

PARCEL SEARCH METHOD AND APPARATUS, ELECTRONIC DEVICE, AND STORAGE MEDIUM

TECHNICAL FIELD

[0001] The present application relates to the field of parcel identification, and specifically, to a parcel search method and apparatus, an electronic device, and a storage medium.

BACKGROUND

[0002] During transportation of a parcel, due to various reasons, a shipping label may fall off, which affects normal routing and sorting. For logistics companies, this abnormal situation requires relevant management personnel of a sorting center to report and investigate, which involves cross-site assistance. However, the cross-site assistance is time-consuming, difficult, and inefficient, and has relatively low accuracy in parcel search.

SUMMARY

[0003] The present application aims to provide a parcel search method and apparatus, an electronic device, and a storage medium, so as to solve a problem of relatively low parcel search accuracy in related technologies.

[0004] According to a first aspect, the present application provides a parcel search method, including: obtaining a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location; determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels; determining, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and determining, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0005] In some possible embodiments, the method further includes: obtaining an initial parcel picture library, where the initial parcel picture library includes a plurality of initial parcel pictures of the plurality of parcels; performing parcel detection on the plurality of initial parcel pictures, to remove a background portion of each initial parcel picture in the plurality of initial

parcel pictures, to obtain a plurality of third parcel pictures; and determining the parcel picture library based on the plurality of third parcel pictures.

[0006] In some possible embodiments, the method further includes: determining a first sampling moment at which the to-be-searched parcel is obtained.

[0007] In some possible embodiments, the determining the parcel picture library based on the plurality of third parcel pictures includes: removing, from the plurality of third parcel pictures, a parcel picture whose sampling moment is after the first sampling moment, to obtain the plurality of first parcel pictures and the plurality of second parcel pictures as the parcel picture library.

[0008] In some possible embodiment, the determining, based on the first target parcel picture and the second target parcel picture, the second parcel feature corresponding to the first target parcel, to obtain the parcel feature set includes: fusing the first target parcel picture and the second target parcel picture to obtain a fused target parcel picture; performing feature extraction on the fused target parcel picture, to determine an initial parcel feature corresponding to the first target parcel; and performing feature extraction on the initial parcel feature, to determine the second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

[0009] According to a second aspect, the present application provides a parcel search apparatus, including: a picture obtaining unit, configured to obtain a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location; a parcel feature processing unit, configured to determine, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels; a parcel feature comparison unit, configured to determine, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and a parcel determining unit, configured to determine, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0010] According to a third aspect, the present application further provides an electronic device, including: one or more processors; a memory; and one or more application programs, where the one or more application programs are stored in the memory and are configured to be executed by the processor, to implement the parcel search method according to any embodiment of the first aspect.

[0011] According to a fourth aspect, the present application further provides a computer-readable storage medium, where the computer-readable storage medium stores a computer program, and the computer program is loaded by a processor to execute the parcel search method according to any embodiment of the first aspect.

[0012] The present application provides the parcel search method and apparatus, the electronic device, and the storage medium. The method includes: obtaining the parcel picture library, where the parcel picture library includes the plurality of first parcel pictures obtained when the plurality of parcels pass through the sorting center, and the plurality of second parcel pictures obtained when the plurality of parcels are at the pickup/delivery location; determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, the parcel feature set corresponding to the plurality of parcels; determining, in the parcel feature set, the target parcel feature that is close in similarity to the first parcel feature corresponding to the to-be-searched parcel; and determining, in the parcel picture library based on the target parcel feature, the target parcel matching the to-be-searched parcel. A plurality of parcel pictures of a parcel are obtained from different sources, so that accuracy of identifying a parcel feature may be improved. Therefore, even if a problem such as damage to the parcel occurs subsequently, an initial parcel corresponding to the damaged parcel may also be found more accurately.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] To describe technical solutions in embodiments of the present application more clearly, the following briefly introduces the accompanying drawings required for the embodiments. It is apparent that the accompanying drawings in the following description show merely some embodiments of the present application, and a person skilled in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0014] FIG. 1 is a schematic diagram of a scenario of a parcel search system according to an embodiment of the present application.

[0015] FIG. 2 is a schematic flowchart of a parcel search method according to an embodiment of the present application.

[0016] FIG. 3 is a schematic flowchart of determining a parcel feature set according to an embodiment of the present application.

[0017] FIG. 4 is a schematic flowchart of determining a target parcel feature according to an embodiment of the present application.

[0018] FIG. 5 is a schematic structural diagram of a parcel search apparatus according to an embodiment of the present application.

[0019] FIG. 6 is a schematic structural diagram of an electronic device according to an embodiment of the present application.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] A method in the embodiments of the present application is executed in an electronic device, and therefore, processing objects of each electronic device exist in the form of data or information. For example, time is actually time information. It may be understood that if a size, a quantity, a position, and the like are mentioned in the subsequent embodiments, they exist as corresponding data, so that the electronic device can process them. Details are not described herein.

[0021] The embodiments of the present application provide a parcel search method and apparatus, an electronic device, and a storage medium, which are separately described in detail below.

[0022] Referring to FIG. 1, FIG. 1 is a schematic diagram of a scenario of a parcel search system according to an embodiment of the present application. The parcel search system may include an electronic device 100.

[0023] In the embodiment of the present application, the electronic device 100 may be an independent server, or a server network or server cluster including servers. For example, the electronic device 100 described in the embodiment of the present application includes but is not limited to a computer, a network host, a single network server, a plurality of network server sets, or a cloud server including a plurality of servers. The cloud server includes a large quantity of computers or network servers that are based on cloud computing.

[0024] A person skilled in the art may appreciate that an application environment shown in FIG. 1 is merely an application scenario in the solutions of the present application and does not constitute a limitation on application scenarios in the solutions of the present application. Another application environment may include more or fewer electronic devices than those shown in FIG. 1. For example, only one electronic device is shown in FIG. 1, and it may be understood that the parcel search system may further include one or more other servers, which are not specifically limited herein.

[0025] In addition, as shown in FIG. 1, the parcel search system may further include a storage unit 200 for storing data.

[0026] A communication connection may be established between the electronic device 100 and the storage unit 200, and the communication connection may be a wired or wireless network connection. Optionally, in terms of deployment and implementation, the electronic device 100 and the storage unit 200 may be deployed on a same physical device or on different physical devices. When the electronic device 100 and the storage unit 200 are deployed on different physical devices, the electronic device 100 and the storage unit 200 may be deployed in a same local area network or in different local area networks.

[0027] The following describes a parcel search process in detail with reference to the solutions of the present application and the parcel search system shown in FIG. 1.

[0028] The electronic device 100 obtains a parcel picture library from the storage unit 200, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location. The electronic device 100 determines, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels. The electronic device 100 determines, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel. The electronic device 100 determines, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0029] In one example, the electronic device 100 is integrated with a parcel search apparatus, configured to execute a parcel search method provided in the embodiments of the present application.

[0030] It should be noted that the schematic diagram of the scenario of the parcel search system shown in FIG. 1 is merely an example. The parcel search system and the scenario described in the embodiment of the present application are intended to describe the technical solutions in the embodiments of the present application more clearly, but do not constitute a limitation on the technical solutions provided in the embodiments of the present application. A person of ordinary skill in the art may learn that the technical solutions provided in the embodiments of the present application are also applicable to a similar technical problem as the parcel search system evolves and a new service scenario emerges.

[0031] With reference to FIG. 2 to FIG. 4, the following describes a parcel search method provided in the embodiments of the present application by using an example in more detail.

[0032] The parcel search method provided in the embodiments of the present application may be executed by the electronic device 100 shown in FIG. 1. For simplicity and ease of description, the execution body is omitted in the subsequent method embodiments.

[0033] The parcel search method provided in the present application is applicable to the logistics field, and is mainly used to, when a parcel is damaged and consequently a shipping label cannot be identified, quickly determine an original parcel corresponding to the damaged parcel. In a conventional parcel transportation process, a plurality of sorting centers are included. The sorting centers in the present application are usually a plurality of parcel sorting centers, excluding pickup and delivery locations of a parcel.

[0034] Referring to FIG. 2, FIG. 2 is a schematic flowchart of a parcel search method according to an embodiment of the present application. As shown in FIG. 2, the parcel search method includes the following content.

[0035] S21: Obtaining a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location.

[0036] A plurality of parcel pictures of a parcel are obtained from different sources, to ensure that, even if the parcel is damaged or deformed during transportation, the damaged or deformed parcel may also be bound to an initial undamaged and undeformed parcel, to facilitate identification of the damaged or deformed parcel.

[0037] During normal transportation of the parcel, a parcel picture corresponding to the parcel may be obtained and saved from a moment at which a courier receives the parcel. During transmission of the parcel on a transmission apparatus at a sorting center, an industrial camera on the transmission apparatus may also be used to shoot and save the parcel picture corresponding to the parcel. Therefore, in the present application, two types of parcel pictures may be obtained by using apparatuses such as cameras. One type of parcel picture is the first parcel picture obtained by the industrial camera on the transmission apparatus when the parcel is transported to different sorting centers; and another type of parcel picture is the second parcel picture obtained by the courier when the parcel is at the pickup/delivery location.

[0038] Usually, one parcel corresponds to at least two second parcel pictures, which are obtained by the courier at a delivery location and a pickup location respectively. One parcel also corresponds to at least one first parcel picture, which is obtained at a sorting center by a camera of the sorting center. Regardless of a type of parcel picture, every time the parcel picture is obtained, the parcel picture may be saved in the parcel picture library. Moreover, a shipping

label number corresponding to the parcel may also be determined when the parcel picture is obtained, to bind a shipping label number of each parcel to its corresponding parcel picture. In this way, when a specific parcel picture is determined, a specific parcel to which the specific parcel picture belongs is determined, and a corresponding shipping label number is also determined.

[0039] In some embodiments, before the parcel picture library is obtained, the method may further include: obtaining an initial parcel picture library; performing parcel detection on a plurality of initial parcel pictures in the initial parcel picture library, to remove background portions in the plurality of initial parcel pictures, to obtain a plurality of third parcel pictures; and determining a first sampling moment at which a to-be-searched picture of the to-be-searched parcel is obtained, and removing, from the plurality of third parcel pictures, a third parcel picture whose sampling moment is after the first sampling moment, to obtain the plurality of first parcel pictures and the plurality of second parcel pictures, that is, the parcel picture library. The parcel picture library includes a plurality of third parcel pictures obtained after removal of the third parcel picture whose sampling moment is after the first sampling moment. That is to say, the plurality of third parcel pictures obtained after removal of the third parcel picture whose sampling moment is after the first sampling moment include the plurality of first parcel pictures and the plurality of second parcel pictures.

[0040] In addition, after the initial parcel picture is obtained by photographing with a camera device, the initial parcel picture may be further processed to determine whether the initial parcel picture meets a requirement, for example, whether the initial parcel picture is clear or whether the initial parcel picture includes a complete parcel. When the initial parcel picture is unclear or the initial parcel picture does not include a complete parcel, this type of initial parcel picture is removed. That is to say, this type of initial parcel picture is not stored in the initial parcel picture library.

[0041] After the foregoing screening, the initial parcel pictures that meet the requirement may also be processed again. This processing is to remove the background portions of the initial parcel pictures. That is to say, only a parcel portion of each initial parcel picture is retained, thereby avoiding that the background portions affect subsequent identification of a parcel feature. For example, the parcel detection is performed on the plurality of initial parcel pictures, to determine the background portions of the plurality of initial parcel pictures. For a specific method for removing the background portions of the plurality of initial parcel pictures to obtain a plurality of initial parcel pictures, refer to related technologies. This is not limited in the present application.

[0042] To reduce computing, in the present application, the first sampling moment corresponding to the to-be-searched picture of the to-be-searched parcel may be further determined, and some parcel pictures in the initial parcel picture library are removed based on the first sampling moment. When it is determined that a parcel requires searching, it indicates that the parcel has been transported, and the first parcel picture and/or the second parcel picture corresponding to the parcel have/has been collected. In this case, screening only needs to be performed in the first parcel pictures and/or the second parcel pictures obtained before the first sampling moment. Therefore, the third parcel picture whose sampling moment is after the first sampling moment may be removed, and the parcel picture library includes a plurality of screened third parcel pictures.

[0043] S22: Determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels.

[0044] In the parcel search method of the present application, the parcels are searched based on picture features corresponding to pictures (or referred to as parcel features). Therefore, after the plurality of first parcel pictures and the plurality of second parcel pictures corresponding to the plurality of parcels are determined, the parcel feature set corresponding to the plurality of parcels may be further determined. As mentioned above, because each parcel is bound to its corresponding first parcel picture and second parcel picture, in the parcel feature set, each parcel may also be bound to its corresponding parcel feature. The parcel feature set includes a parcel feature corresponding to each parcel. A specific method for determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, the parcel feature corresponding to each parcel is described in detail in the subsequent embodiments.

[0045] S23: Determining, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel.

[0046] S24: Determining, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0047] After the parcel feature corresponding to each parcel is determined, if a parcel is damaged or deformed and consequently the parcel is unrecognizable, image-based search may be performed to determine a normal parcel corresponding to the damaged or deformed parcel. For example, the first parcel feature corresponding to the to-be-searched parcel may be determined first, and then search may be performed in the parcel feature set based on the first parcel feature until a parcel relatively similar to the to-be-searched parcel is found, that is, the target parcel.

[0048] In one example, a feature similarity between each parcel feature in the parcel feature set and the first parcel feature is determined, to determine a parcel relatively similar to the to-be-searched parcel. That is, after a parcel feature with a relatively high parcel similarity is determined, a parcel picture corresponding to the parcel feature with a relatively high parcel similarity may be further determined, so that a corresponding normal parcel, namely, the target parcel, can be determined.

[0049] The parcel search method provided in the embodiments of the present application is applied to the logistics field. The method includes: obtaining the parcel picture library, where the parcel picture library includes the plurality of first parcel pictures obtained when the plurality of parcels pass through the sorting center, and the plurality of second parcel pictures obtained when the plurality of parcels are at the pickup/delivery location; determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, the parcel feature set corresponding to the plurality of parcels; determining, in the parcel feature set, the target parcel feature that is close in similarity to the first parcel feature corresponding to the to-be-searched parcel; and determining, in the parcel picture library based on the target parcel feature, the target parcel matching the to-be-searched parcel. A plurality of parcel pictures of a parcel are obtained from different sources, so that accuracy of identifying a parcel feature may be improved. Therefore, even if a problem such as damage to the parcel occurs subsequently, an initial parcel (that is, the target parcel) corresponding to the damaged parcel (that is, the to-be-searched parcel) may also be found more accurately.

[0050] In an embodiment of the present application, as shown in FIG. 3, a process of determining the parcel feature set may include the following content.

[0051] S31: Using each first parcel picture in the plurality of first parcel pictures as a first target parcel picture, where a parcel in the first target parcel picture is a first target parcel.

[0052] S31: Determining, from the plurality of second parcel pictures, a second target parcel picture associated with the first target parcel.

[0053] Any first parcel picture in the plurality of first parcel pictures is used as the first target parcel picture, and the parcel associated with the first target parcel picture is the first target parcel. Because the first target parcel is associated with its corresponding first parcel picture and second parcel picture, the second parcel picture associated with the first target parcel may be further determined from the plurality of second parcel pictures, that is, the second target parcel picture associated with the first target parcel picture is determined.

[0054] S33: Fusing the first target parcel picture and the second target parcel picture to obtain a fused target parcel picture.

[0055] Because the second target parcel picture is obtained by shooting the first target parcel at the pickup/delivery location, and the second target parcel picture obtained at the pickup location usually includes a normal and undamaged parcel, after a long period of transportation, the first target parcel may be damaged or deformed after arriving at the delivery location, resulting in an abnormality in a parcel in the second target parcel picture obtained at the delivery location. Similarly, for the first target parcel picture obtained at the sorting center during a parcel transportation process, there may also be a problem that the first target parcel picture is abnormal due to abnormality in the first target parcel.

[0056] Therefore, the first target parcel picture and the second target parcel picture corresponding to the first target parcel may be combined to determine a parcel feature corresponding to the first target parcel. For example, the first target parcel picture and the second target parcel picture may be fused to obtain the fused target parcel picture, and then a second parcel feature corresponding to the first target parcel is determined based on the fused target parcel picture, thereby ensuring accuracy of subsequent parcel feature extraction.

[0057] In a specific embodiment, two Convolutional Neural Network (CNN) models may be used to fuse the first target parcel picture and the second target parcel picture. Inputs of the two CNN models are respectively a picture pixel matrix of $h1*w1*c1$ corresponding to the first target parcel picture and a picture pixel matrix of $h2*w2*c2$ corresponding to the second target parcel picture. A picture pixel matrix of $h3*w3*c3$ is obtained by using a fusing network. Structures of the two CNN models are the same. However, after training, different weights are respectively assigned to the two CNN models for the first target parcel picture and the second target parcel picture, to achieve an objective of mapping different parcel pictures to a same feature space (that is, fusing a plurality of parcel pictures).

[0058] S34: Performing feature extraction on the fused target parcel picture, to determine an initial parcel feature corresponding to the first target parcel.

[0059] S35: Performing feature extraction on the initial parcel feature, to determine the second parcel feature, to obtain the parcel feature set.

[0060] A neural network model is used to perform the feature extraction on the fused target parcel feature. Moreover, two times of feature extraction (for example, coarse extraction and fine extraction) are used to obtain a high-precision feature. For example, the coarse extraction in the two times of feature extraction is to perform the feature extraction on the fused target parcel picture, to obtain the initial parcel feature corresponding to the first target parcel; and the fine extraction in the two times of feature extraction is to perform the feature extraction on the initial parcel feature, to obtain the higher-precision second parcel feature corresponding to

the first target parcel. Actually, the feature extraction is performed twice on the fused target parcel picture, to ensure accuracy of the extracted feature.

[0061] It should be noted that the second parcel feature corresponding to the first target parcel may be extracted by using the neural network model. When the coarse extraction is performed by using the neural network model, that is, during extraction of the initial parcel feature corresponding to the fused target parcel picture, an input of the neural network model is the fused target parcel picture. When the fine extraction is performed by using the neural network model, that is, during feature extraction of the initial parcel feature, an input of the neural network model is the initial parcel feature. That is, the fine extraction is performed on a basis of a feature obtained by means of coarse extraction, instead of feature re-extraction of the fused target parcel picture.

[0062] In a specific embodiment, a deep learning capability of the neural network may be used to abstract a cross-domain feature map of a parcel picture into a 768-dimensional deep feature, so that features respective to parcels with different shipping label numbers are distinguishable. That is, distances between a plurality of parcel features corresponding to a plurality of parcel pictures with a same shipping label number are closer, and distances between a plurality of parcel features corresponding to a plurality of parcel pictures with different shipping label numbers are farther. More specifically, the fused target parcel picture may be input into a convNeXt network, and finally, a global pooling layer is used to obtain a 768-dimensional parcel feature (that is, the second parcel feature) corresponding to the fused target parcel picture.

[0063] In the embodiments described above, how to determine a corresponding second parcel feature based on each first parcel picture is described. That is, one first parcel picture corresponds to one second parcel feature, and there are a plurality of first parcel pictures in the parcel picture library, and therefore, through the foregoing Steps S31 to S35, the plurality of second parcel features respective to the plurality of first parcel pictures may be determined, to obtain the parcel feature set including the plurality of second parcel features.

[0064] It should be noted that, because the first parcel picture and the second parcel picture of one parcel are bound, the second parcel feature corresponding to the first parcel picture of one target parcel is actually a parcel feature corresponding to the second parcel picture of the one target parcel. Moreover, the second parcel feature is determined also by using the first parcel picture and a corresponding second parcel picture. Therefore, in some other embodiments, any second parcel picture may also be first determined from the plurality of

second parcel pictures, and then the first parcel picture corresponding to the second parcel picture is determined, so as to determine the corresponding second parcel feature.

[0065] In an embodiment of the present application, as shown in FIG. 4, a process of determining the target parcel feature includes the following content.

[0066] S41: Computing a similarity between the first parcel feature and each second parcel feature in the plurality of second parcel features, to obtain a plurality of parcel similarities.

[0067] In some embodiments, a cosine distance between the first parcel feature and each second parcel feature in the plurality of second parcel features may be computed to obtain a plurality of cosine distances, and the plurality of parcel similarities are determined based on the plurality of cosine distances. It should be noted that, the larger the cosine distance, the larger the difference between two parcel features, and consequently, the lower the similarity between the two parcel features. The smaller the cosine distance, the smaller the difference between the two parcel features, and consequently, the larger the similarity between the two parcel features. That is, the cosine distance is inversely proportional to the parcel similarity.

[0068] In other embodiments, the parcel similarity may alternatively be computed by using another method. A method for calculating the similarity is not limited in the present application.

[0069] S42: Sorting the plurality of parcel similarities in descending order, to obtain a plurality of sorted parcel similarities.

[0070] S43: Determining, from the plurality of sorted parcel similarities, a preset quantity of sorted parcel similarities starting from a first-ranked one, as a target parcel similarity.

[0071] S44: Determining, in the parcel feature set, a second parcel feature corresponding to the target parcel similarity, as the target parcel feature.

[0072] After the plurality of parcel similarities are obtained, the plurality of parcel similarities may be further sorted according to a specific order. For example, the plurality of parcel similarities may be sorted in descending order or ascending order. This is to determine a relatively high parcel similarity among the plurality of sorted parcel similarity as the target parcel similarity. The relatively high parcel similarity also indicates that two parcels are relatively similar. In this case, a parcel with a relatively high similarity is more likely to be the target parcel corresponding to the to-be-searched parcel.

[0073] In order to improve accuracy, instead of directly determining a largest parcel similarity among the plurality of parcel similarities, the plurality of parcel similarities are arranged in ascending order, and the preset quantity of sorted parcel similarities starting from a first-ranked one are selected to screen out a preset quantity of second parcel features with relatively high similarities to the first parcel feature, and then the preset quantity of second parcel features are

screened again, to determine the target parcel with a highest matching degree with the to-be-searched parcel.

[0074] Due to computing accuracy and different features corresponding to different parcels, in the present application, the target parcel feature is determined not by determining whether a parcel similarity is within a parcel similarity threshold range. Instead, the plurality of parcel similarities are directly sorted in ascending order, and among the plurality of sorted parcel similarities, the preset quantity of sorted parcel similarities starting from a first-ranked one, are determined as the target parcel similarity. The second parcel feature corresponding to the target parcel similarity is the target parcel feature. Therefore, regardless of how the parcel similarities vary, the second parcel feature corresponding to a relatively high parcel similarity is always selected.

[0075] In a specific embodiment, starting from a first-ranked sorted parcel similarity among the plurality of sorted parcel similarities, 50 sorted parcel similarities are selected. 50 second parcel features corresponding to these 50 sorted parcel similarities are the target parcel features with relatively high similarities to the first parcel feature. After the target parcel feature that is close in similarity to the first parcel feature is determined, a parcel picture corresponding to the target parcel feature may be determined in the parcel picture library, so as to determine a corresponding parcel that is not damaged or deformed.

[0076] The method embodiments of the present application are described in detail above with reference to FIG. 1 to FIG. 4. Apparatus embodiments of the present application are described in detail below with reference to FIG. 5 and FIG. 6. It should be understood that the descriptions of the method embodiments correspond to the descriptions of the apparatus embodiments, and therefore, for parts that are not described in detail, refer to the foregoing method embodiments.

[0077] To better implement the parcel search method in the embodiments of the present application, based on the parcel search method, the embodiments of the present application further provide a parcel search apparatus. As shown in FIG. 5, FIG. 5 is a schematic structural diagram of a parcel search apparatus according to an embodiment of the present application. The parcel search apparatus includes: a picture obtaining unit 501, a parcel feature processing unit 502, a parcel feature comparison unit 503, and a parcel determining unit 504.

[0078] The picture obtaining unit 501 is configured to obtain a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location.

[0079] The parcel feature processing unit 502 is configured to determine, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels.

[0080] The parcel feature comparison unit 503 is configured to determine, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel.

[0081] The parcel determining unit 504 is configured to determine, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0082] In the parcel search apparatus provided in the embodiment of the present application, the parcel picture library is obtained, where the parcel picture library includes the plurality of first parcel pictures obtained when the plurality of parcels pass through the sorting center, and the plurality of second parcel pictures obtained when the plurality of parcels are at the pickup/delivery location. The parcel feature set corresponding to the plurality of parcels is determined based on the plurality of first parcel pictures and the plurality of second parcel pictures. The target parcel feature that is close in similarity to the first parcel feature corresponding to the to-be-searched parcel is determined in the parcel feature set. The target parcel matching the to-be-searched parcel is determined in the parcel picture library based on the target parcel feature. A plurality of parcel pictures of a parcel are obtained from different sources, so that accuracy of identifying a parcel feature may be improved. Therefore, even if a problem such as damage to the parcel occurs subsequently, an initial parcel corresponding to the damaged parcel may also be found more accurately.

[0083] In some implementations of the present application, the picture obtaining unit 501 is further configured to: obtain an initial parcel picture library, where the initial parcel picture library includes a plurality of initial parcel pictures of the plurality of parcels; perform parcel detection on the plurality of initial parcel pictures, to remove a background portion of each initial parcel picture in the plurality of initial parcel pictures, to obtain a plurality of third parcel pictures; and determine the parcel picture library based on the plurality of third parcel pictures.

[0084] In some implementations of the present application, the picture obtaining unit 501 is further configured to: determine a first sampling moment at which the to-be-search parcel is obtained, and when determining the parcel picture library based on the plurality of third parcel picture, the picture obtaining unit 501 is specifically configured to: remove, from the plurality of third parcel pictures, a parcel picture whose sampling moment is after the first sampling moment, to obtain the plurality of first parcel pictures and the plurality of second parcel pictures as the parcel picture library.

[0085] In some implementations of the present application, the picture obtaining unit 501 is further configured to: determine whether each initial parcel picture in the plurality of initial parcel pictures meets a requirement, where the requirement includes at least one of following requirements: whether the initial parcel picture is clear or whether the initial parcel picture includes a complete parcel; and when the initial parcel picture is unclear and/or the initial parcel picture does not include a complete parcel, remove the initial parcel picture from the initial parcel picture library.

[0086] In some implementations of the present application, the parcel feature processing unit 502 is specifically configured to: use each first parcel picture in the plurality of first parcel pictures as a first target parcel picture, where a parcel in the first target parcel picture is a first target parcel; determine, from the plurality of second parcel pictures, a second target parcel picture associated with the first target parcel; and determine, based on the first target parcel picture and the second target parcel picture, a second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

[0087] In some implementations of the present application, the parcel feature processing unit 502 is specifically configured to: use each second parcel picture in the plurality of second parcel pictures as a second target parcel picture, where a parcel in the second target parcel picture is a first target parcel; determine, from the plurality of first parcel pictures, a first target parcel picture associated with the first target parcel; and determine, based on the first target parcel picture and the second target parcel picture, a second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

[0088] In some implementations of the present application, when determining, based on the first target parcel picture and the second target parcel picture, the second parcel feature corresponding to the first target parcel, to obtain the parcel feature set, the parcel feature processing unit 502 is specifically configured to: fuse the first target parcel picture and the second target parcel picture to obtain a fused target parcel picture; performing feature extraction on the fused target parcel picture, to determine an initial parcel feature corresponding to the first target parcel; and perform feature extraction on the initial parcel feature, to determine the second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

[0089] In some implementations of the present application, when fusing the first target parcel picture and the second target parcel picture to obtain the fused target parcel picture, the parcel feature processing unit 502 is specifically configured to: input the first target parcel picture into a first convolutional neural network model, to output a preset-size first picture pixel matrix corresponding to the first target parcel picture; input the second target parcel picture into a

second convolutional neural network model, to output a preset-size second picture pixel matrix corresponding to the second target parcel picture; and fuse the first picture pixel matrix and the second picture pixel matrix by using a fusion network, to obtain the fused target parcel picture, where for the first target parcel picture and the second target parcel picture, different weights are respectively assigned to the first convolutional neural network model and the second convolutional neural network model.

[0090] In some implementations of the present application, the parcel feature set includes a plurality of second parcel features corresponding to the plurality of parcels, and one parcel corresponds to at least one second parcel feature; and when determining, in the parcel feature set, the target parcel feature that is close in similarity to the first parcel feature corresponding to the to-be-searched parcel, the parcel feature comparison unit 504 is specifically configured to: compute a parcel similarity between the first parcel feature and each second parcel feature in the plurality of second parcel features, to obtain a plurality of parcel similarities; sort the plurality of parcel similarities in descending order, to obtain a plurality of sorted parcel similarities; determine, from the plurality of sorted parcel similarities, a preset quantity of parcel similarities starting from a first-ranked one, as a target parcel similarity; and determine, in a parcel feature set, a second parcel feature corresponding to the target parcel similarity, as the target parcel feature.

[0091] In some implementations of the present application, when computing the parcel similarities between the first parcel feature and the plurality of second parcel features, to obtain the plurality of parcel similarities, the parcel feature comparison unit 504 is specifically configured to: compute a cosine distance between the first parcel feature and each second parcel feature in the plurality of second parcel features to obtain a plurality of cosine distances; and determine the plurality of parcel similarities based on the plurality of cosine distances.

[0092] The embodiments of the present application further provide an electronic device. FIG. 6 is a schematic structural diagram of an electronic device according to an embodiment of the present application. In one example, the electronic device may be integrated with the parcel search apparatus provided in any embodiment of the present application.

[0093] As shown in FIG. 6, the electronic device may include one or more processors 601 with a processing core, one or more memories 602, a power supply 603, and an input unit 604. A person skilled in the art may understand that a structure of the electronic device shown in the figure does not constitute a limitation on the electronic device. The electronic device may include more or fewer components than those shown in the figure, or combine some components, or have different component arrangements.

[0094] The processor 601 is a control center of the electronic device, and is connected to various parts of the entire electronic device through various interfaces and lines. For example, the processor 601 performs various functions and data processing of the electronic device by running or executing a software program and/or a module stored in the memory 602 and invoking data stored in the memory 602, so as to perform overall monitoring on the electronic device. Optionally, the processor 601 may be integrated with an application processor and a modem processor. The application processor mainly processes an operating system, a user interface, an application program, and the like. The modem processor mainly processes wireless communication. It may be understood that the modem processor may not be integrated into the processor 601.

[0095] The memory 602 may be configured to store a software program and a module. The processor 601 executes various functional applications and data processing by running the software program and the module that are stored in the memory 602. The memory 602 may mainly include a program storage area and a data storage area. The program storage area may store an operating system, an application program required by at least one function (for example, a sound playing function or an image playing function), and the like. The data storage area may store data created based on use of the electronic device, and the like. In addition, the memory 602 may include a high-speed random access memory, and may further include a non-volatile memory, for example, at least one magnetic disk storage device, a flash memory device, or other volatile solid-state storage devices. Correspondingly, the memory 602 may further include a memory controller, to provide access to the memory 602 for the processor 601.

[0096] The electronic device further includes the power supply 603 that supplies power to each component. Preferably, the power supply 603 may be logically connected to the processor 601 through a power management system, so as to implement functions such as charging management, discharging management, and power consumption management by using the power management system. The power supply 603 may further include any component such as one or more direct current or alternating current power supplies, a recharge system, a power failure detection circuit, a power converter, an inverter, or a power status indicator.

[0097] The electronic device may further include the input unit 604. The input unit 604 may be configured to receive input digit or character information, and generate a keyboard, mouse, joystick, optical, or trackball signal input related to user setting and function control.

[0098] Although not shown, a display unit or the like may be further included in the electronic device, and details are not described herein. Specifically, in this embodiment, the processor 601 in the electronic device loads, according to the following instructions, executable files

corresponding to processes of one or more application programs into the memory 602, and the processor 601 runs the application program stored in the memory 602, to implement various functions, such as: obtaining a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location; determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels; and determining, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and determining, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0099] A person of ordinary skill in the art may understand that all or some of the steps in the method in the foregoing embodiments may be implemented by using an instruction, or by controlling related hardware by using an instruction. The instruction may be stored in a computer-readable storage medium, and loaded and executed by a processor.

[0100] Therefore, the embodiments of the present application provide a computer-readable storage medium. The storage medium may include: a Read Only Memory (ROM), a Random Access Memory (RAM), a disk or an optical disc, and the like. The computer-readable storage medium stores a computer program, and the computer program is loaded by a processor, to perform the steps in the parcel search method provided in any embodiment of the present application. For example, the computer program is loaded by the processor to perform the following steps: obtaining a parcel picture library, where the parcel picture library includes a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location; determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels; and determining, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and determining, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

[0101] In the foregoing embodiments, the descriptions of the embodiments have different focuses. For a part that is not described in detail in an embodiment, refer to the foregoing detailed descriptions of other embodiments. Details are not described herein again.

[0102] During specific implementation, the foregoing units or structures may be implemented as separate entities, or may be randomly combined to be implemented as one or more entities. For specific implementation of the foregoing operations, units, or structures, reference may be made to the foregoing method embodiments, and details are not described herein again.

[0103] The foregoing describes in detail the parcel search method and apparatus, the electronic device, and the storage medium provided by the embodiments of the present application. The principles and implementations of the present application are described herein through specific examples. The description of the embodiments is merely provided to help understand the method and core ideas of the present application. In addition, for a person skilled in the art, based on the ideas of the present application, there will be changes in the specific implementation and scope of application. In summary, the content of this specification should not be understood as a limitation on the present application.

CLAIMS

What is claimed is:

1. A parcel search method, comprising:

obtaining a parcel picture library, wherein the parcel picture library comprises a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location;

determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels;

determining, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and

determining, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

2. The parcel search method according to claim 1, further comprising:

obtaining an initial parcel picture library, wherein the initial parcel picture library comprises a plurality of initial parcel pictures of the plurality of parcels;

performing parcel detection on the plurality of initial parcel pictures, to remove a background portion of each initial parcel picture in the plurality of initial parcel pictures, to obtain a plurality of third parcel pictures; and

determining the parcel picture library based on the plurality of third parcel pictures.

3. The parcel search method according to claim 2, further comprising:

determining a first sampling moment at which the to-be-searched parcel is obtained,

wherein the determining the parcel picture library based on the plurality of third parcel pictures comprises:

removing, from the plurality of third parcel pictures, a parcel picture whose sampling moment is after the first sampling moment, to obtain the plurality of first parcel pictures and the plurality of second parcel pictures as the parcel picture library.

4. The parcel search method according to claim 2 or 3, further comprising:

determining whether each initial parcel picture in the plurality of initial parcel pictures meets a requirement, wherein the requirement comprises at least one of following requirements:

whether the initial parcel picture is clear or whether the initial parcel picture comprises a complete parcel; and

when the initial parcel picture is unclear and/or the initial parcel picture does not comprise a complete parcel, removing the initial parcel picture from the initial parcel picture library.

5. The parcel search method according to any one of claims 1 to 4, wherein the determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, the parcel feature set corresponding to the plurality of parcels comprises:

using each first parcel picture in the plurality of first parcel pictures as a first target parcel picture, wherein a parcel in the first target parcel picture is a first target parcel;

determining, from the plurality of second parcel pictures, a second target parcel picture associated with the first target parcel; and

determining, based on the first target parcel picture and the second target parcel picture, a second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

6. The parcel search method according to any one of claims 1 to 4, wherein the determining, based on the plurality of first parcel pictures and the plurality of second parcel pictures, the parcel feature set corresponding to the plurality of parcels comprises:

using each second parcel picture in the plurality of second parcel pictures as a second target parcel picture, wherein a parcel in the second target parcel picture is a first target parcel;

determining, from the plurality of first parcel pictures, a first target parcel picture associated with the first target parcel; and

determining, based on the first target parcel picture and the second target parcel picture, a second parcel feature corresponding to the first target parcel, to obtain the parcel feature set.

7. The parcel search method according to claim 5 or 6, wherein the determining, based on the first target parcel picture and the second target parcel picture, the second parcel feature corresponding to the first target parcel, to obtain the parcel feature set comprises:

fusing the first target parcel picture and the second target parcel picture to obtain a fused target parcel picture;

performing feature extraction on the fused target parcel picture, to determine an initial parcel feature corresponding to the first target parcel; and

performing feature extraction on the initial parcel feature, to determine the second parcel feature, to obtain the parcel feature set.

8. The parcel search method according to claim 7, wherein the fusing the first target parcel picture and the second target parcel picture to obtain the fused target parcel picture comprises:

inputting the first target parcel picture into a first convolutional neural network model, to output a preset-size first picture pixel matrix corresponding to the first target parcel picture;

inputting the second target parcel picture into a second convolutional neural network model, to output a preset-size second picture pixel matrix corresponding to the second target parcel picture; and

fusing the first picture pixel matrix and the second picture pixel matrix by using a fusion network, to obtain the fused target parcel picture,

wherein for the first target parcel picture and the second target parcel picture, different weights are respectively assigned to the first convolutional neural network model and the second convolutional neural network model.

9. The parcel search method according to any one of claims 1 to 8, wherein the parcel feature set comprises a plurality of second parcel features corresponding to the plurality of parcels, and one parcel corresponds to at least one second parcel feature; and

the determining, in the parcel feature set, the target parcel feature that is close in similarity to the first parcel feature corresponding to the to-be-searched parcel comprises:

computing a similarity between the first parcel feature and each second parcel feature in the plurality of second parcel features, to obtain a plurality of parcel similarities;

sorting the plurality of parcel similarities in descending order, to obtain a plurality of sorted parcel similarities;

determining, from the plurality of sorted parcel similarities, a preset quantity of sorted parcel similarities starting from a first-ranked one, as a target parcel similarity; and

determining a second parcel feature corresponding to the target parcel similarity as the target parcel feature.

10. The parcel search method according to claim 9, wherein the computing the similarity between the first parcel feature and each second parcel feature in the plurality of second parcel features, to obtain the plurality of parcel similarities comprises:

computing a cosine distance between the first parcel feature and each second parcel feature in the plurality of second parcel features to obtain a plurality of cosine distances; and

determining the plurality of parcel similarities based on the plurality of cosine distances.

11. A parcel search apparatus, wherein the parcel search apparatus comprises:

a picture obtaining unit, configured to obtain a parcel picture library, wherein the parcel picture library comprises a plurality of first parcel pictures obtained when a plurality of parcels pass through a sorting center, and a plurality of second parcel pictures obtained when the plurality of parcels are at a pickup/delivery location;

a parcel feature processing unit, configured to determine, based on the plurality of first parcel pictures and the plurality of second parcel pictures, a parcel feature set corresponding to the plurality of parcels;

a parcel feature comparison unit, configured to determine, in the parcel feature set, a target parcel feature that is close in similarity to a first parcel feature corresponding to a to-be-searched parcel; and

a parcel determining unit, configured to determine, in the parcel picture library based on the target parcel feature, a target parcel matching the to-be-searched parcel.

12. An electronic device, wherein the electronic device comprises:

one or more processors;

a memory; and

one or more application programs, wherein the one or more application programs are stored in the memory and are configured to be executed by the processor, to implement the parcel search method according to any one of claims 1 to 10.

13. A computer-readable storage medium, wherein the computer readable storage medium stores a computer program, and the computer program is loaded by a processor to execute the parcel search method according to any one of claims 1 to 10.