

DESCRIPTION

A LIVING BODY DETECTION METHOD AND DEVICE BASED ON INFRARED AND VISIBLE BINOCULAR IMAGES

TECHNICAL FIELD

The present invention relates to the field of video security, and in particular, to a living body detection method and device based on infrared and visible binocular images.

BACKGROUND

The living body detection of fixed place based on visual information has a wide range of applications in many scenes, such as community access control, self-service withdrawal in bank, Automatic procedure in the government departments. Face recognition is used to verify the identity of a person in these scenes, but living body detection is required to prevent attacks. There are some common attack methods: photos, videos, hole masks, 3d masks, etc., with no reliable mainstream solution so far. There are some common practices: preventing photo attacks by detecting blinking; preventing simple photo or video attacks by detecting three-dimensional information by multiple cameras at different locations; preventing simple video attacks through screen texture information; preventing simple video attacks through infrared temperature sensors, etc.

Those practices mentioned above have the following problems: First, there is not a single system can prevent all attacks. This will leave the attacker with a chance to take advantage of. Secondly, the performance is hard to guarantee. There are high requirements on security and user experience in many scenes, such as self-service withdrawal in bank.

SUMMARY OF THE INVENTION

The purpose of the present invention is to provide a living body detection method and device based on infrared and visible binocular images in order to overcome the defects of the prior art described above.

The purpose of the present invention can be achieved by the following technical solutions:

A living body detection method, comprising:

S1: capturing an infrared light image of an object to be identified by an infrared camera, and capturing a visible light image of the object to be identified by a visible light camera;

S2: if there is no image in the infrared light image, it is determined that the object to be identified is non-living, otherwise, executing step S3;

S3: extracting the features of the eyes and face of the object to be identified in the visible light image and the infrared light image, and determining whether the object to be identified is living or not based on the extracted features.

Step S3 specifically includes the steps of:

S31: determining whether there is a face in the visible light image and the infrared light image, if yes, executing step S32; or if no, repeating step S31;

S32: extracting the features of the face of the object to be identified in the visible light image and the infrared light image. If the nose reflects light and cheeks are dim in the infrared light image, perform S33.

S33: Extracting features of the eyes of the object to be identified in the visible light image and the infrared light image. If the pupils reflect light and the white part of the eye is gray in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

After being identified as living in step S3, executing the steps of:

S4: determining the distance between the object to be identified with the infrared camera and the visible camera respectively;

S5: determining the angle between the front of the object to be identified with the infrared camera and the visible camera respectively;

S6: determining whether the object to be identified captured by the infrared camera and the visible light camera is the same thing according to the data obtained in steps S4 and S5 in combination with the positional and angular relationship between the infrared camera and the visible light camera. if yes, then the object to be identified is determined to be living, if not, the object to be identified is determined to be non-living.

The angle between the front of the object to be identified and the infrared camera is the angle between the front of the object to be identified and the front of the infrared camera. The angle between the front of the object to be identified and the visible camera is the angle between the front of the object to be identified and the front of the visible light camera.

A device, comprising:

a visible light camera, for capturing a visible light image of the object to be identified by a visible light camera;

an infrared camera, for capturing an infrared light image of an object to be identified by an infrared camera;

a computer, connected with the visible light camera and the infrared camera respectively, for determining whether the object to be identified is living or not according to the visible light image and the infrared light image.

The computer comprising:

a pre-recognition module, for determining whether it is non-living based on whether there is an image in the infrared light image;

a feature identification module, connected with the pre-identification module, for extracting features of the eyes and face of the object to be identified in the visible light image and the infrared light image after passes the pre-identification module verification, and determining whether the object to be identified is living or not based on the extracted features.

The feature identification module comprising:

a first identification unit, for extracting the features of the face of the object to be identified in the visible light image and the infrared light image. If the nose reflects light and cheeks are dim in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living

a second identification unit, for extracting features of the eyes of the object to be identified in the visible light image and the infrared light image. If the pupils reflect light and the white part of the eye is gray in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

The computer further comprising:

a distance identification module, connected with the feature identification module, determining the distance between the object to be identified with the infrared camera and the visible camera respectively, and the angle between the front of the object to be identified with the infrared camera and the visible camera respectively after passes the feature identification module verification, and determining whether the object to be identified captured by the infrared camera and the visible light camera is the same thing by combining the positional and angular relationship between the infrared camera and the visible light camera. if yes, then the object to be identified is determined to be living, if not, the object to be identified is determined to be

non-living.

Compared with the prior art, the present invention has the following advantages:

1) Pre-recognition is performed by whether image can be capture by the infrared camera or not, so all the video attacks, most of the photos, holes attacks, 3d mask attacks can be prevented, and then by comparing features between the visible light image and the infrared light image, guarantees a great non-living attack ultimately.

2) Living body is identified through features such as nose reflecting light, cheeks being dim, pupils reflecting light and the white part of the eye being gray, etc. The whole system can ensure 99.9% pass rate, 0% pass rate of video attack, and less than 0.1% pass rate of other attacks in the case of good lighting. It can reach completing determination within less than half a second in speed.

3) The use of the classification of the infrared camera and the visible infrared binocular camera: which truly prevent all attacks, and ensure universality.

4) The use of the latest classification technology in academia: the performance and speed getting more assurance, and better user experience.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic flow diagram of the main steps of the method of the present invention;

Figure 2 is a schematic structural diagram of the device of the present invention;
wherein: 1, the visible light camera; 2, the infrared camera; 3, computer.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is described in detail below with reference to the accompanying drawings and specific embodiments. The embodiment is implemented on the premise of the technical solutions of the present invention, and details of the implementation and the specific operation process are given. However, the protection scope of the present invention is not limited to the following embodiments.

After their own repeated explorations, the inventor found that most of the paper materials and all the videos cannot displayed in the infrared camera, but the real person can normally appear in the infrared camera.

A living body detection method, as shown in Figure 1, comprising:

S1: capturing an infrared light image of an object to be identified by an infrared camera, and capturing a visible light image of the object to be identified by a visible light camera;

S2: if there is no image in the infrared light image, it is determined that the object to be identified is non-living, otherwise, executing step S3;

S3: extracting the features of the eyes and face of the object to be identified in the visible light image and the infrared light image, and determining whether the object to be identified is living or not based on the extracted features.

The inventor also found that for photo attacks, the light source of the scene where the photo was taken would be a point source or a parallel source, there is only one feature. But there will be obvious traces of point light (such as the tip of the nose reflecting light because of closer to the screen, cheeks being dim, etc.) in the face of a real person under the infrared fill light irradiation, while there will be none of those features in the visible light image. In this way, the rest of the photos, and hole attacks can be prevented, and it almost does not affect the pass rate of real people. The achievement of these classification uses advanced deep learning technologies at home and abroad. Combined with our years of practical experience in the visual industry, eventually we get classifiers with good performance, fast speed, and small size. In addition, for the scene without exposing the real human eye (such as photo attack and 3d mask attack), the eyes of a real human under infrared light will have the features of pupil reflecting light, and the white part of the eye being gray, etc., and the pupils in the visible light will not have these features. Using the different features of the eyes in the visible and infrared light, the anti-attack capability can be further enhanced.

Step S3 specifically includes the steps of:

S31: determining whether there is a face in both of the visible light image and the infrared light image, if yes, executing step S32; or if no, executing step S31;

S32: extracting the features of the face and eyes of the object to be identified in the visible light image and the infrared light image.

S34: If the nose reflects light and cheeks are dim, the pupils reflect light and the white part of the eye is gray in the infrared light image, while there is no above feature in the visible light image, it is determined that the object to be identified is living, otherwise is non-living.

After being identified as living in step S3, executing the steps of:

S4: determining the distance between the object to be identified with the infrared camera and the visible camera respectively;

S5: determining the angle between the front of the object to be identified with the infrared camera and the visible camera respectively;

S6: determining whether the object to be identified captured by the infrared

camera and the visible light camera is the same thing according to the data obtained in steps S4 and S5 in combination with the positional and angular relationship between the infrared camera and the visible light camera. if yes, then the object to be identified is determined to be living, if not, the object to be identified is determined to be non-living.

The angle between the front of the object to be identified and the infrared camera is the angle between the front of the object to be identified and the front of the infrared camera. The angle between the front of the object to be identified and the infrared camera is the angle between the front of the object to be identified and the front of the visible light camera.

A device, as shown in fig.2, comprising:

a visible light camera 1, for capturing a visible light image of the object to be identified by a visible light camera

an infrared camera 2, for capturing an infrared light image of an object to be identified by an infrared camera;

a computer 3, connected with the visible light camera 1 and the infrared camera 2 respectively, for determining whether the object to be identified is living or not according to the visible light image and the infrared light image.

The computer 3 comprising:

A pre-recognition module, for determining whether it is non-living based on whether there is an image in the infrared light image;

A feature identification module, connected with the pre-identification module, for extracting features of the eyes and face of the object to be identified in the visible light image and the infrared light image after passes the pre-identification module verification, and determining whether the object to be identified is living or not based on the extracted features.

The feature identification module comprising:

a first identification unit, for extracting the features of the face of the object to be identified in the visible light image and the infrared light image. If the nose reflects light and cheeks are dim in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

a second identification unit, for extracting features of the eyes of the object to be identified in the visible light image and the infrared light image. If the pupils reflect light and the white part of the eye is gray in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

The computer further comprising:

A distance identification module, connected with the feature identification module, determining the distance between the object to be identified with the infrared camera and the visible camera respectively, and the angle between the front of the object to be identified with the infrared camera and the visible camera respectively after passes the feature identification module verification, and determining whether the object to be identified captured by the infrared camera and the visible light camera is the same thing by combining the positional and angular relationship between the infrared camera and the visible light camera. If yes, then the object to be identified is determined to be living, if not, the object to be identified is determined to be non-living.

The whole system can ensure 99.9% accuracy, 0% pass rate of video attack, and less than 0.1% pass rate of other attacks in the case of good lighting. It can reach completing determination within less than half a second in speed.

CLAIMS

1. A living body detection method, wherein comprising:

5 S1: capturing an infrared light image of an object to be identified by an infrared camera, and capturing a visible light image of the object to be identified by a visible light camera;

S2: if there is no image in the infrared light image, it is determined that the object to be identified is non-living, otherwise, executing step S3;

10 S3: extracting the features of the eyes and face of the object to be identified in the visible light image and the infrared light image, and determining whether the object to be identified is living or not based on the extracted features, wherein Step S3 specifically includes the steps of:

15 S31: determining whether there is a face in both of the visible light image and the infrared light image, if yes, executing step S32; or if no, repeating step S31;

S32: extracting the features of the face of the object to be identified in the visible light image and the infrared light image; if the nose reflects light and the cheeks are dim in the infrared light image, perform S33;

20 S33: Extracting features of the eyes of the object to be identified in the visible light image and the infrared light image; if the pupils reflect light and the white part of the eye is gray in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

25 2. The living body detection method of claim 1, wherein after being identified as living in step S3, executing the steps of:

S4: determining the distance between the object to be identified with the infrared camera and the visible camera respectively;

S5: determining the angle between the front of the object to be identified with the infrared camera and the visible camera respectively;

30 S6: determining whether the object to be identified captured by the infrared camera and the visible light camera is the same thing according to the data obtained in steps S4 and S5 in combination with the positional and angular relationship between the

infrared camera and the visible light camera, if yes, then the object to be identified being determined to be living, if not, the object to be identified being determined to be non-living.

5 3. The living body detection method of claim 2, wherein The angle between the front of the object to be identified and the infrared camera is the angle between the front of the object to be identified and the front of the infrared camera; the angle between the front of the object to be identified and the infrared camera is the angle between the front of the object to be identified and the front of the visible light camera.

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4. A device for implementing the method of any one of claims 1 to 3, wherein comprising:

 a visible light camera, for capturing a visible light image of the object to be identified by a visible light camera;

15 an infrared camera, for capturing an infrared light image of an object to be identified by an infrared camera;

 a computer, connected with the visible light camera and the infrared camera respectively, for determining whether the object to be identified is living or not according to the visible light image and the infrared light image.

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5. The device of claim 4, wherein the computer comprising:

 a pre-recognition module, for determining whether it is non-living based on whether there is an image in the infrared light image;

 a feature identification module, connected with the pre-identification module, for
25 extracting features of the eyes and face of the object to be identified in the visible light image and the infrared light image after passes the pre-identification module verification, and determining whether the object to be identified is living or not based on the extracted features.

30 6. The device of claim 4, wherein the feature identification module comprising:

 a first identification unit, for extracting the features of the face of the object to be

identified in the visible light image and the infrared light image, if the nose reflects light and cheeks are dim in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living;

5 a second identification unit, for extracting features of the eyes of the object to be identified in the visible light image and the infrared light image, if the pupils reflect light and the white part of the eye is gray in the infrared light image, it is determined that the object to be identified is living, otherwise is non-living.

7. The device of claim 4, wherein the computer further comprising:
10 a distance identification module, connected with the feature identification module, determining the distance between the object to be identified with the infrared camera and the visible camera respectively, and the angle between the front of the object to be identified with the infrared camera and the visible camera respectively after passes the feature identification module verification, and determining whether the object
15 to be identified captured by the infrared camera and the visible light camera is the same thing by combining the positional and angular relationship between the infrared camera and the visible light camera, if yes, then the object to be identified being determined to be living, if not, the object to be identified being determined to be non-living.