CLAIMS

1. A body and hand association method, comprising:

acquiring an image to be detected of which an image content comprises a body and a hand;

determining a body bounding box of the body and a hand bounding box of the hand in the image to be detected;

determining an association probability between the body bounding box and the hand bounding box;

determining a circumscribed box of the body bounding box and the hand bounding box; and

determining a degree of association between the body and hand in the circumscribed box based on a hand key point in the circumscribed box and the association probability,

wherein determining the circumscribed box of the body bounding box and the hand bounding box comprises:

determining, as a target bounding box pair, a body bounding box and a hand bounding box between which an association probability is greater than a preset probability threshold, wherein the target bounding box pair is selected from multiple bounding box pairs obtained by combining each detected body bounding box and each detected hand bounding box; and

determining a circumscribed box of the body bounding box and the hand bounding box in the target bounding box pair.

2. The method of claim 1, wherein determining the association probability between the body

bounding box and the hand bounding box comprises:

determining a body feature of the body bounding box and a hand feature of the hand bounding box; and

determining the association probability between the body bounding box and the hand bounding box based on the body feature and the hand feature.

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3. The method of claim 1, wherein determining the circumscribed box of the body bounding box and the hand bounding box in the target bounding box pair comprises:

determining a candidate box that encloses the target bounding box pair; and

adjusting a cover area of the candidate box based on a relative positional relationship between the body bounding box and the hand bounding box in the target bounding box pair to obtain the circumscribed box.

4. The method of any one of claims 1 to 3, wherein determining the degree of association between the body and hand in the circumscribed box based on the hand key point in the circumscribed box and the association probability comprises:

determining at least two target hand key points in the circumscribed box, the at least two target hand key points comprising key points that belong to two different hands of a same person respectively; and

determining, based on the at least two target hand key points, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box.

5. The method of claim 4, wherein determining, based on the at least two target hand key points, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box comprises:

determining a confidence that each target hand key point is a ground truth point;

in a case that any confidence is greater than a preset threshold, determining a distance from the target hand key point corresponding to the confidence greater than the preset threshold to the hand bounding box that forms the circumscribed box;

determining, based on the distance, a target association probability between the body bounding box and the hand bounding box that form the circumscribed box; and

determining, based on the target association probability, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box.

6. The method of claim 5, wherein determining, based on the distance, the target association probability between the body bounding box and the hand bounding box that form the circumscribed box comprises:

in a case that the distance is less than or equal to a preset distance, determining the association probability between the body bounding box and the hand bounding box that form the circumscribed box to obtain an in-box association probability; and

determining the in-box association probability as the target association probability.

7. The method of claim 5 or 6, wherein determining, based on the distance, the target association probability between the body bounding box and the hand bounding box that form the circumscribed box comprises:

in a case that the distance is greater than the preset distance, decreasing the association probability between the body bounding box and the hand bounding box that form the circumscribed box to obtain a corrected association probability; and

determining the corrected association probability as the target association probability.

8. The method of claim 7, wherein decreasing the association probability between the body bounding box and the hand bounding box that form the circumscribed box to obtain the corrected association probability in the case that the distance is greater than the preset distance comprises:

in the case that the distance is greater than the preset distance, acquiring a preset adjustment parameter configured to adjust the association probability; and

lowering the association probability between the body bounding box and the hand bounding box that form the circumscribed box using the preset adjustment parameter to obtain the corrected association probability.

9. The method of any one of claims 5 to 8, wherein determining, based on the at least two target hand key points, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box comprises:

in a case that the at least two target hand key points comprise no target hand key point of which the confidence is greater than the preset threshold, decreasing the association probability between the body bounding box and the hand bounding box that form the circumscribed box to obtain the corrected association probability; and

determining the corrected association probability as the target association probability.

10. The method of any one of claims 4 to 9, wherein the target hand key point comprises a wrist key point.

11. The method of any one of claims 1 to 10,

wherein determining the circumscribed box of the body bounding box and the hand bounding box comprises: determining a circumscribed box of the body bounding box and the hand bounding box in each bounding box pair; and

determining the degree of association between the body and hand in the circumscribed box based on the hand key point in the circumscribed box and the association probability comprises:

determining a degree of association between a body and hand in each circumscribed box to obtain a set of target degrees of association,

determining a candidate degree of association greater than a preset association degree threshold in the set of target degrees of association, and

based on a target circumscribed box corresponding to the candidate degree of association, determining a hand matching a body in the target circumscribed box.

12. A body and hand association apparatus, comprising:

a first acquisition module, configured to acquire an image to be detected of which an image content comprises a body and a hand;

a first determination module, configured to determine a body bounding box of the body and a hand bounding box of the hand in the image to be detected;

a second determination module, configured to determine an association probability between the body bounding box and the hand bounding box;

a third determination module, configured to determine a circumscribed box of the body bounding box and the hand bounding box; and

a fourth determination module, configured to determine a degree of association between the body and hand in the circumscribed box based on a hand key point in the circumscribed box and the association probability,

wherein the third determination module comprises:

a bounding box determination sub-module, configured to determine, as a target bounding box pair, a body bounding box and a hand bounding box between which an association probability is greater than a preset probability threshold, wherein the target bounding box pair is selected from multiple bounding box pairs obtained by combining each detected body bounding box and each detected hand bounding box; and

a circumscribed box determination sub-module, configured to determine a circumscribed box of the body bounding box and the hand bounding box in the target bounding box pair.

13. The apparatus of claim 12, wherein the second determination module comprises:

a feature determination sub-module, configured to determine a body feature of the body bounding box and a hand feature of the hand bounding box; and

an association probability determination sub-module, configured to determine the association probability between the body bounding box and the hand bounding box based on the body feature and the hand feature.

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14. The apparatus of claim 12, wherein the circumscribed box determination sub-module comprises:

a candidate box determination subunit, configured to determine a candidate box that encloses the target bounding box pair; and

a circumscribed box determination subunit, configured to adjust a cover area of the candidate box based on a relative positional relationship between the body bounding box and the hand bounding box in the target bounding box pair to obtain the circumscribed box.

15 The apparatus of any one of claims 12 to 14, wherein the fourth determination module comprises:

a hand key point determination sub-module, configured to determine at least two target hand key points in the circumscribed box, the at least two target hand key points comprising key points that belong to two different hands of a same person respectively; and

an association degree determination sub-module, configured to determine, based on the at least two target hand key points, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box.

16. The apparatus of claim 15, wherein the association degree determination sub-module comprises:

a confidence determination subunit, configured to determine a confidence that each target hand key point is a ground truth point;

a distance determination subunit, configured to, in a case that any confidence is greater than a preset threshold, determine a distance from the target hand key point corresponding to the confidence greater than the preset threshold to the hand bounding box that forms the circumscribed box;

an association probability determination subunit, configured to determine, based on the distance, a target association probability between the body bounding box and the hand bounding box that form the circumscribed box e; and

an association degree determination subunit, configured to determine, based on the target association probability, the degree of association between the body bounding box and the hand bounding box that form the circumscribed box.

17. A computer device, comprising a memory and a processor, wherein computer-executable instructions are stored in the memory, and the processor runs the computer-executable instructions in the memory to implement the body and hand association method of any one of claims 1 to 11.

18. A computer storage medium having stored thereon computer-executable instructions that, when executed, cause the body and hand association method of any one of claims 1 to 11 to be implemented.