step S340, on the basis of a previously trained LSTM, use the damage identification result, the image feature information, and the change made by the user as input, and acquire the optimized damage identification result.

[0061] In an embodiment, as shown in FIG. 5, H_0 represents a preliminary damage identification result determined on the basis of the damage identification
25 model; X_1 represents the image feature information, and, at this time, the user made no modification, so that outputted H_1 is still the preliminary damage identification result; further, X_2 represents the image feature information and a modification made by the user on the basis of the preliminary damage identification result; the optimized damage identification result H_2 can be
30 acquired by inputting H_1 and X_2 to the previously trained LSTM.

[0062] Further, another modification made by the user to the damage identification result can be subsequently received, and this modification and the image feature information are used as X_n ; X_n and the damage identification result H_{n-1} on which this modification is based are inputted to the LSTM, so as to
5 acquire the corresponding optimized identification result H_n .

[0063] It should be noted that the process of pre-training the LSTM is similar to the process of using the trained LSTM, and a difference lies in that in the process of training the LSTM, a large number of vehicle damage samples labeled with damage identification results are needed for usage, and the LSTM is
10 trained in combination with data interaction with a staff member. Therefore, for the training process of the LSTM, reference can be made to a process of using the same, which will be described below, and details will not be described herein again.

[0064] In addition, consider that damage made to a plurality of positions
15 on a vehicle body surface by one collision or scratch accident usually has similar visual features. For example, the damage has substantially the same height, and the mark is substantially continuous, or colors attached thereon due to scratching are the same. In addition, light reflection spots, stains, and so on, which are likely to be mistaken as damage, usually have similar visual effects. According to this
20 feature, it is suggested that an attention mechanism is introduced during the process of using the LSTM to optimize the damage identification result, so as to further optimize the damage detection result.

[0065] The attention mechanism is a concept commonly used in natural language processing. During natural language processing, when the meaning of a
25 word or a sentence needs to be understood, contextual information plays a critical role, and can facilitate accurate understanding of a word or a sentence. However, contexts in different positions have different effects on a current word or sentence to be processed, and “attention” to be paid is therefore different. In addition, a context having the greatest effect on the current word or sentence is not in a fixed
30 position, because the context may be before or after the current word or sentence,

and with an uncertain distance. Therefore, the attention mechanism is needed in order to solve such a problem.

[0066] The attention mechanism can also be applied in the field of image processing. For example, the mechanism can be used to learn and determine, in
5 an image, which regions are critical to identification of a current object, namely regions to which more attention needs to be paid.

[0067] On the basis of the capability of the LSTM in processing a data sequence and the characteristic of the attention mechanism, in one or a plurality of
10 embodiments of the specification, with reference to the idea of the attention mechanism, for a plurality of damage boxes identified by the damage identification model, attention is paid to a similarity between a certain damage box and other damage boxes, so as to remove an abnormal region (outlier) and optimize the damage detection result.

[0068] In an embodiment, the damage identification result includes a
15 plurality of damage boxes. The modification made by the user includes deleting one of the damage boxes. It is highly likely that a damage object in the deleted damage box is not damage, such as actually being stains or the like, or is not damage caused by this accident. It can be inferred accordingly that among other damage boxes, if a damage box similar to the deleted damage box exists, it should
20 also be deleted, and damage boxes not similar thereto are kept. Therefore, in a specific embodiment, the modification made by the user includes deleting a first damage box in the damage identification result. Correspondingly, optimizing damage identification result can include: firstly, determining a plurality of similarities between a first damage box and a plurality of other damage boxes;
25 and then using, as part of the optimized damage identification result, a damage box corresponding to a similarity less than a preset threshold among the plurality of similarities. Further, in a specific embodiment, determining similarities between damage boxes can include: firstly, determining feature vectors corresponding to the damage boxes, and then, using dot products of
30 corresponding feature vectors as the similarities.

[0069] According to a specific example, the damage identification result includes the three damage boxes shown in FIG. 4b, and the user deletes “a moderate deformation on a right rear vehicle door” therein. Correspondingly, a similarity between a damage box (denoted as a damage box 1) with the damage classification being “a moderate deformation on a right rear vehicle door” and a damage box (denoted as a damage box 2) with the damage classification being “a moderate deformation on a wheel fender” and a similarity between the damage box (denoted as the damage box 1) with the damage classification being “a moderate deformation on a right rear vehicle door” and a damage box (denoted as a damage box 3) with the damage classification being “a mild scratch on a right rear vehicle door” can be separately calculated. Assuming that the calculated similarities are respectively 0.8 and 0.1, and a preset threshold is 0.7. Then, damage box 2 with the damage classification being “a moderate deformation on a wheel fender” can be deleted. The optimized damage identification result is shown in FIG. 4d. It can be seen that the similarity between damage box 2 and damage box 1 deleted by the user is high (in fact the two are both light reflection spots). In the situation where the user confirms damage box 1 not being true damage and therefore being deleted, after a damage optimization process, damage box 2 similar to damage box 1 is also deleted.

[0070] In another aspect, in the scenario where the user modifies the damage box by using more of other methods, then by using candidate damage boxes generated by the damage identification model in the damage identification result generation process, damage identification optimization can be carried out on the basis of the modification made by the user.

[0071] Generally, in order to identify a damage result, after extracting the image feature information, the damage identification model generates candidate damage boxes on the basis of the image feature information, and then determines, according to a preset determination criterion, at least part of the candidate damage boxes as damage boxes in the damage result. On this basis, in the situation where the user modifies the damage box, optimizing the damage identification result can

include: firstly, acquiring candidate damage boxes generated by the damage identification model on the basis of the image feature information, the candidate damage boxes including damage boxes in the damage result; then, updating the candidate damage boxes on the basis of the modification made by the user to the damage boxes in the damage identification result; subsequently, for the updated candidate damage boxes, determining optimized damage boxes on the basis of similarities between the candidate damage boxes, and using the optimized damage boxes as part of the optimized damage identification result.

[0072] Further, according to a specific embodiment, determining the optimized damage box from the updated candidate damage boxes includes: firstly, determining a plurality of similarities between an arbitrary first candidate damage box in the updated candidate damage boxes and other candidate damage boxes; then, inputting the plurality of similarities into a predetermined prediction model, and according to an output result of the prediction model, determining whether the first candidate damage box is an abnormal box; then, if the first candidate damage box is not an abnormal box, including the first candidate damage box as part of the optimized damage box.

[0073] Further, in a specific embodiment, determining the plurality of similarities between an arbitrary first candidate damage box in the updated candidate damage boxes and the other candidate damage boxes includes: calculating a dot product of a first feature vector corresponding to the first candidate damage box and each of a plurality of other feature vectors corresponding to the plurality of other candidate damage boxes, and determining a plurality of dot product results as the plurality of similarities. In other embodiments, the similarities between the candidate damage boxes can also be determined on the basis of other mathematical operation, such as acquiring a difference vector, a distance, or the like, between the feature vectors of the candidate damage boxes.

[0074] Regarding extraction of the feature vectors of the candidate damage boxes, in one example, determining feature vectors corresponding to the

candidate damage boxes can include: on the basis of a feature map included in the image feature information, extracting the feature vectors corresponding to the respective candidate damage boxes. In another example, determining feature vectors corresponding to the candidate damage boxes can include: acquiring, from
5 pixel features of an original vehicle damage image, pixel features, such as RGB pixel values, corresponding to the candidate damage boxes, and then extracting feature vectors of the candidate damage boxes on the basis of these pixel features.

[0075] In a specific embodiment, the prediction model can be previously trained using positive samples and negative samples, and the trained prediction
10 model is directly used as part of the LSTM. Further, the positive samples include a plurality of damage regions labeled as true damage; the negative samples include a plurality of damage regions labeled as true damage and at least one region labeled as false damage. It should be noted that the damage region and the false damage region can be understood as a region surrounded by a corresponding
15 labeled damage box. In one example, the prediction model can be a linear regression model. In another specific embodiment, the prediction model can be trained jointly with other parts of the LSTM in a coordinated manner. That is, the training process of the LSTM includes determining parameters in the prediction model.

[0076] According to a specific example, the candidate damage boxes generated by the damage identification model include a damage box A, a damage box B, a damage box C, a damage box D, and a damage box E. Damage box A, damage box B, and damage box C are damage boxes in the damage result. In addition, the modification made by the user to the damage boxes includes:
25 deleting damage box B, and reducing damage box C to acquire a damage box C'. Correspondingly, acquired updated candidate damage boxes include: damage box A, damage box C', damage box D, and damage box E. Then, similarities between damage box A and, respectively, damage box C', damage box D, and damage box E can be separately determined, and these three similarities can be inputted into
30 the prediction model, so as to determine whether damage box A is an abnormal

box. Similarly, it can also be separately determined whether damage box C', damage box D, and damage box E are abnormal boxes. Assuming that it is determined that damage box A, damage box C', and damage box D are not abnormal boxes but damage box E is an abnormal box, therefore, damage box A, damage box C', and damage box D can be used as part of the optimized damage result.

[0077] According to the foregoing, the attention mechanism is introduced in addition to the LSTM, so that the damage identification result is further optimized.

[0078] In view of the above, in the damage identification result optimization method provided by the embodiments of the specification, firstly, image feature information is extracted on the basis of a single damage determination image captured by a user, and a damage identification result is preliminarily identified; then, data of a modification made by the user to the damage identification result is received; further, on the basis of a previously trained LSTM, the extracted image feature information, the preliminarily acquired damage identification result, and the data of the modification made by the user are used as input to update the damage identification result. If the user is still unsatisfied with the updated damage identification result, another modification can be made, until the user is satisfied with the damage determination result.

[0079] The foregoing mainly discusses the damage identification result optimization method for a single damage determination image. Since a damage determination process generally involves a plurality of damage determination images, in addition to using the foregoing method to perform damage identification and damage identification result optimization on each of the plurality of damage determination images, the inventor thinks that information of association among the damage determination images can also be considered, so as to optimize damage identification results of the plurality of damage determination images together.

[0080] Similarly, considering that LSTM can process time sequence

information, embodiments of the specification further provide a damage identification result optimization method for a plurality of images. FIG. 6 shows a flowchart of a damage identification result optimization method according to an embodiment. The executive body of the method can be a device having a processing capability: a server, a system, or an apparatus. For example, the device is a damage determination client. As shown in FIG. 6, a process of the method includes the following steps: step S610, acquire first image feature information of a first vehicle damage image and a first damage identification result corresponding to the first vehicle damage image, and acquire second image feature information of a second vehicle damage image and a second damage identification result corresponding to the second vehicle damage image; and step S620, on the basis of a previously trained long short-term memory (LSTM) network, use the first damage identification result, the first image feature information, the second image feature information, and the second damage identification result as input to obtain an optimized second damage identification result. Execution of the aforementioned steps is introduced below.

[0081] Firstly, in step S610, acquire first image feature information of a first vehicle damage image and a first damage identification result corresponding to the first vehicle damage image, and acquire second image feature information of a second vehicle damage image and a second damage identification result corresponding to the second vehicle damage image.

[0082] In one embodiment, on the basis of a previously trained damage identification model, the first image feature information of the first vehicle damage image can be extracted, and the first damage identification result can be determined; the second image feature information of the second vehicle damage image can be extracted, and the second damage identification result can be determined. For descriptions of the damage identification model, the image feature information, and the damage identification result, reference can be made to the foregoing embodiments, and details will not be described herein again.

[0083] Further, in a specific embodiment, the acquired first damage

identification result or second damage identification result can also be the damage identification result optimized on the basis of the method shown in FIG. 3. In one example, the first damage identification result is a damage identification result optimized on the basis of data of user interaction, and the second damage identification result is a damage identification result preliminarily determined on the basis of the damage identification model. Therefore, the second damage identification result can be optimized with reference to the first damage identification result, and then the optimized second damage identification result is displayed to the user.

10 **[0084]** Then, in step S620, on the basis of a previously trained long short-term memory (LSTM), using the first damage identification result, the first image feature information, the second image feature information, and the second damage identification result as input to obtain an optimized second damage identification result.

15 **[0085]** It should be noted that the previously trained LSTM involved herein is different from the previously trained LSTM mentioned in step S340. The previously trained LSTM in step S340 is used to optimize a damage determination result for a single damage determination image according to user's interaction data; however, the LSTM in this step is used to optimize a damage determination result of a current image according to a damage determination result of another image. It can be understood that these two LSTM are models that need to be trained separately. However, the two models can be used in a nested manner.

20 **[0086]** In one embodiment, the first image feature information and the first damage identification result can be used as initial input, and the second image feature information and the second damage identification result can be used as new input of a current time. The two parts of input are inputted into the previously trained LSTM together, so as to acquire the optimized second damage identification result. Similarly, by combining the LSTM and the attention mechanism, optimization of the second damage identification result is improved.

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[0087] In one embodiment, the second damage identification result includes a first damage box; correspondingly, optimizing the second damage identification result can include: firstly, on the basis of a region matching and positioning algorithm, determining, from the first vehicle image, a matching
5 region matching the first damage box; and then, optimizing a classification of the first damage box according to the matching region.

[0088] In a specific example, the user finds that damage to a vehicle light in FIG. 4d is not identified, and therefore, adds a close-up image of the vehicle light, as shown in FIG. 7a. In this case, the second damage identification result,
10 namely the first damage box and the corresponding damage classification “vehicle light is broken,” shown in FIG. 7b can be determined on the basis of the damage identification model. Therefore, the classification information indicating that the vehicle light is broken is identified from the image. However, it is not identified which vehicle light, such as a head light or a tail light, is broken. However, it can
15 be learned from FIG. 4d that it is the right tail light. Specifically, optimizing the second damage identification result can include: firstly, on the basis of a region matching and positioning algorithm, determining, from the first vehicle image, a region matching the first damage box; and then, acquiring component information, namely right tail light, of the matching region acquired by means of
20 identification performed on the basis of the image feature information, optimizing the classification of the first damage box into “right tail light is broken,” and displaying the optimized damage identification result to the user, as shown in FIG. 7c.

[0089] It should be noted that after step S620, on one hand, the user can
25 continue to capture vehicle damage images, or selectively delete captured vehicle damage images. On the basis of the user adding or deleting images, the damage identification result can be updated and optimized using the optimization method shown in FIG. 6. On the other hand, step S330 and step S340 shown in FIG. 3 can also be adopted. By receiving the modification made by the user to the
30 second damage identification result, the second damage identification result is

further optimized, until the user is satisfied with the second damage identification result.

5 **[0090]** In addition, after step S620, the optimized second damage identification result, the second image feature information, the first damage identification result, and the first image feature information can be used as input, so as to optimize the first damage identification result. That is, after the second damage identification result is optimized according to the first damage identification result, the first damage identification result can be optimized by using the optimized second damage identification result.

10 **[0091]** As in the aforementioned embodiment, optimizing the second damage identification result can include: firstly, on the basis of a region matching and positioning algorithm, determining, from the first vehicle image, a matching region matching the first damage box; and then, optimizing a classification of the first damage box according to the matching region.

15 **[0092]** Further, optimizing the second damage identification result can include: optimizing at least one damage box in the first damage identification result according to the matching region. According to a specific example, as shown in FIG. 7c, the optimized second damage identification result includes a damage box with the classification “right tail light is broken.” Therefore, the
20 corresponding damage box can be labeled in the matching region matching the damage box in the first vehicle image. The optimized first damage identification result is shown in FIG. 7d.

25 **[0093]** In view of the above, the damage identification result optimization method provided by the embodiments of the specification can optimize a damage determination result of a current image with reference to a damage determination result of another image.

30 **[0094]** According to an embodiment of another aspect, an optimization apparatus is further provided, applied to processing of a single image. FIG. 8 shows a structural diagram of a damage identification result optimization apparatus according to an embodiment. Said apparatus 800 includes:

[0095] an acquisition unit 810, used to acquire a vehicle damage image inputted by a user;

[0096] an extraction unit 820, used to, on the basis of a previously trained damage identification model, extract image feature information;

5 [0097] a determining unit 830, used to determine a damage identification result corresponding to the vehicle damage image, the damage identification result including at least a damage box;

[0098] a display unit 840, used to display the damage identification result to the user;

10 [0099] a receiving unit 850, used to receive a modification made by a user on the basis of the damage identification result; and

[00100] an optimization unit 860, used to, on the basis of a previously trained long short-term memory (LSTM) network, use the damage identification result, the image feature information, and the modification as input to obtain the
15 optimized damage identification result.

[00101] In one embodiment, the damage identification model in the extraction unit is previously trained based on the following steps:

[00102] acquiring a plurality of historical vehicle damage images labeled with damage identification results; and

20 [00103] on the basis of a convolutional neural network (CNN), using the plurality of historical vehicle damage images as training samples to train the damage identification model.

[00104] In one embodiment, the damage identification result further includes a damage classification corresponding to the damage box; the
25 modification includes modifying the damage box and/or modifying the damage classification; wherein modifying the damage box includes at least one of deleting, adding, moving, reducing, and amplifying.

[00105] Further, according to one aspect, in a specific embodiment, the modification includes modifying the damage box; optimization unit 860
30 specifically includes:

[00106] an acquisition subunit 861, used to, according to the image feature information, acquire candidate damage boxes generated by the damage identification model to acquire the damage identification result, the candidate damage boxes including a damage box in the damage result;

5 [00107] an updating subunit 862, used to, on the basis of the modification, update the candidate damage boxes; and

[00108] a determining subunit 863, used to, for the updated candidate damage boxes, on the basis of similarities among the candidate damage boxes, determine an optimized damage box, and use the optimized damage box as part of
10 the optimized damage identification result.

[00109] Further, in an example, determining subunit 863 is specifically used to:

[00110] determine a plurality of similarities between an arbitrary first candidate damage box in the updated candidate damage boxes and the other
15 candidate damage boxes;

[00111] input the plurality of similarities into a predetermined prediction model, and according to an output result of the prediction model, determine whether the first candidate damage box is an abnormal box, the prediction model included in the LSTM; and

20 [00112] if the first candidate damage box is not an abnormal box, use the first candidate damage box as part of the optimized damage box.

[00113] Further, in an example, determining subunit 863 is specifically used to determine the plurality of similarities between an arbitrary first candidate damage box in the updated candidate damage boxes and the other candidate
25 damage boxes, including:

[00114] Calculating a dot product of a first feature vector corresponding to the first candidate damage box and each of a plurality of other feature vectors corresponding to the plurality of other candidate damage boxes, and determining a plurality of dot product results as the plurality of similarities.

30 [00115] In another example, the prediction model is previously trained

using positive samples and negative samples; the positive samples include a plurality of damage regions labeled as true damage; the negative samples include a plurality of damage regions labeled as true damage and at least one region labeled as false damage.

5 **[00116]** In another example, the prediction model is a linear regression model.

[00117] According to another aspect, in a specific embodiment, the damage identification result includes a plurality of damage boxes; the plurality of damage boxes include a first damage box; the modification includes deleting the
10 first damage box; optimization unit 860 is specifically used to:

[00118] determine a plurality of similarities between the first damage box and a plurality of other damage boxes; and

[00119] use, as part of the optimized damage identification result, a damage box corresponding to a similarity less than a preset threshold among the
15 plurality of similarities.

[00120] In view of the above, in the damage identification result optimization apparatus provided by the embodiments of the specification, firstly, image feature information is extracted on the basis of a single damage determination image captured by a user, and a damage identification result is
20 preliminarily identified; then, data of a modification made by the user to the damage identification result is received; further, on the basis of a previously trained LSTM, the extracted image feature information, the preliminarily identified damage identification result, and the data of the modification made by the user are used as input to update the damage identification result. If the user is
25 still unsatisfied with the updated damage identification result, another modification can be made until the user is satisfied with the damage determination result.

[00121] According to one embodiment of another aspect, an optimization apparatus is further provided, applied to processing of a plurality of images. FIG.
30 9 shows a structural diagram of a damage identification result optimization

apparatus according to an embodiment. As shown in FIG. 9, apparatus 900 includes:

5 **[00122]** an acquisition unit 910, used to acquire first image feature information of a first vehicle damage image and a first damage identification result corresponding to the first vehicle damage image, and acquire second image feature information of a second vehicle damage image and a second damage identification result corresponding to the second vehicle damage image; and

10 **[00123]** a first optimization unit 920, used to, on the basis of a previously trained long short-term memory (LSTM) network, use the first damage identification result, the first image feature information, the second image feature information, and the second damage identification result as input to obtain an optimized second damage identification result.

15 **[00124]** In one embodiment, the first image feature information and the second image feature information are separately extracted on the basis of a previously trained damage identification model.

[00125] In one embodiment, the first damage identification result and the second damage identification result are separately determined on the basis of a previously trained damage identification model, or are separately determined on the basis of the method shown in FIG. 3.

20 **[00126]** In one embodiment, the second damage identification result includes a first damage box; the first optimization unit 920 is specifically used to:

[00127] on the basis of a region matching and positioning algorithm, determine, from the first vehicle image, a matching region matching the first damage box; and

25 **[00128]** optimize a classification of the first damage box according to the matching region.

[00129] In one embodiment, the apparatus further includes:

30 **[00130]** a second optimization unit 930, used to use the optimized second damage identification result, the second image feature information, the first damage identification result, and the first image feature information as input to

acquire an optimized first damage identification result.

[00131] Further, in a specific embodiment, the second damage identification result includes a first damage box; the first optimization unit 920 is specifically used to:

5 [00132] on the basis of a region matching and positioning algorithm, determine, from the first vehicle image, a matching region matching the first damage box; and

[00133] optimize a classification of the first damage box according to the matching region.

10 [00134] The second optimization unit 930 is specifically used to: optimize at least one damage box in the first damage identification result according to the matching region.

[00135] In view of the above, the damage identification result optimization apparatus provided by the embodiments of the specification can
15 optimize a damage determination result of a current image with reference to a damage determination result of another image.

[00136] According to an embodiment of another aspect, a computer-readable storage medium is further provided, on which a computer program is stored, wherein the computer program, when executed on a computer, causes the
20 computer to perform the method described with reference to FIG. 3 or FIG. 6.

[00137] According to an embodiment of another aspect, a computing device is further provided, including a memory and a processor, wherein the memory stores executable code, and the processor, when executing the executable code, implements the method described with reference to FIG. 3 or FIG. 6.

25 [00138] A person skilled in the art may be aware that in the aforementioned one or plurality of examples, the functions described in the plurality of embodiments disclosed in the specification can be implemented by hardware, software, firmware, or any combination thereof. When implemented by software, these functions may be stored in a computer-readable medium, or
30 transmitted as one or a plurality of instructions or as one or a plurality of pieces of

code in the computer-readable medium.

[00139] The objectives, the technical solutions, and the beneficial effects of the plurality of embodiments disclosed in the specification are further described in detail in the foregoing specific implementation. It should be understood that the foregoing descriptions are merely specific implementation of the plurality of embodiments disclosed in the specification, and are not intended to limit the protection scope of the plurality of embodiments disclosed in the specification. Any modification, equivalent replacement, and improvement made on the basis of the technical solutions of the plurality of embodiments disclosed in the specification shall fall within the protection scope of the specification.

What Is Claimed Is:

- 1 1. A damage identification result optimization method, applied to
2 processing of a single image, the method comprising:
3 acquiring a vehicle damage image inputted by a user;
4 on the basis of a previously trained damage identification model, extracting
5 image feature information, and determining a damage identification result
6 corresponding to the vehicle damage image, the damage identification result
7 comprising at least a damage box;
8 displaying the damage identification result to the user, and receiving a
9 modification made by the user on the basis of the damage identification result;
10 and
11 on the basis of a previously trained long short-term memory (LSTM)
12 network, using the damage identification result, the image feature information,
13 and the modification as input to obtain an optimized damage identification result.
- 1 2. The method according to claim 1, wherein the damage
2 identification model is previously trained on the basis of the following steps:
3 acquiring a plurality of historical vehicle damage images labeled with
4 damage identification results; and
5 on the basis of a convolutional neural network (CNN), using the plurality
6 of historical vehicle damage images as training samples to train the damage
7 identification model.
- 1 3. The method according to claim 1, wherein the damage
2 identification result further comprises a damage classification corresponding to
3 the damage box; the modification comprises modifying the damage box and/or
4 modifying the damage classification; wherein modifying the damage box
5 comprises at least one of deleting, adding, moving, reducing, and amplifying.

1 4. The method according to claim 3, wherein the modification
2 comprises modifying the damage box; and wherein obtaining the optimized
3 damage identification result comprises:
4 according to the image feature information, acquiring candidate damage
5 boxes generated by the damage identification model to acquire the damage
6 identification result, wherein the candidate damage boxes comprises the damage
7 box in the damage result;
8 on the basis of the modification, updating the candidate damage boxes;
9 for the updated candidate damage boxes, on the basis of similarities among
10 the candidate damage boxes, determining optimized damage boxes, and using the
11 optimized damage boxes as part of the optimized damage identification result.

1 5. The method according to claim 4, wherein determining the
2 optimized damage box comprises:
3 determining a plurality of similarities between an arbitrary first candidate
4 damage box in the updated candidate damage boxes and other candidate damage
5 boxes;
6 inputting the plurality of similarities to a predetermined prediction model,
7 and according to an output result of the prediction model, determining whether
8 the first candidate damage box is an abnormal box, the prediction model
9 comprised in the LSTM; and
10 if the first candidate damage box is not the abnormal box, using the first
11 candidate damage box as part of the optimized damage boxes.

1 6. The method according to claim 5, wherein determining the
2 plurality of similarities between an arbitrary first candidate damage box in the
3 updated candidate damage boxes and the other candidate damage boxes
4 comprises:

5 calculating a dot product of a first feature vector corresponding to the first
6 candidate damage box and each of a plurality of other feature vectors
7 corresponding to the plurality of other candidate damage boxes, and determining a
8 plurality of dot product results as the plurality of similarities.

1 7. The method according to claim 5, wherein the prediction model is
2 previously trained using positive samples and negative samples; wherein the
3 positive samples comprise a plurality of damage regions labeled as true damage;
4 and wherein the negative samples comprise a plurality of damage regions labeled
5 as true damage and at least one region labeled as false damage.

1 8. The method according to claim 5, wherein the prediction model is
2 a linear regression model.

1 9. The method according to claim 3, wherein the damage
2 identification result comprises a plurality of damage boxes; wherein the plurality
3 of damage boxes comprise a first damage box; wherein the modification
4 comprises deleting the first damage box; and wherein optimizing the damage
5 identification result comprises:
6 determining a plurality of similarities between the first damage box and a
7 plurality of other damage boxes; and
8 using, as part of the optimized damage identification result, a damage box
9 corresponding to a similarity less than a preset threshold among the plurality of
10 similarities.

1 10. A damage identification result optimization method, applied to
2 processing of a plurality of images, the method comprising:
3 acquiring first image feature information of a first vehicle damage image
4 and a first damage identification result corresponding to the first vehicle damage
5 image, and acquiring second image feature information of a second vehicle

6 damage image and a second damage identification result corresponding to the
7 second vehicle damage image; and
8 on the basis of a previously trained long short-term memory (LSTM)
9 network, using the first damage identification result, the first image feature
10 information, the second image feature information, and the second damage
11 identification result as input to obtain an optimized second damage identification
12 result.

1 11. The method according to claim 10, wherein the first image feature
2 information and the second image feature information are separately extracted on
3 the basis of a previously trained damage identification model.

1 12. The method according to claim 10, wherein the first damage
2 identification result and the second damage identification result are separately
3 determined on the basis of a previously trained damage identification model, or
4 are separately determined on the basis of the method according to claim 1.

1 13. The method according to claim 10, wherein the second damage
2 identification result comprises a first damage box; and wherein obtaining the
3 optimized second damage identification result comprises:
4 on the basis of a region matching and positioning algorithm, determining,
5 from the first vehicle image, a matching region matching the first damage box;
6 and
7 optimizing a classification of the first damage box according to the
8 matching region.

1 14. The method according to claim 10, further comprising:
2 using the optimized second damage identification result, the second image
3 feature information, the first damage identification result, and the first image

4 feature information as input to obtain an optimized first damage identification
5 result.

1 15. The method according to claim 14, wherein the second damage
2 identification result comprises a first damage box; wherein obtaining the
3 optimized second damage identification result comprises:
4 on the basis of a region matching and positioning algorithm, determining,
5 from the first vehicle image, a matching region matching the first damage box;
6 and
7 optimizing a classification of the first damage box according to the
8 matching region;
9 wherein obtaining the optimized first damage identification result
10 comprises: optimizing at least one damage box in the first damage identification
11 result according to the matching region.

1 16. A damage identification result optimization apparatus, applied to
2 processing of a single image, the apparatus comprising:
3 an acquisition unit, used to acquire a vehicle damage image inputted by a
4 user;
5 an extraction unit, used to, on the basis of a previously trained damage
6 identification model, extract image feature information;
7 a determining unit, used to determine a damage identification result
8 corresponding to the vehicle damage image, the damage identification result
9 comprising at least a damage box;
10 a display unit, used to display the damage identification result to the user;
11 a receiving unit, used to receive a modification made by the user on the
12 basis of the damage identification result; and
13 an optimization unit, used to, on the basis of a previously trained long
14 short-term memory (LSTM) network, use the damage identification result, the

15 image feature information, and the modification as input to obtain the optimized
16 damage identification result.

1 17. The apparatus according to claim 16, wherein the damage
2 identification model in the extraction unit is previously trained on the basis of the
3 following steps:

4 acquiring a plurality of historical vehicle damage images labeled with
5 damage identification results; and

6 on the basis of a convolutional neural network (CNN), using the plurality
7 of historical vehicle damage images as training samples to train the damage
8 identification model.

1 18. The apparatus according to claim 16, wherein the damage
2 identification result further comprises a damage classification corresponding to
3 the damage box; the modification comprises modifying the damage box and/or
4 modifying the damage classification; wherein modifying the damage box
5 comprises at least one of deleting, adding, moving, reducing, and amplifying.

1 19. The apparatus according to claim 18, wherein the modification
2 comprises modifying the damage box; wherein the optimization unit specifically
3 comprises:
4 an acquisition subunit, used to, according to the image feature information,
5 acquire candidate damage boxes generated by the damage identification model in
6 order to obtain the damage identification result, wherein the candidate damage
7 boxes comprises the damage box in the damage result;
8 an updating subunit, used to, on the basis of the modification, update the
9 candidate damage boxes; and
10 a determining subunit, used to, for the updated candidate damage boxes, on
11 the basis of similarities among the candidate damage boxes, determine optimized

12 damage boxes, and use the optimized damage boxes as part of the optimized
13 damage identification result.

1 20. The apparatus according to claim 19, wherein the determining
2 subunit is specifically used to:
3 determine a plurality of similarities between an arbitrary first candidate
4 damage box in the updated candidate damage boxes and other candidate damage
5 boxes;
6 input the plurality of similarities to a predetermined prediction model, and
7 according to an output result of the prediction model, determine whether the first
8 candidate damage box is an abnormal box, the prediction model comprised in the
9 LSTM; and
10 if the first candidate damage box is not the abnormal box, use the first
11 candidate damage box as part of the optimized damage boxes.

1 21. The apparatus according to claim 20, wherein the determining
2 subunit is specifically used to determine the plurality of similarities between an
3 arbitrary first candidate damage box in the updated candidate damage boxes and
4 the other candidate damage boxes, comprising:
5 calculating a dot product of a first feature vector corresponding to the first
6 candidate damage box and each of a plurality of other feature vectors
7 corresponding to the plurality of other candidate damage boxes, and determining a
8 plurality of dot product results as the plurality of similarities.

1 22. The apparatus according to claim 21, wherein the prediction model
2 is previously trained using positive samples and negative samples; wherein the
3 positive samples comprise a plurality of damage regions labeled as true damage;
4 and wherein the negative samples comprise a plurality of damage regions labeled
5 as true damage and at least one region labeled as false damage.

1 23. The apparatus according to claim 22, wherein the prediction model
2 is a linear regression model.

1 24. The apparatus according to claim 18, wherein the damage
2 identification result comprises a plurality of damage boxes; wherein the plurality
3 of damage boxes comprise a first damage box; wherein the modification
4 comprises deleting the first damage box; and wherein the optimization unit is
5 specifically used to:
6 determine a plurality of similarities between the first damage box and a
7 plurality of other damage boxes; and
8 use, as part of the optimized damage identification result, a damage box
9 corresponding to a similarity less than a preset threshold among the plurality of
10 similarities.

1 25. A damage identification result optimization apparatus, applied to
2 processing of a plurality of images, the apparatus comprising:
3 an acquisition unit, used to acquire first image feature information of a first
4 vehicle damage image and a first damage identification result corresponding to
5 the first vehicle damage image, and acquire second image feature information of a
6 second vehicle damage image and a second damage identification result
7 corresponding to the second vehicle damage image; and
8 a first optimization unit, used to, on the basis of a previously trained long
9 short-term memory (LSTM) network, use the first damage identification result,
10 the first image feature information, the second image feature information, and the
11 second damage identification result as input to obtain an optimized second
12 damage identification result.

1 26. The apparatus according to claim 25, wherein the first image
2 feature information and the second image feature information are separately
3 extracted on the basis of a previously trained damage identification model.

1 27. The apparatus according to claim 25, wherein the first damage
2 identification result and the second damage identification result are separately
3 determined on the basis of a previously trained damage identification model, or
4 are separately determined on the basis of the method according to claim 1.

1 28. The apparatus according to claim 25, wherein the second damage
2 identification result comprises a first damage box; and wherein the first
3 optimization unit is specifically used to:
4 on the basis of a region matching and positioning algorithm, determine,
5 from the first vehicle image, a matching region matching the first damage box;
6 and
7 optimize a classification of the first damage box according to the matching
8 region.

1 29. The apparatus according to claim 25, further comprising:
2 a second optimization unit, used to use the optimized second damage
3 identification result, the second image feature information, the first damage
4 identification result, and the first image feature information as input to obtain an
5 optimized first damage identification result.

1 30. The apparatus according to claim 29, wherein the second damage
2 identification result comprises a first damage box; wherein the first optimization
3 unit is specifically used to:
4 on the basis of a region matching and positioning algorithm, determine,
5 from the first vehicle image, a matching region matching the first damage box;
6 and

7 optimize a classification of the first damage box according to the matching
8 region;
9 wherein the second optimization unit is specifically used to: optimize at
10 least one damage box in the first damage identification result according to the
11 matching region.

1 31. A computer-readable storage medium, on which a computer
2 program is stored, wherein the computer program, when executed on a computer,
3 causes the computer to perform the method according to any one of claims 1-15.

1 32. A computing device, comprising a memory and a processor,
2 characterized in that the memory stores executable code, and the processor, when
3 executing the executable code, implements the method according to any one of
4 claims 1-15.