

In a possible implementation, the apparatus further comprises:

a fifth determination module, configured to determine a marketing plan for the companions according to the companions among the plurality of persons; and/or, determine an abnormal person among the companions.

According to one aspect of the present disclosure, there is provided a system for detecting companions, comprising a plurality of image capture devices disposed in different areas, and a processing device, wherein

the plurality of image capture devices are configured to capture video images, and send the video images to the processing device;

the processing device is configured to perform person detection on the video images, to determine, according to an obtained person detection result, an image set corresponding to at least one person among a plurality of persons, the image set including person images;

the processing device is further configured to determine track information of the at least one person according to position information of the plurality of image capture devices, the image set corresponding to the at least one person, and time for capturing the person images; and

the processing device is further configured to determine companions among the plurality of persons according to track information of the plurality of persons.

In a possible implementation, the processing device is integrated in the image capture devices.

According to one aspect of the present disclosure, there is provided an electronic device, comprising:

a processor; and

a memory configured to store processor executable instructions,

wherein the processor is configured to ~~invoke~~call the instructions stored in the memory, to execute the above method.

According to one aspect of the present disclosure, there is provided a computer-readable storage medium having computer program instructions stored thereon, wherein the computer program instructions, when executed by a processor, implement the above method.

According to one aspect of the present disclosure, there is provided a computer program, comprising computer-readable codes, wherein when the computer-readable codes run in an electronic device, a processor in the electronic device executes the above method.

In this way, person detection is performed on video images captured by a plurality of image capture devices deployed in different areas during a preset time period; an image set

Various exemplary embodiments, features and aspects of the present disclosure will be described below in detail with reference to the accompanying drawings. Same reference numbers in the accompanying drawings indicate same or similar components. Although various aspects of the embodiments are illustrated in the accompanying drawings, the accompanying drawings are unnecessarily drawn by scale unless specified otherwise.

As used herein, the word "exemplary" means "serving as an example, instance, or illustration". Any embodiment described herein as "exemplary" is not to be construed as necessarily preferred or advantageous over other embodiments.

The term "and/or" herein is only an association relationship for describing associated objects, and represents that three relationships may exist, for example, A and/or B may represent that: A exists alone, both A and B exist, and B exists alone. In addition, the term "at least one" herein represents any one of a plurality of elements or any combination of at least two elements of the plurality of elements, for example, including at least one of A, B and C may represent including any one or more elements selected from a set formed by A, B and C.

Besides, in order to better describe the present disclosure, many specific details are presented in the following detailed description. It will be appreciated by those skilled in the art that the present disclosure may still be implemented even without some specific details. In some examples, methods, means, components and circuits well-known to those skilled in the art are not described in detail, to highlight the subject of the present disclosure.

FIG. 1 illustrates a flowchart of a method for detecting companions according to an embodiment of the present disclosure. The object association method may be executed by electronic devices such as a terminal device or a server. The terminal device may be User Equipment (UE), a mobile device, a user terminal, a terminal, a cell phone, a cordless phone, a Personal Digital Assistant (PDA), a handheld device, a computing device, a vehicle-mounted device, a wearable device, etc. The object association method may be implemented by enabling the processor to ~~invoke~~call the computer-readable instruction stored in the memory. Or, the object association method may be executed by the server.

As shown in FIG. 1, the object association method may include:

In step S11, video images respectively captured by a plurality of image capture devices deployed in different areas during a preset time period are obtained.

For example, the image capture devices may be deployed in a plurality of different areas, and the video images of the areas may be captured by the plurality of image capture devices. Thereafter, the video images captured by the plurality of image capture devices during the preset time period may be obtained from the captured video images. The preset time period is one preset time period or a plurality of preset time periods, and a length of each time period

limited, and may include but not limited to the cases exemplified in the present disclosure.

According to the system for detecting companions provided by the present disclosure, based on the position information and capturing time of the images corresponding to the at least one person and captured by the plurality of image capture devices deployed in the different areas during the preset time period, the track information of the at least one person may be established, thereby determining the companions from the plurality of persons according to the track information of the at least one person. Since the track information can better reflect the dynamic state of the at least one person, determining the companions based on the track information can improve the accuracy of detection on the companions.

An embodiment of the present disclosure further provides a computer-readable storage medium having computer program instructions stored thereon, and the computer program instructions, when executed by a processor, implement the above method. The computer-readable storage medium may be a non-volatile computer-readable storage medium.

An embodiment of the present disclosure further provides an electronic device, which may include: a processor; and a memory, configured to store processor executable instructions, wherein the processor is configured to ~~invoke~~call the instructions stored in the memory, to execute the above method.

An embodiment of the present disclosure further provides a computer program product, which may include computer-readable codes; and when the computer-readable codes run on a device, a processor in the device executes the instructions for implementing the method for detecting companions provided by any of the above embodiments.

An embodiment of the present disclosure further provides another computer program product, for storing computer-readable instructions, which, when executed, cause a computer to execute the operations for detecting the companions provided by any of the above embodiments.

An embodiment of the present disclosure further provides another computer program, which may include computer-readable codes; and when the computer readable codes run in an electronic device, a processor in the electronic device executes the operations for detecting the companions provided by any of the above embodiments.

The electronic device may be provided as a terminal, a server or other types of devices.

Different embodiments of the present disclosure may be combined with each other without departing from the logic. The different embodiments are described with an emphasis, and for contents not described intensively, the descriptions in the other embodiments may be referred to.

CLAIMS

What is claimed is:

1. A method for detecting companions, comprising:

- 5 obtaining video images respectively captured by a plurality of image capture devices deployed in different areas during a preset time period;
performing ~~a~~ person detection on the video images, to determine, according to an obtained person detection result, an image set corresponding to at least one person among a plurality of persons, the image set including person images;
10 determining track information of the at least one person according to position information of the plurality of image capture devices, the image set corresponding to the at least one person, and ~~a~~ time for capturing the person images; and
determining companions among the plurality of persons according to ~~the~~ track information of the plurality of persons.

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2. The method according to claim 1, wherein determining the track information of the at least one person according to the position information of the plurality of image capture devices, the image set corresponding to the at least one person, and ~~the~~ time for capturing the person images ~~comprises~~includes:

- 20 determining, for at least one person image in the image set corresponding to the at least one person, first position information of a target person in the person image in a video image corresponding to the person image;
determining a spatial position coordinate of the target person in a spatial coordinate system according to the first position information and second position information, the second position
25 information being position information of an image capture device for capturing the video image corresponding to the person image;
obtaining a spatio-temporal position coordinate of the target person in a spatio-temporal coordinate system according to the spatial position coordinate and ~~a~~ time for capturing the video image corresponding to the person image; and
30 obtaining the track information of the at least one person in the spatio-temporal coordinate system according to spatio-temporal position coordinates of the plurality of persons.

3. The method according to claim 1 or 2, wherein determining ~~the~~ companions among the plurality of persons according to ~~the~~ track information of the plurality of persons
35 ~~comprises~~includes:

clustering the track information of the plurality of persons to obtain at least one cluster set; and determining persons respectively corresponding to a plurality of pieces of track information belonging to the same cluster set as a group of companions.

5 4. The method according to claim 2, wherein the track information of the at least one person includes a point group in the spatio-temporal coordinate system; and determining ~~the~~ companions among the plurality of persons according to track information of the plurality of persons ~~comprises~~ includes:

determining ~~a~~ similarity for point groups corresponding to every two persons in the spatio-temporal coordinate system in the track information of the plurality of persons;

10 determining a plurality of person pairs based on a relationship between the similarity and a first similarity threshold, each person pair including two persons, and the similarity for each person pair having a value greater than the first similarity threshold; and

determining at least one group of companions according to the plurality of person pairs.

15 5. The method according to claim 4, wherein determining ~~the~~ at least one group of companions according to the plurality of person pairs ~~comprises~~ includes:

establishing a companion set according to a first person pair in the plurality of person pairs;

20 determining an associated person pair from at least one second person pair, other than the person pair included in the companion set, in the plurality of person pairs, the associated person pair including at least one person in the companion set;

adding the associated person pair to the companion set; and

determining persons in the companion set as a group of companions.

25 6. The method according to claim 5, wherein adding the associated person pair to the companion set ~~comprises~~ includes:

determining a number of person pairs including a first person in the associated person pairs; and

30 adding the associated person pair to the companion set in a case where the number of person pairs including the first person is less than a number-of-person-pairs threshold.

7. The method according to any one of claims 4 to 6, ~~wherein~~ after determining the at least one group of companions according to the plurality of person pairs, ~~the method~~ further ~~comprises~~ comprising:

35 determining, in a case where the number of persons included in the group of companions is

greater than a first number threshold, at least one person pair having a value of the similarity greater than a second similarity threshold in the plurality of person pairs as a group of companions, such that the number of persons included in the group of companions is less than the first number threshold, the second similarity threshold being greater than the first similarity threshold.

8. The method according to any one of claims 4 to 7, wherein determining ~~the~~ similarity for ~~the~~ point groups corresponding to ~~the~~ every two persons in the spatio-temporal coordinate system in the track information of the plurality of persons ~~comprises~~ includes:

determining a spatial distance between at least one first spatio-temporal position coordinate corresponding to a first person of the every two persons in the spatio-temporal coordinate system and at least one second spatio-temporal position coordinate corresponding to a second person of the every two persons in the spatio-temporal coordinate system;

determining a first number of first spatio-temporal position coordinates corresponding to ~~the~~ spatial distances less than or equal to a distance threshold, and a second number of second spatio-temporal position coordinates corresponding to ~~the~~ spatial distances less than or equal to the distance threshold;

determining a first ratio of the first number to a total number of ~~the~~ first spatio-temporal position coordinates, and a second ratio of the second number to a total number of ~~the~~ second spatio-temporal position coordinates; and

determining a maximum value of the first ratio and the second ratio as the similarity between the two persons.

9. The method according to any one of claims 1 to 8, wherein performing ~~the~~ person detection on the video images, to determine, according to the obtained person detection result, the image set corresponding to ~~the~~ at least one person among ~~the~~ a plurality of persons ~~comprises~~ includes:

performing the person detection on the video images to obtain person images including detection information, the person detection including at least one of a face detection and a body detection, wherein in a case where the person detection includes the face detection, the detection information includes face information; and in a case where the person detection includes the body detection, the detection information includes body information; and

determining, according to the person images, the image set corresponding to the at least one person among the plurality of persons.

10. The method according to claim 9, wherein determining, according to the person images, the

image set corresponding to the at least one person among the plurality of persons ~~comprises~~includes:

clustering the person images including the face information to obtain a face clustering result, the face clustering result including at least one face identity for the person images including the
5 face information;

clustering the person images including the body information to obtain a body clustering result, the body clustering result including at least one body identity for the person images including the body information; and

determining, according to the face clustering result and the body clustering result, the image set
10 corresponding to the at least one person among the plurality of persons.

11. The method according to claim 10, wherein determining, according to the face clustering result and the body clustering result, the image set corresponding to the at least one person among the plurality of persons ~~comprises~~includes:

15 determining corresponding relationships between face identities and body identities in at least one person image including the face information and the body information; and

obtaining, according to a first corresponding relationship in the corresponding relationships, person images including the face information and/or the body information in the first corresponding relationship from the person images to form an image set corresponding to one
20 person.

12. The method according to claim 11, wherein determining ~~the~~ corresponding relationships between ~~the~~ face identities and ~~the~~ body identities in ~~the~~ at least one person image including the face information and the body information ~~comprises~~includes:

25 obtaining face identities corresponding to the face information and body identities corresponding to the body information in the person images including the face information and the body information;

grouping the person images including the face information and the body information according to body identities to which the person images correspond, to obtain at least one body image
30 group, person images in the same body image group having the same body identity; and

determining, for a first body image group in the body image groups, face identities respectively corresponding to at least one person image in the first body image group, and determining, according to the number of person images corresponding to at least one face identity in the first body image group, corresponding relationships between face identities and body identities in
35 the person images in the first body image group.

13. The method according to claim 11, wherein determining ~~the~~ corresponding relationships between ~~the~~ face identities and ~~the~~ body identities in ~~the~~ at least one person image including the face information and the body information ~~comprises~~includes:

5 obtaining face identities corresponding to the face information and body identities corresponding to the body information in the person images including the face information and the body information;

grouping the person images including the face information and the body information according to face identities to which the person images correspond, to obtain at least one face image group, person images in the same face image group having the same face identity; and

10 determining, for a first face image group in the face image groups, body identities respectively corresponding to at least one person image in the first face image group, and determining, according to the number of person images corresponding to at least one body identity in the first face image group, corresponding relationships between face identities and body identities
15 in the person images in the first face image group.

14. The method according to any one of claims 11 to 13, wherein determining, according to the face clustering result and the body clustering result, the image set corresponding to the at least one person among the plurality of persons ~~comprises~~includes:

20 determining, for person images including the face information and not belonging to the image set, an image set corresponding to at least one person according to face identities of the person images.

15. The method according to any one of claims 1 to 14, wherein, after determining companions among the plurality of persons according to the track information of the plurality of persons, the method further comprises at least one of:

determining a marketing plan for the companions according to the companions among the plurality of persons; and

determining an abnormal person among the companions.

16. An apparatus for detecting companions, comprising:

an obtaining module, configured to obtain video images respectively captured by a plurality of image capture devices deployed in different areas during a preset time period;

a first determination module, configured to perform a person detection on the video images
35 obtained by the obtaining module to determine, according to an obtained person detection

result, an image set corresponding to at least one person among a plurality of persons, the image set including person images;

a second determination module, configured to determine track information of the at least one person according to position information of the plurality of image capture devices, the image set corresponding to the at least one person and obtained by the second determination module, and a time for capturing the person images; and

a third determination module, configured to determine companions among the plurality of persons according to the track information of the plurality of persons that is obtained by the second determination module.

17. The apparatus according to claim 16, wherein the second determination module is further configured to:

determine, for at least one person image in the image set corresponding to the at least one person, first position information of a target person in the person image in a video image corresponding to the person image;

determine a spatial position coordinate of the target person in a spatial coordinate system according to the first position information and second position information, the second position information being position information of an image capture device for capturing the video image corresponding to the person image;

obtain a spatio-temporal position coordinate of the target person in a spatio-temporal coordinate system according to the spatial position coordinate and a time for capturing the video image corresponding to the person image; and

obtain the track information of the at least one person in the spatio-temporal coordinate system according to spatio-temporal position coordinates of the plurality of persons.

18. The apparatus according to claim 16 or 17, wherein the third determination module is further configured to:

cluster the track information of the plurality of persons to obtain at least one cluster set; and determine persons respectively corresponding to a plurality of pieces of track information belonging to the same cluster set as a group of companions.

19. The apparatus according to claim 17, wherein the track information of the at least one person includes a point group in the spatio-temporal coordinate system; and the second determination module is further configured to:

determine similarity for point groups corresponding to every two persons in the

spatio-temporal coordinate system in the track information of the plurality of persons;
determine a plurality of person pairs based on a relationship between the similarity and a first similarity threshold, each person pair including two persons, and the similarity for each person pair having a value greater than the first similarity threshold; and

5 determine at least one group of companions according to the plurality of person pairs.

20. The apparatus according to claim 19, wherein the second determination module is further configured to:

establish a companion set according to a first person pair in the plurality of person pairs;

10 determine an associated person pair from at least one second person pair, other than the person pair included in the companion set, in the plurality of person pairs, the associated person pair including at least one person in the companion set;

add the associated person pair to the companion set; and

determine persons in the companion set as a group of companions.

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21. The apparatus according to claim 20, wherein the second determination module is further configured to:

determine a number of person pairs including a first person in the associated person pairs; and

add the associated person pair to the companion set in a case where the number of person pairs including the first person is less than a number-of-person-pairs threshold.

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22. The apparatus according to any one of claims 19 to 21, further comprising:

a fourth determination module, configured to determine, in a case where the number of persons included in the group of companions is greater than a first number threshold, at least one person pair having a value of the similarity greater than a second similarity threshold in the plurality of person pairs as a group of companions, such that the number of persons included in the group of companions is less than the first number threshold, the second similarity threshold being greater than the first similarity threshold.

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23. The apparatus according to any one of claims 19 to 22, wherein the second determination module is further configured to:

determine a spatial distance between at least one first spatio-temporal position coordinate corresponding to a first person of the every two persons in the spatio-temporal coordinate system and at least one second spatio-temporal position coordinate corresponding to a second person of the every two persons in the spatio-temporal coordinate system;

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determine a first number of first spatio-temporal position coordinates corresponding to the spatial distances less than or equal to a distance threshold, and a second number of second spatio-temporal position coordinates corresponding to the spatial distances less than or equal to the distance threshold;

5 determine a first ratio of the first number to a total number of the first spatio-temporal position coordinates, and a second ratio of the second number to a total number of the second spatio-temporal position coordinates; and

determine a maximum value of the first ratio and the second ratio as the similarity between the two persons.

10 24. The apparatus according to any one of claims 16 to 23, wherein the first determination module is further configured to:

perform the person detection on the video images to obtain person images including detection information, the person detection including at least one of a face detection and a body detection,

15 wherein in a case where the person detection includes the face detection, the detection information includes face information; and in a case where the person detection includes the body detection, the detection information includes body information; and

determine, according to the person images, the image set corresponding to the at least one person among the plurality of persons.

20 25. The apparatus according to claim 24, wherein the first determination module is further configured to:

cluster the person images including the face information to obtain a face clustering result, the face clustering result including at least one face identity for the person images including the face information;

25 cluster the person images including the body information to obtain a body clustering result, the body clustering result including at least one body identity for the person images including the body information; and

30 determine, according to the face clustering result and the body clustering result, the image set corresponding to the at least one person among the plurality of persons.

26. The apparatus according to claim 25, wherein the first determination module is further configured to:

35 determine corresponding relationships between face identities and body identities in each person image including the face information and the body information; and

obtain, according to a first corresponding relationship in the corresponding relationships, person images including the face information and/or the body information in the first corresponding relationship from the person images to form an image set corresponding to one person.

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27. The apparatus according to claim 26, wherein the first determination module is further configured to:

obtain face identities corresponding to the face information and body identities corresponding to the body information in the person images including the face information and the body information;

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group the person images including the face information and the body information according to body identities to which the person images correspond, to obtain at least one body image group, person images in the same body image group having the same body identity; and

determine, for a first body image group in the body image groups, face identities respectively corresponding to at least one person image in the first body image group, and determine, according to the number of person images corresponding to at least one face identity in the first body image group, corresponding relationships between face identities and body identities in the person images in the first body image group.

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28. The apparatus according to claim 26, wherein the first determination module is further configured to:

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obtain face identities corresponding to the face information and body identities corresponding to the body information in the person images including the face information and the body information;

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group the person images including the face information and the body information according to face identities to which the person images correspond, to obtain at least one face image group, person images in the same face image group having the same face identity; and

determine, for a first face image group in the face image groups, body identities respectively corresponding to at least one person image in the first face image group, and determine, according to the number of person images corresponding to at least one body identity in the first face image group, corresponding relationships between face identities and body identities in the person images in the first face image group.

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29. The apparatus according to any one of claims 25 to 27, wherein the first determination module is further configured to:

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determine, for person images including the face information and not belonging to the image set, an image set corresponding to at least one person according to face identities of the person images.

30. The apparatus according to any one of claims 16 to 29, further comprising:
a fifth determination module, configured to determine a marketing plan for the companions according to the companions among the plurality of persons; and/or, determine an abnormal person among the companions.

31. A system for detecting companions, comprising a plurality of image capture devices disposed in different areas, and a processing device, wherein
the plurality of image capture devices are configured to capture video images, and send the video images to the processing device;

the processing device is configured to perform a person detection on the video images, to determine, according to an obtained person detection result, an image set corresponding to at least one person among a plurality of persons, the image set including person images;

the processing device is further configured to determine track information of the at least one person according to position information of the plurality of image capture devices, the image set corresponding to the at least one person, and a time for capturing the person images; and

the processing device is further configured to determine companions among the plurality of persons according to the track information of the plurality of persons.

32. The system according to claim 31, wherein the processing device is integrated in the image capture devices.

33. An electronic device, comprising:

a processor; and

a memory configured to store processor executable instructions,

wherein the processor is configured to ~~invoke~~call the instructions stored in the memory, to execute the method according to any one of claims 1 to 15.

34. A computer-readable storage medium having computer program instructions stored thereon, wherein the computer program instructions, when executed by a processor, implement the method according to any one of claims 1 to 15.

35. A computer program, comprising computer-readable codes, wherein when the computer-readable codes run in an electronic device, a processor in the electronic device executes the method according to any one of claims 1 to 15.