

METHOD AND APPARATUS FOR OBTAINING SAMPLE IMAGES, AND ELECTRONIC DEVICE

Technical Field

The present disclosure relates to a machine learning technology, and specifically relates to methods and apparatuses for obtaining sample images, and electronic devices.

Background

In recent years, with continuous development of an artificial intelligence technology, the artificial intelligence technology achieves good effects in aspects such as computer vision and speech recognition. Game currencies used in a game are required for recognizing in some relatively special scenes such as a tabletop game scene. Automatically recognizing game currencies is also an important research topic for constructing a wise game place. Moreover, as a precondition of recognizing game currencies in a game, acquiring a sample image including a game currency for a recognition network used for training game currency recognition is an essential step. The quality of the sample image directly affects the precision of game currency recognition.

Summary

In view of this, the present disclosure at least provides a method and apparatus for obtaining sample images, and an electronic device.

According to a first aspect, provided is a method for obtaining sample images, including:

acquiring images of stacked objects, where stacked objects in different images have different item information, and the item information includes: attributes of the stacked objects and a combination of stacking modes; and

taking an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality.

According to any one of embodiments of the present disclosure, the method further includes: confirming that a distribution data of item information of stacked objects in sample images of a sample image set does not meet a predetermined distribution condition, the sample image set including multiple sample images; and acquiring a missing image which is an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition.

According to any one of embodiments of the present disclosure, after acquiring the missing image, the method further includes: taking the missing image as a sample image in the case that the acquired missing image meets the filtering condition of the image quality.

According to any one of embodiments of the present disclosure, the stacking modes include: a stacking direction, a stacking area, a neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object; the attribute of the stacked object includes: a value represented by each object constituting the stacked object and the object type of each object; stacked objects in different sample images are different from each other in at least one of the following aspects: the stacking direction, the stacking area, the neighboring relation among the objects, the number of objects in the stacked object, and the value represented by each object constituting the stacked object and the object type.

According to any one of embodiments of the present disclosure, acquiring images of stacked objects includes: acquiring N image subsets, where stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; stacked objects in images of different image subsets have different first attributes; the attributes of stacked objects in images of one image subset cover different possible combinations of second attributes; the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object; the second attribute is one of the value and the object type other than the first attribute.

According to any one of embodiments of the present disclosure, when the stacking direction is parallel to a surface where the stacked object is placed, the acquiring images of stacked objects includes: acquiring images of stacked objects at an overhead view of the surface.

According to any one of embodiments of the present disclosure, when the stacking direction is perpendicular to the surface where the stacked object is placed, the acquiring images of stacked objects includes: acquiring images of stacked objects at a side view of the surface.

According to any one of embodiments of the present disclosure, the taking an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality includes: determining bounding boxes of target objects in the acquired image, the target objects including a stacked object; determining respectively that an Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than a first predetermined threshold; and taking an acquired image as the sample image.

According to any one of embodiments of the present disclosure, after determining respectively that the Intersection over Union between the bounding box of the stacked object and

bounding boxes of other target objects is less than the first predetermined threshold, and before taking an acquired image as the sample image, the method further includes: determining that a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, where the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image.

According to a second aspect, provided is an apparatus for obtaining sample images, including:

an image acquisition module, configured to acquire images of stacked objects, where stacked objects in different images have different item information, and the item information includes: attributes of the stacked objects and a combination of stacking modes; and

an image filtering module, configured to take an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality.

According to any one of embodiments of the present disclosure, the image acquisition module is further configured to acquire a missing image when it is confirmed that a distribution data of item information of stacked objects in sample images of a sample image set does not meet a predetermined distribution condition, where the missing image is an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition; the sample image set including multiple sample images.

According to any one of embodiments of the present disclosure, the image filtering module is further configured to take the missing image as a sample image in the case that the acquired missing image meets the filtering condition of the image quality.

According to any one of embodiments of the present disclosure, the stacking modes include: a stacking direction, a stacking area, a neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object; the attribute of the stacked object includes: a value represented by each object constituting the stacked object and the object type of each object; stacked objects in different sample images are different from each other in at least one of the following aspects: the stacking direction, the stacking area, the neighboring relation among the objects, the number of objects in the stacked object, and the value represented by each object constituting the stacked object and the object type.

According to any one of embodiments of the present disclosure, the image acquisition

module is configured to acquire N image subsets, where stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; stacked objects in images of different image subsets have different first attributes; the attributes of stacked objects in images of one image subset cover different possible combinations of second attributes; the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object; the second attribute is one of the value and the object type other than the first attribute.

According to any one of embodiments of the present disclosure, the image acquisition module is configured to, when the stacking direction is parallel to a surface where the stacked object is placed, acquire images of stacked objects at an overhead view of the surface.

According to any one of embodiments of the present disclosure, the image acquisition module is configured to, when the stacking direction is perpendicular to the surface where the stacked object is placed, acquire images of stacked objects at a side view of the surface.

According to any one of embodiments of the present disclosure, the image filtering module is specifically configured to determine bounding boxes of target objects in the acquired image, the target objects including a stacked object; determine respectively that an Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than a first predetermined threshold; and take an acquired image as the sample image.

According to any one of embodiments of the present disclosure, the image filtering module is further configured to, after determining respectively that the Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than the first predetermined threshold, and before taking an acquired image as the sample image, determine that a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, where the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image.

According to a third aspect, provided is an electronic device, including a memory and a processor, where the memory is configured to store computer instructions runnable on the processor, and the processor is configured to implement the method according to any one of embodiments of the present disclosure when the computer instructions are executed.

According to a fourth aspect, provided is a computer-readable storage medium. A computer program is stored thereon, and when the program is executed by a processor, the method according to any one of embodiments of the present disclosure is implemented.

According to the methods and apparatuses for obtaining sample images, and electronic devices provided in embodiments of the present disclosure, the item information included in the acquired sample image becomes rich by acquiring multiple images having different pieces of item information. Moreover, the quality of the sample image can also be further improved by filtering sample images of better quality so that the sample image which is of better quality and includes rich item information is used for training a neural network, and the performance of recognizing the neural network of a stacked object is improved, for example, the recognition accuracy and the generalization capability of a stacked object recognition network are improved.

Brief Description of the Drawings

To describe the technical solutions in one or more embodiments of the present disclosure or the related art more clearly, the accompanying drawings required for describing the embodiments or the related art are briefly introduced below. Apparently, the accompanying drawings in the following description show merely some embodiments described in the one or more embodiments of the present disclosure, and a person of ordinary skill in the art can still derive other accompanying drawings from these accompanying drawings without involving an inventive effort.

FIG. 1 is a diagram of a method for obtaining sample images provided by at least one embodiment of the present disclosure;

FIG. 2 is a diagram of a game table scene provided by at least one embodiment of the present disclosure;

FIG. 3 is a diagram of a stacking mode of game currencies provided by at least one embodiment of the present disclosure;

FIG. 4 is a diagram of a storage area provided by at least one embodiment of the present disclosure;

FIG. 5 is a diagram of another stacking mode of game currencies provided by at least one embodiment of the present disclosure;

FIG. 6 is a diagram of an apparatus for obtaining sample images provided by at least one embodiment of the present disclosure.

Detailed Description

To make a person skilled in the art better understand the technical solutions in one or more embodiments of the present disclosure, the technical solutions in the one more embodiments of the present disclosure are clearly and fully described below with reference to the accompanying drawings in the one or more embodiments of the present disclosure. Apparently, the described embodiments are merely some of the embodiments of the present disclosure, but not all the embodiments. Based on the one or more embodiments of the present disclosure, all other embodiments obtained by a person of ordinary skill in the art without involving an inventive effort shall fall within the scope of protection of the present disclosure.

Embodiments of the present disclosure provide a method for obtaining sample images. The method can be used for acquiring and obtaining a sample image. The sample image can be, for example, used for training a neural network.

The sample image can include a stacked object. The stacked object can be, for example, multiple game currencies stacked together, or a sheet-like object such as multiple coins stacked together. However, when the sample image is used for training a neural network, the neural network obtained by training the sample image can be a neural network used for recognizing the stacked object (i.e., recognizing objects constituting the stacked object).

FIG. 1 shows a method for obtaining sample images provided by at least one embodiment of the present disclosure. As shown in FIG. 1, the method includes the following processing:

At step 100, an image of a stacked object is acquired, where stacked objects in different images have different item information, and the item information includes: attributes of the stacked objects and a combination of stacking modes.

At this step, a large number of images can be acquired. Each image can include stacked objects. However, stacked objects in different sample images can be different from each other in at least one of the following item information: for example, the attributes of stacked objects in different images are different, or the stacking modes of stacked objects in different images are different, or both the attributes and the stacking modes are different.

Taking an example, the attributes of the stacked object include: the value represented by each object constituting the stacked object and the object type of objects. Taking a stacked object being multiple coins stacked together as an example, the value can be the denomination of a coin, for example, 1 RMB coin and 5 RMB coin. The object type can be the type of a coin (for example, coins in different countries; a coin in each country is of the same type). For example, coins can be of multiple types, and the stacked object can include coins of different types.

Taking an example, the stacking mode of the stacked object can include: the stacking

direction, the stacking area, the neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object.

For example, the stacking direction can include: a first direction and a second direction, where the first direction can be a direction parallel to a surface where a stacked object is placed; the second direction can be a direction perpendicular to a surface where a stacked object is placed. Objects in the stacked object can be stacked along the first direction or the second direction.

For example, a surface where a stacked object is placed can include multiple stacking areas, while stacked objects in the acquired different images can be placed in different stacking areas, respectively. Furthermore, the neighboring relation among objects constituting stacked objects in different images can also be different. For example, two images both include 1 RMB coin, 5 RMB coin, and 10 RMB coin. 5 RMB coin in one image is located in the middle of a stacked object, and 1 RMB and 10 RMB coins are located on both sides. 10 RMB coin in the other image is located in the middle of a stacked object, and 1 RMB and 5 RMB coins are located on both sides.

At step 102, the acquired image is taken as a sample image when the acquired image meets the filtering condition of the image quality.

At this step, the quality of the image acquired in step 100 can be filtered to select an image meeting the quality filtering condition as a sample image, where the image quality filtering condition can be set according to actual service requirements, for example, the filtering condition is that a stacked object in an image is not shielded by other objects in the image at all. The filtering condition can be achieved by setting a filtering process algorithm.

According to the method for obtaining sample images provided in the present embodiments, the item information included in the acquired sample image becomes rich by acquiring multiple images having different pieces of item information. Moreover, the quality of the sample image can also be further improved by filtering sample images of better quality so that the sample image which is of better quality and includes rich item information is used for training a neural network, and the performance of recognizing the neural network of a stacked object is improved, for example, the recognition accuracy and the generalization capability of a stacked object recognition network are improved.

With continuous development of an artificial intelligence technology, the intelligent construction is attempted to be made in a large variety of places. For example, one topic is the construction of a wise game place. In this case, one of requirements of the wise game place is

automatically recognizing game currencies used in a game, for example, automatically recognizing the number of game currencies. According to the method for obtaining sample images provided in embodiments of the present disclosure, the sample image acquired by this method can be used for training a game currency recognition network. The game currency recognition network is used for recognizing game currencies used in a game.

Taking acquiring images of stacked objects in a tabletop game scene as an example below, the method for obtaining sample images in embodiments of the present disclosure is described. In one exemplary tabletop game scene, multiple players sit at four corners of a game table which includes multiple game areas. Different game areas have different game meanings. These game areas can be different stacking areas in the description below. Moreover, in a multiplayer game, users can play a game via game currencies.

For example, a user can exchange the game currency with his/her own items, and place the game currency in different stacking areas of the game table for playing a game. For example, a first user exchanges game currencies used in the game with multiple watercolor pens owned by him/her, and uses the game currencies to play a game by the game rule among different stacking areas of the game table. If a second user wins over the first user in the game, the watercolor pens of the first user belong to the second user. For example, the game above is suitable for pleasure of multiple family members in leisure time such as a holiday.

In the image acquisition scene of the game currency, game currencies included in different images can be different from each other in at least one of the following: the denomination of a game currency, the type of a game currency, the stacking direction of a game currency, the stacking area, the neighboring relation among game currencies (for example, game currencies of different denominations or different types) included in a stacked object, and the number of game currencies included in a stacked object.

For an exemplary example, one image includes five game currencies which are placed by users who participate in the game in one stacking area on the left of the game table. The other image includes five game currencies which are placed in one stacking area on the right of the game table. Alternatively, one image includes three game currencies of type A and five game currencies of type B, and the other image includes four game currencies of type A and seven game currencies of type C. Other examples are not described again.

Next, taking the game table shown in FIG. 2 as an example, a sample image acquisition method is described. As shown in FIG. 2, users can play a game on a game table 20 in a game scene, and images of game currencies placed in stacking areas of the game table are acquired by

cameras 211 and 212 on both sides. A user 221, a user 222, and a user 223 who participate in the game are located at one side of the game table 20, and can be called as first users. The other user 23 who participates in the game is located at the other side of the game table 20, and can be called as a second user. The second user can be a user who is in charge of controlling the game process in the game.

At the beginning stage of the game, first users exchange game currencies to the second user with their own items for exchange (such as watercolor pens or other items that may be interested by users for obtaining), and the second user hands over the game currencies placed in a storage area 27 thereof to the first users. Next, the first users place the game currencies in betting areas of the game table such as a betting area 241 placed by the first user 222 and a betting area 242 placed by the first user 223. During the game playing stage, a dealing device 25 deals cards to a game playing area 26 to play the game. After the game is ended, the second user can determine the game result according to the card condition of the game playing area 26, and adds game currencies of the first users who are winners in the game. The storage area 27, the betting area 241, the betting area 242, etc. are called as stacking areas.

In addition, it can also be seen from FIG. 2 that the game table includes multiple betting areas such as the betting area 241 and the betting area 242. The game currency stacking mode of the betting area can be an example in FIG. 3, or vertically stacking multiple game currencies on the game tabletop.

As shown in FIG. 3, the stacked object includes multiple game currencies, and the stacking mode of the game currencies is stacking along the stacking direction perpendicular to a surface (i.e., a game tabletop) where the stacked object is placed. Images of stacked objects can be acquired at a side view of the game tabletop. The image acquired at the side view is similar to that in FIG. 3.

By continuing referring to FIG. 2, an image acquisition apparatus can be provided around the game table for acquiring an image where game currencies on the game table are placed to be taken as a sample image for training a game currency recognition network. The image acquisition apparatus can be, for example, a camera. For example, a video stream of an item on the game table can be photographed by the camera, and video frames included in the video stream are obtained to be taken as the acquired image. Taking an example, a first image acquisition apparatus is provided on the left and right (or multiple sides) of the game table for acquiring a betting image. The game currencies in the betting image are placed in the betting area. For example, the cameras (such as side cameras 211 and 212) on the left and right of the game table in the image of the betting area can acquire images similar to those acquired by the

game currency placement mode (which can be called as a stand stacking mode) shown in FIG. 3.

The game table can further include multiple storage areas. As illustrated in FIG. 4, multiple storage areas 27 of the game currencies are available. Each storage area 27 can be in a form of slot. The placement mode of the game currencies in the storage area can be different from the stacking mode thereof in the betting area. For example, as illustrated in FIG. 5, multiple game currencies are horizontally arranged along a direction parallel to the game tabletop.

As shown in FIG. 5, the stacked object includes multiple game currencies, and the stacking mode of the game currencies is stacking along the stacking direction parallel to a surface (i.e., a game tabletop) where the stacked object is placed. Images of stacked objects can be acquired at an overhead view of the game tabletop. The image acquired at the top view is similar to that in FIG. 5. Taking an example, a second image acquisition apparatus (for example, a top mounted camera) can also be provided above the game table for acquiring a stored image at an overhead view. The game currencies in the stored image are placed in the storage area, which is similar to that shown in FIG. 5 (which can be called as float stacking). The placement modes of the game currencies in the betting image and those of the game currencies in the stored image are different.

In one example, the image acquired by a first image acquisition apparatus can be used for training a first game currency recognition network. The first game currency recognition network is used for recognizing the denomination, the number of game currencies in a stand stacking mode in the betting area, etc. In an actual implementation, the first image acquisition apparatus can include cameras on the left and right of the game table. The two cameras can cover to photograph all the areas on the whole game table at left side view and right side view. The image acquired by a second image acquisition apparatus can be used for training a second game currency recognition network. The second game currency recognition network is used for recognizing information such as the denomination and the number of game currencies in a float stacking mode in the storage area. In an actual implementation, the second image acquisition apparatus can include a camera provided above the game table. The camera can photograph all the areas on the whole game table in a bird's-eye view. Optionally, in other examples, both the game currencies in the storage area and the game currencies in the betting area can be recognized by the same game currency recognition network.

In order to improve the network performance of the game currency recognition network, the acquired image of the game currencies on the game table can be more rich, for example, the generalization capability of the trained recognition network can be improved by a rich sample image and a wide covering surface.

In some embodiments, N image subsets can be acquired, where each image subset can include multiple images; stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; stacked objects in images of different image subsets have different first attributes. Moreover, the attributes of stacked objects in images of one image subset cover different possible combinations of second attributes, the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object, and the second attribute is one of the value and the object type other than the first attribute.

For example, taking one image subset as an example, the game currencies constituting a stacked object in multiple images of the image subset are of the same type, while the denomination of the game currencies in the multiple images are different. For example, some images include game currencies having denominations of 2 RMB and 5 RMB, and some images include game currencies having denominations of 5 RMB, 7 RMB, and 10 RMB. For another example, even though the denominations of the game currencies in two images are 5 RMB, 7 RMB, and 10 RMB, the neighboring relation among game currencies of three denominations can be different, or the number of respective game currencies of the three denominations is different.

Images acquired by several image acquisition apparatus are shown below:

For example, the attribute of game currencies can include, but is not limited to: the denomination or the type of a game currency.

Taking an example, multiple denominations of game currencies can be included such as 0.5, 2.5, 5, 10, 25, 50, 100, 500, 1,000, 5,000, and 10,000. Multiple types of game currencies can also be included (for example, game currencies used in different game places), for example, tens of types are included. Game currencies of different types can have different quantities and different denominations, for example, game currencies of one type can include eight denominations of 10, 25, 50, 100, 500, 1,000, 5,000, and 10,000.

Based on the game currencies of multiple denominations and types, the richness of the acquired images of the game currencies placed in the storage area or the betting area is respectively described below. The item information of the game currencies included in the images of the acquired image set in the betting area or the storage area can be different. The item information of the game currency can include the attribute of the game currencies and the stacking mode thereof. As mentioned above, the attribute can be the denomination or the type of the game currencies, and the stacking mode can include the stacking direction of the game currencies, the stacking area, the neighboring relation among game currencies constituting a

stacked object, and the number of game currencies in a stacked object.

Image acquisition of game currencies in the betting area:

In one example, the acquired image set can include a first image subset which can include multiple first images. The attribute of game currencies included in different first images is the same, and the number of game currencies included in different first images and/or the stacking areas where the game currencies are located are different. For example, taking the attribute of the denomination of game currencies as an example, the denomination of game currencies included in different first images is the same, while the number of game currencies in different first images or the stacking areas where the game currencies are located are different.

For example, it can be known by comparing different images in the acquired image set that multiple denomination mixing modes can be included in these different images. The denomination mixing mode can be mixing game currencies which have different denominations and are of the same type.

A. Mixing of one denomination: for example, assuming that game currencies of the same type include eight denominations of 10, 25, 50, 100, 500, 1,000, 5,000, and 10,000. Taking an example, the same certain denomination (for example, 100 is selected from eight denominations in total) is included in a batch of first images. The batch of first images can include 20 images which are acquired for game currencies vertically stacked in the betting area. The number of game currencies included in different first images gradually increases, and the betting areas where the game currencies are located are also different. For example, a first first image includes one game currency located in a betting area Z1 of the game table; a second first image includes two game currencies located in a betting area Z2 of the game table; a third first image includes three game currencies located in a betting area Z3 of the game table, etc.

B. Mixing of two denominations: for example, any two of eight denominations of the same type can be selected, and a total of 28 selections can be made, for example, "100/500", "10/25", etc. No more examples are described. A second image subset can be acquired in any one of the selections. The second image subset includes the following batch of second images of which game currencies include two identical denominations, while the number of game currencies of the two denominations and/or the stacking areas where the game currencies are located are different. Taking a combination of two denominations "100/500" as an example:

Second image p1: starting from the game tabletop, when viewing the stacked game currencies from bottom to top, a game currency of the denomination 500 is on the bottom, i.e., on the game tabletop, and 19 game currencies of the denomination 100 are stacked on the game

currency above. That is, such stacking mode relates to placing game currencies of the large denomination on the bottom, and placing game currencies of the small denomination on the top. The total number of two denominations is 20. The game currencies in the image are placed in the betting area Z1.

Second image p2: two game currencies of the denomination 500 and 18 game currencies of the denomination 100 are included, and are located in the betting area Z2.

Second image p3: three game currencies of the denomination 500 and 17 game currencies of the denomination 100 are included, and are located in the betting area Z3.

Second image p4: four game currencies of the denomination 500 and 16 game currencies of the denomination 100 are included, and are located in the betting area Z4.

In a similar fashion, the selection is made until the second image includes 19 game currencies of the denomination 500 and one game currency of the denomination 100.

Two denominations in each of the 28 selections can be used for image acquisition by the mixing mode above so that the game currencies included in different second images have different quantities of items in different stacking areas.

C. Mixing of three denominations: any three of eight denominations of the same type can be selected, and a total of 56 selections can be made, for example, "100/500/1,000", "10/25/50", etc. No more examples are described. A batch of second images can be acquired in any one of the selections. The game currencies in the batch of second images include three identical denominations, while the number of game currencies of the three denominations and/or the stacking areas where the game currencies are located are different. Taking a combination of three denominations "100/500/1,000" as an example:

Second image p5: starting from the game tabletop, when viewing the stacked game currencies from bottom to top, game currencies of the large denomination are on the bottom, game currencies of the small denomination are on the top, and the total number of three denominations is 20. Taking an example, one game currency of the denomination 1,000, one game currency of the denomination 500, 18 game currencies of the denomination 100 are included, and the game currencies in the image are stacked in the betting area Z1.

Second image p6: one game currency of the denomination 1,000, two game currencies of the denomination 500, and 17 game currencies of the denomination 100 are included, and are located in the betting area Z2.

Second image p7: one game currency of the denomination 1,000, three game currencies of

the denomination 500, and 16 game currencies of the denomination 100 are included, and are located in the betting area Z3.

Second image p8: two game currencies of the denomination 1,000, three game currencies of the denomination 500, and 15 game currencies of the denomination 100 are included, and are located in the betting area Z4; alternatively, one game currency of the denomination 1,000, three game currencies of the denomination 500, and 16 game currencies of the denomination 100 are included, and are located in the betting area Z3.

Other combination modes are not described in details. In a word, the number of game currencies of the three denominations and/or the stacking area where the game currencies are located in different second images are different.

Images having mixing modes of three denominations, two denominations, etc. are listed above. Mixing modes of four denominations, five denominations, etc. can also be included, and are not described in details. The denomination, the number and/or the stacking area of game currencies in different acquired images can be changed.

In addition, the difference among different images in the acquired image set (including multiple image subsets) can also be that different mixing modes are used for the type of game currencies in stacked objects included in different images. The type mixing mode can be mixing game currencies which have the same denomination and are of different types.

The type mixing mode is similar to the denomination mixing mode above. Taking a simple example below for explaining:

For example, for mixing of game currencies of two types, two types of the same denomination can be selected from eight types, and a total of 28 selections can be made. A second image subset can be acquired in any one of the selections. The second image subset includes the following batch of second images of which game currencies include two identical types of type X1 and type X2, while the number of game currencies of the two types and/or the stacking areas where the game currencies are located are different.

Second image p1: starting from the game tabletop, when viewing the stacked game currencies from bottom to top, a game currency of type X1 is on the bottom, i.e., on the game tabletop, and 19 game currencies of type X2 are stacked on the game currency above. That is, such stacking mode relates to placing game currencies of type X1 on the bottom, and placing game currencies of type X2 on the top. The total number of two types is 20. The game currencies in the image are placed in the betting area Z1.

Second image p2: two game currencies of type X1 and 18 game currencies of type X2 are included, and are located in the betting area Z2.

Second image p3: three game currencies of type X1 and 17 game currencies of type X2 are included, and are located in the betting area Z3.

Second image p4: four game currencies of type X1 and 16 game currencies of type X2 are included, and are located in the betting area Z4.

In a similar fashion, the selection is made until the second image includes 19 game currencies of type X1 and one game currency of type X2.

Image acquisition of game currencies in the storage area:

The difference among different images in the acquired image set (including multiple image subsets) can also be that different mixing modes are used for the denomination and the type of game currencies in stacked objects included in different images, which is similar to the mixing modes of the game currencies in the betting area.

The mixing mode of three denominations is shown as an example:

For example, one second image has multiple storage areas. 60 game currencies can be placed in one storage area C1, and includes three denominations. 20 game currencies of each denomination are included.

In another second image, 55 game currencies are placed in a storage area C1, and five game currencies are placed in adjacent storage areas C2. The five game currencies can be obtained by randomly extracting 60 game currencies and placed in the storage area C2.

In still another second image, 53 game currencies are placed in a storage area C1, and seven game currencies are placed in adjacent storage areas C2. The increasing two game currencies can be obtained by randomly extracting 55 game currencies and placed in the storage area C2.

In a similar fashion, the operation is made until the storage area C1 in one second image is blank, and 60 game currencies are placed in the storage area C2, i.e., 60 game currencies in the storage area C1 are all transferred to the storage area C2. The game currencies are then continued moving from the storage area C2 to adjacent storage areas C3 by the mode above, and multiple second images in the transfer process are obtained. The game currencies in different second images have three identical denominations. However, these denominations correspond to different quantities of game currencies in different storage areas.

The richness of the acquired image is exemplarily described above. Game currencies having different item attributes are more balanced in the acquired image by means of the approach. For

example, there is no big difference between the number of game currencies of the large denomination in the set of the acquired images and the number of game currencies of the small denomination in the set of the acquired images. For another example, the image set can further include a large variety of combinations of game currencies of different denominations or different types.

The item information of game currencies covered by the image obtained by the sample image acquisition method of embodiments of the present disclosure is distributed uniformly, and covers comprehensive data. For example, the images of game currencies of different denominations or different types are acquired, and the number of game currencies of the large denomination and the number of game currencies of the small denomination are not significantly different from each other. The problems such as "the number of images of some game currencies of the large denomination is one hundredth even one thousandth as the number of images of common game currencies of the small denomination" and "uncommon combinations of some large denominations and small denominations hardly appear even never appear", do not exist.

In one example, the distribution condition of game currency information can also be set, and the distribution data of the game currency information in the set of the acquired images is obtained. If the distribution data does not meet the distribution condition, the missing image can be continued acquiring, and can be an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition.

For example, the distribution condition can be "the following image of game currencies does not exist: the percentage of the number of images of game currencies of one denomination in the total number of images in an image set is lower than 2%." Therefore, if it is found that the percentage of the number of images of game currencies of the denomination 100 in the total number of images in an image set is 1%, images of game currencies of the denomination 100 can be continued acquiring. These images of game currencies of the denomination 100 are missing images.

After the missing image is acquired, the quality of the missing image can also be continued filtering to select the missing image of which the filtering condition meets the image quality as a sample image.

The following example shows how to filter an image having good quality as a sample image. Some of the acquired images have bad quality, and are not suitable for training game currency recognition networks. For example, game currencies in some images are shielded by a hand of a user, and some basis information of the game currencies for recognizing the type or the

denomination is shielded. Efficient recognition cannot be carried out when the shielded images are used for training networks. Therefore, after the image set of game currencies used in a game is acquired, images can be filtered according to the filtering condition of the image quality to select an image having good quality as a sample image for training a game currency recognition network.

For example, one method for filtering images can include: first determining bounding boxes of target objects in the acquired image, the target objects including a stacked object; multiple bounding boxes in the image being included, for example, some bounding boxes including stacked objects, and some bounding boxes including other target objects other than the stacked objects in the image; next, when it is respectively determined that an Intersection over Union (IoU) between the bounding box of the stacked object and bounding boxes of other target objects (for example, the target object can be a hand of a user who participates in the game) is less than a first predetermined threshold (e.g. 50%), confirming that the image is suitable for being taken as a sample image for training a game currency recognition network. Such filtering method relates to selecting an image in which a stacked object is shielded as less as possible as a sample image to avoid the influence of the shielding of the stacked object on network training.

In another example, after an Intersection over Union between bounding boxes of stacked objects and bounding boxes of other target objects is less than a first predetermined threshold is determined respectively, it can be continued determining a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of a first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, where the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image. Taking an example, other objects in a second bounding box can be hands. A ratio of the length of an overlapping area of the first bounding box and the second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object can be the width of game currencies shielded by human hands. For example, if the percentage of the width of game currencies shielded by human hands in the width of the game currencies is less than a second predetermined threshold (for example, the width of game currencies shielded by human hands is 50%), it is confirmed that the image can be taken as a sample image.

According to the method for obtaining sample images in embodiments of the present disclosure, game currencies included in the acquired image are shielded by other objects as less

as possible by filtering the quality of the acquired image, and have a higher quality so as to facilitate improving the performance of a network trained by the sample image.

FIG. 6 is the structure of an apparatus for obtaining sample images provided by an exemplary embodiment of the present disclosure. The apparatus can be configured to implement a method for obtaining sample images in any one of embodiments of the present disclosure. As shown in FIG. 6, the apparatus can include: an image acquisition module 61 and an image filtering module 62.

The image acquisition module 61 is configured to acquire images of stacked objects, where stacked objects in different images have different item information, and the item information includes: attributes of the stacked objects and a combination of stacking modes.

The image filtering module 62 is configured to take an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality.

In one example, the image acquisition module 61 is further configured to acquire a missing image when it is confirmed that the distribution data of item information of stacked objects in sample images of a sample image set does not meet a predetermined distribution condition, where the missing image is an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition; the sample image set including multiple sample images.

In one example, the image filtering module 62 is further configured to take the missing image as a sample image in the case that the acquired missing image meets the filtering condition of the image quality.

In one example, the stacking modes include: a stacking direction, a stacking area, a neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object; the attribute of the stacked object includes: a value represented by each object constituting the stacked object and the object type of each object; stacked objects in different sample images are different from each other in at least one of the following aspects: the stacking direction, the stacking area, the neighboring relation among the objects, the number of objects in the stacked object, and the value represented by each object constituting the stacked object and the object type.

In one example, the image acquisition module 61 is configured to acquire N image subsets, where stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; stacked objects in images of different image subsets have different first attributes; the attributes of stacked objects

in images of one image subset cover different possible combinations of second attributes; the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object; the second attribute is one of the value and the object type other than the first attribute.

In one example, the image acquisition module 61 is configured to, when the stacking direction is parallel to a surface where the stacked object is placed, acquire images of stacked objects at an overhead view of the surface.

In one example, the image acquisition module 61 is configured to, when the stacking direction is perpendicular to the surface where the stacked object is placed, acquire images of stacked objects at a side view of the surface.

In one example, the image filtering module 62 is specifically configured to determine bounding boxes of target objects in the acquired image, the target objects including a stacked object; determine respectively that an Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than a first predetermined threshold; and take an acquired image as the sample image.

In one example, the image filtering module 62 is configured to, after determining respectively that the Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than the first predetermined threshold, and before taking an acquired image as the sample image, determine that a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, where the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image.

Also provided in the present disclosure is an electronic device, including a memory and a processor, where the memory is configured to store computer instructions runnable on the processor, and the processor is configured to implement the method for obtaining sample images according to any one of embodiments of the present disclosure when executing the computer instructions.

The present disclosure also provides a computer-readable storage medium. A computer program is stored thereon, and when the program is executed by a processor, the method for obtaining sample images according to any one of embodiments of the present disclosure is

implemented.

A person skilled in the art should understand that one or more embodiments of the present disclosure may provide a method, a system or a computer program product. Therefore, one or more embodiments of the present disclosure may take the forms of hardware embodiments, software embodiments, or embodiments in combination with software and hardware. Moreover, one or more embodiments of the present disclosure may use the form of the computer program product implemented over one or more computer usable storage media (including but not limited to a disk memory, a CD-ROM, and an optical memory, etc.) that include a computer usable program code.

Embodiments of the present disclosure further provide a computer-readable storage medium, having a computer program stored thereon, where when the program is executed by a processor, steps of the training method for a neural network for character recognition described in any one of embodiments of the present disclosure is implemented, and/or steps of a character recognition method described in any one of embodiments of the present disclosure is implemented. "And/or" means at least one of the two, e.g., "multiple and/or B" includes three schemes: multiple, B, and "multiple and B".

The embodiments in the present disclosure are all described in a progressive manner, for same or similar parts in the embodiments, refer to these embodiments, and each embodiment focuses on a difference from other embodiments. In particular, data processing device embodiments are substantially similar to method embodiments and therefore are only described briefly, and for the associated part, refer to the descriptions of the method embodiments.

The specific embodiments of the present disclosure are described above. Other embodiments are within the scope of the appended claims. In some cases, actions or steps described in the claims may be performed in an order different from that in the embodiments and can still achieve a desired result. In addition, the processes described in the accompanying drawings do not necessarily require a specific order shown or a sequential order to achieve the desired result. In some implementations, multi-task processing and parallel processing may also be performed or may be advantageous.

The embodiments of the subject matter and functional operations described in the present disclosure may be implemented in digital electronic circuitry, tangible computer software or firmware, computer hardware including the structures disclosed in the present disclosure and structural equivalents thereof, or a combination of one or more thereof. The embodiments of the subject matter described in the present disclosure may be implemented as one or more computer

programs, i.e., one or more modules of computer program instructions encoded on a tangible non-transitory program carrier to be executed by a data processing apparatus or to control operations of the data processing apparatus. Alternatively or additionally, the program instructions may be encoded on artificially generated propagated signals, such as machine-generated electrical, optical or electromagnetic signals, generated to encode and transmit information to a suitable receiver apparatus for execution by the data processing apparatus. The computer storage medium may be a machine-readable storage device, a machine-readable storage substrate, a random or serial access memory device, or a combination of one or more thereof.

The processes and logic flows described in the present disclosure can be performed by one or more programmable computers executing one or more computer programs to perform corresponding functions by performing operations according to input data and generating output. The processes and logic flows may also be performed by a special logic circuit, such as a Field Programmable Gate Array (FPGA) or an Application Specific Integrated Circuit (ASIC), and the apparatus may also be implemented as a special logic circuit.

The computer suitable for executing the computer program includes, for example, a general-purpose microprocessor and/or a special-purpose microprocessor, any other type of central processing unit. Generally, the central processing unit receives instructions and data from a read-only memory and/or a random access memory. Basic components of the computer include a central processing unit for implementing or executing instructions and one or more memory devices for storing instructions and data. Generally, the computer further includes one or more large-capacity storage devices for storing data, for example, a magnetic disk, a magneto-optical disk, or an optical disk, or the computer is operably coupled to the large-capacity storage device to receives data therefrom or transmit data thereto, or receive data therefrom and transmit data therefrom. However, the computer does not necessarily include such a device. Furthermore, the computer may be embedded in another device, for example, a mobile phone, a Personal Digital Assistant (PDA), a mobile audio or a video player, a game console, a Global Positioning System (GPS) receiver, or a portable storage device, for example, a Universal Serial Bus (USB) flash drive, just a few examples provided.

A computer-readable medium suitable for storing computer program instructions and data include a non-volatile memory, a medium, and a memory device in all forms, including, for example, a semiconductor memory device (for example, an EPROM, an EEPROM, and a flash device), a magnetic disk (for example, an internal hardware or a movable disk), a magneto-optical disk, and a CD ROM and DVD-ROM disk. The processor and the memory may

be supplemented by the special logic circuit or incorporated into the special logic circuit

Although the present disclosure includes many specific implementation details, these should not be interpreted as limiting the scope of any disclosure or the scope of protection, and are mainly used for describing the features of specific embodiments of a specific disclosure. Some features described in multiple embodiments in the present disclosure may also be implemented in combination in a single embodiment. In addition, various features described in a single embodiment may be implemented respectively in multiple embodiments or in any suitable sub-combination. Furthermore, although the features may function in some combinations as described above and even set forth in such a way initially, one or more features from a claimed combination may be removed from the combination in some cases, and the claimed combination may relate to a sub-combination or a modification of the sub-combination.

Similarly, although operations are described in the accompanying drawings in a specific order, this should not be understood as requiring that such operations are performed in the specific order shown or in a sequential order, or that all illustrated operations are performed to achieve a desired result. In some cases, multi-task and parallel processing may be advantageous. Furthermore, the separation of various system modules and components in the embodiments above should not be understood as requiring such separation in all embodiments, and it should be understood that the described program components and systems can generally be integrated together in a single software product or packaged into multiple software products.

Thus, specific embodiments of the subject matter have been described. Other embodiments are within the scope of the appended claims. In some cases, the actions described in the claims can be performed in a different order and still achieve the desired result. In addition, the processes described in the accompanying drawings do not necessarily require a specific order shown or a sequential order to achieve the desired result. In some cases, multi-task and parallel processing may be advantageous.

The above descriptions are only preferred embodiments of one or more embodiments of the present disclosure and are not intended to limit one or more embodiments of the present disclosure. Any modifications, equivalent substitutions and improvements made without departing from the spirit and principle of one or more embodiments of the present disclosure are intended to be included within the scope of one or more embodiments of the present disclosure.

CLAIMS

1. A method for obtaining sample images, comprising:

acquiring images of stacked objects, wherein stacked objects in different images have different item information, and the item information comprises: attributes of the stacked objects and a combination of stacking modes; and

taking an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality.

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

confirming that a distribution data of item information of stacked objects in sample images of a sample image set does not meet a predetermined distribution condition, the sample image set comprising multiple sample images; and

acquiring a missing image which is an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition.

3. The method according to claim 2, wherein after acquiring the missing image, the method further comprises:

taking the missing image as a sample image in the case that the acquired missing image meets the filtering condition of the image quality.

4. The method according to any one of claims 1 to 3, wherein the stacking modes comprise: a stacking direction, a stacking area, a neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object; the attribute of the stacked object comprises: a value represented by each object constituting the stacked object and the object type of each object;

stacked objects in different sample images are different from each other in at least one of the following aspects:

the stacking direction, the stacking area, the neighboring relation among the objects, the number of objects in the stacked object, and the value represented by each object constituting the stacked object and the object type.

5. The method according to claim 4, wherein the acquiring images of stacked objects comprises:

acquiring N image subsets, wherein stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; and stacked objects in images of different image subsets have different first attributes;

the attributes of stacked objects in images of one image subset cover different possible combinations of second attributes; the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object; the second attribute is one of the value and the object type other than the first attribute.

6. The method according to claim 4, wherein when the stacking direction is parallel to a surface where the stacked object is placed, the acquiring images of stacked objects comprises:

acquiring images of stacked objects at an overhead view of the surface.

7. The method according to claim 4, wherein when the stacking direction is perpendicular to the surface where the stacked object is placed, the acquiring images of stacked objects comprises:

acquiring images of stacked objects at a side view of the surface.

8. The method according to any one of claims 1 to 7, wherein the taking the acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality comprises:

determining bounding boxes of target objects in the acquired image, the target objects comprising a stacked object;

determining respectively that Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than a first predetermined threshold; and

taking the acquired image as the sample image.

9. The method according to claim 8, wherein after determining respectively that the Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than the first predetermined threshold, and before taking the acquired image as the sample image, the method further comprises:

determining that a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, wherein the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image.

10. An apparatus for obtaining sample images, comprising:

an image acquisition module, configured to acquire images of stacked objects, wherein stacked objects in different images have different item information, and the item information comprises: attributes of the stacked objects and a combination of stacking modes; and

an image filtering module, configured to take an acquired image as a sample image in the case that the acquired image meets a filtering condition of image quality.

11. The apparatus according to claim 10, wherein

the image acquisition module is further configured to acquire a missing image when it is confirmed that a distribution data of item information of stacked objects in sample images of a sample image set does not meet a predetermined distribution condition, wherein the missing image is an image of a stacked object having missing item information not included in the distribution data but included in the predetermined distribution condition, and the sample image set comprises multiple sample images.

12. The apparatus according to claim 11, wherein

the image filtering module is further configured to take the missing image as a sample image in the case that the acquired missing image meets the filtering condition of the image quality.

13. The apparatus according to any one of claims 10 to 12, wherein

the stacking modes comprise: a stacking direction, a stacking area, a neighboring relation among objects constituting a stacked object, and the number of objects in the stacked object;

the attribute of the stacked object comprises: a value represented by each object constituting the stacked object and the object type of each object;

stacked objects in different sample images are different from each other in at least one of the following aspects: the stacking direction, the stacking area, the neighboring relation among the objects, the number of objects in the stacked object, and the value represented by each object constituting the stacked object and the object type.

14. The apparatus according to claim 13, wherein

the image acquisition module is configured to acquire N image subsets, wherein stacked objects in images of the same image subset have the same first attribute; the first attribute is one of the value and the object type; N is a natural number; stacked objects in images of different image subsets have different first attributes; the attributes of stacked objects in images of one image subset cover different possible combinations of second attributes; the attribute of the stacked object is determined by a second attribute of each object constituting the stacked object; and the second attribute is one of the value and the object type other than the first attribute.

15. The apparatus according to claim 13, wherein

the image acquisition module is configured to, when the stacking direction is parallel to a surface where the stacked object is placed, acquire images of stacked objects at an overhead view of the surface.

16. The apparatus according to claim 13, wherein

the image acquisition module is configured to, when the stacking direction is perpendicular to the surface where the stacked object is placed, acquire images of stacked objects at a side view of the surface.

17. The apparatus according to any one of claims 10 to 16, wherein

the image filtering module is configured to: determine a bounding boxes of target objects in the acquired image, the target objects comprising a stacked object; determine respectively that Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than a first predetermined threshold; and take the acquired image as the sample image.

18. The apparatus according to claim 17, wherein

the image filtering module is configured to, after determining respectively that the Intersection over Union between the bounding box of the stacked object and bounding boxes of other target objects is less than the first predetermined threshold, and before taking the acquired image as the sample image, determine that a ratio of the length of an overlapping area of a first bounding box and a second bounding box in the direction perpendicular to the stacking direction of a stacked object to the length of the first bounding box in the direction perpendicular to the stacking direction of the stacked object is less than a second predetermined threshold, wherein the first bounding box is a bounding box of the stacked object, and the second bounding box is a bounding box of other target objects other than the stacked object in an image.

19. An electronic device, comprising a memory and a processor, wherein the memory is configured to store computer instructions runnable on the processor, and the processor is configured to implement the method according to any one of claims 1 to 9 when executing the computer instructions.

20. A computer-readable storage medium, having a computer program stored thereon, wherein when the program is executed by a processor, the method according to any one of claims 1 to 9 is implemented.