Patent Literature 1, it may be difficult to suitably collect necessary information based on the user's movement.

[0005]

In view of the problem described above, this disclosure provides an information processing apparatus, an information processing method, and a storage medium that can suitably acquire necessary biometrics information based on a user's movement.

[0006]

In one ~~aspect~~example, there is provided an information processing apparatus comprising: a memory configured to store instructions; and a processor configured to execute the instructions to: output first information to prompt a user to perform an action; acquire second information corresponding to the action performed by the user; display a frame indicating a progress of acquiring the second information; wherein the frame indicates that the action performed by the user is proper based on the second information matching the first information, and the frame indicates that the action performed by the user is improper based on the second information not matching the first information.

[0007]

In another ~~aspect~~example, there is provided an information processing method comprising: outputting first information to prompt a user to perform an action; acquiring second information corresponding to the action performed by the user; displaying a frame indicating a progress of acquiring the second information; wherein the frame indicates that the action performed by the user is proper based on the second information matching the first information, and the frame indicates that the action performed by the user is improper based on the second information

not matching the first information.

[0008]

In another ~~aspect~~example, there is provided a storage medium storing a program that causes a computer to perform: outputting first information to prompt a user to perform an action; acquiring second information corresponding to the action performed by the user; displaying a frame indicating a progress of acquiring the second information; wherein the frame indicates that the action performed by the user is proper based on the second information matching the first information, and the frame indicates that the action performed by the user is improper based on the second information not matching the first information.

[0008a]

In an aspect, the present disclosure refers to an information processing apparatus comprising:

a memory configured to store instructions; and

a processor configured to execute the instructions to:

output first information to prompt a user to perform an action;

acquire, after the user has performed the action, second information corresponding to the action performed by the user, the second information including a plurality of face images and a face feature point of the user;

display a gauge indicating a progress of acquiring the second information, wherein

the gauge indicates that the action performed by the user is proper based on the second information being acquirable from the action, the gauge indicates that the action performed by the user is improper based on the second information not being acquirable from the action, and the gauge increases as more face images of the plurality of face images required for an impersonation determination are acquired,

the gauge has a ring-like shape, and

the impersonation determination is whether or not the user is being impersonated by a non-living object, based on a change in the position of the face feature point in the plurality of face images.

[0008b]

In an aspect, the present disclosure refers to an information processing apparatus comprising:

a memory configured to store instructions; and

a processor configured to execute the instructions to:

display first information to prompt a user to perform an action, wherein the first information comprises instructions regarding a face movement of a face of the user;

acquire, after the user has performed the action, second information comprising a plurality of face images corresponding to a plurality of action movements associated with the action performed by the user;

display a progress status indicating a progress of acquiring the second information;

display an action icon that indicates the action and the progress status;

change display of the action icon and the progress status based on the action performed by the user being proper;

acquire biometrics information from the second information;

perform a first comparison of the acquired biometrics information with registered biometrics information prior to the number of the plurality of face images of the acquired biometrics information reaching a threshold number of face images;

stop acquiring the biometrics information when, prior to the number of the plurality of face images reaching the threshold number of face images, a result of the first comparison indicates that the acquired biometrics information does not match the registered biometrics information;

change display of the first information that prompts the user

to perform the action based on the progress status of the action;

output an authentication result based on:

a result of an impersonation determination indicating whether an existence of the user is three-dimensional based on whether the threshold number of face images has been acquired in the second information; and

a result of a facial recognition determination based on a second comparison of the acquired biometrics information with the registered biometrics information performed after the threshold number of face images is acquired, wherein the impersonation determination is performed simultaneously with or after the facial recognition determination; and

display a completion icon different from the action icon after the impersonation determination is finished.

face image acquisition unit 12c may display the acquisition rate of face images as a numerical value in a form of percentage expression or may display an acquisition rate of face images by using a ~~gage~~gauge or a progress bar whose length changes in accordance with the acquisition ratio of face images, for example. The shape of a ~~gage~~gauge or a progress bar indicating an acquisition ratio of face images is not particularly limited, and a bar-like shape, a ring-like shape, or a frame-like shape may be employed, for example. The face image acquisition unit 12c controls and changes the display indicating the progress status of acquisition of face images, which is display directed to the user, in accordance with the acquisition status of face images. The face image acquisition unit 12c can cause the display unit 20 to display the display indicating the progress status of acquisition of face images, such as a ~~gage~~gauge, a progress bar, or the like, in accordance with the user's movement status. Note that a form of display indicating the progress status of acquisition of face images is not limited to a ~~gage~~gauge or a progress bar, and various forms of display may be employed.

[0037]

When the time limit elapses without the predefined number of face images being acquired by the face image acquisition unit 12c and thus acquisition of the predetermined number of face images fails, that is, when a predetermined amount of biometrics information is not acquired within a predetermined time period, the information provide unit 12d provides guidance information to the user. The guidance information is information that may be a reference, a guide, a help, or the like for successful acquisition of the predefined number of face images by the face image acquisition unit 12c when face authentication is again performed. The information provide unit 12d can cause

unit 22 and a movement instruction display region SF14 that displays an instruction about a particular movement from the movement instruction unit 12b. Further, the face authentication window SF includes a bar-like ~~gage~~gauge SF16 indicating the progress status of acquisition of face images and frame-like ~~gage~~gauges SF18L and SF18R similarly indicating the progress status of acquisition of face images. Further, the face authentication window SF includes a "Use password" button SF20 used for switching the authentication scheme to a password scheme and a "Cancel" button SF22 used for cancelling face authentication.

[0067]

The moving image display region SF12 displays, in substantially real time, a moving image including a face of the user captured by the capture unit 22. The user is able to determine whether or not his/her movement to the instruction of a particular movement from the movement instruction unit 12b is proper by checking the moving image of his/her face displayed in the moving image display region SF12.

[0068]

The movement instruction display region SF14 displays an instruction message SF142 providing an instruction about a particular movement and a face icon SF144 similarly providing an instruction about a particular movement. The instruction message SF142 indicates the content of a particular movement instructed by the movement instruction unit 12b. Further, the face icon SF144 moves as an animation with a particular movement instructed by the movement instruction unit 12b. The movement instruction unit 12b instructs the user about a particular movement by using the instruction message SF142 such as "Please shake your head", for example. Further, the movement instruction unit 12b instructs the user about a particular movement by using the face icon SF144 that

shakes the head as an animation movement, for example.

[0069]

The bar-like ~~gage~~gauge SF16 changes the length thereof in accordance with the progress status of acquisition of face images performed by the face image acquisition unit 12c. Specifically, the bar-like ~~gage~~gauge SF16 changes the length thereof so as to extend from the left to the right in accordance with an acquisition rate of face images performed by the face image acquisition unit 12c. Further, inside the bar-like ~~gage~~gauge SF16, the acquisition rate of face images is displayed as a numerical value in a form of percentage representation.

[0070]

The frame-like ~~gage~~gauges SF18L and SF18R are arranged so as to form the left half frame portion and the right half frame portion around the moving image display region SF12, respectively. The frame-like ~~gage~~gauges SF18L and SF18R changes the lengths thereof in accordance with the progress status of acquisition of face images performed by the face image acquisition unit 12c, respectively, in a similar manner to the bar-like ~~gage~~gauge SF16. Specifically, the frame-like ~~gage~~gauges SF18L and SF18R change the lengths thereof so as to extend from the bottom to the top in accordance with the acquisition rate of face images performed by the face image acquisition unit 12c, respectively.

[0071]

On the frame surrounding the moving image display region SF12 formed of the frame-like ~~gage~~gauges SF18L and SF18R, the face icon SF144 is arranged at the center on the upper side, and the bar-like ~~gage~~gauge SF16 is arranged at the center on the lower side. The frame-like ~~gage~~gauges SF18L and SF18R indicate an acquisition rate of face images of 0% at the center of the bar-like ~~gage~~gauge SF16 and indicate an acquisition rate of face images of 100% at the reaching point at the face icon SF144, respectively.

by the capture unit 22 (step S118).

[0080]

Next, the face image acquisition unit 12c evaluates the quality of the detected face image (step S120). If the face image acquisition unit 12c determines that the quality of the face image is not above a predetermined quality (step S120, NO), the process proceeds to step S110 described above to again attempt acquisition of face images.

[0081]

On the other hand, if the face image acquisition unit 12c determines that the quality of the face image is above a predetermined quality (step S120, YES), the face image acquisition unit 12c acquires a high quality face image having a quality above the predetermined quality (step S122).

[0082]

In response to acquiring face images, the face image acquisition unit 12c controls and changes the display indicating the progress status of acquisition of face images, such as a ~~gage~~gauge, a progress bar, a numerical value in a form of percentage indicating an acquisition rate of face images, or the like (step S124).

[0083]

Fig. 7 illustrates one example of the face authentication window SF when face images are being acquired by the face image acquisition unit 12c. Note that Fig. 7 illustrates the face authentication window SF when the acquisition rate of face images is 50%. In the face authentication window SF during acquisition of face images, the bar-like ~~gage~~gauge SF16 extends from the left to the right, and the frame-like ~~gage~~gauges SF18L and SF18R extend from the bottom to the top as the number of acquired face images increases, as illustrated in Fig. 7. Further, the numerical value of the acquisition rate of face images inside the bar-like

~~gage~~gauge SF16 increases as the number of acquired face images increases.

[0084]

Next, as illustrated in Fig. 2, the face image acquisition unit 12c determines whether or not a predefined number of face images necessary for impersonation determination is acquired (step S126). If the face image acquisition unit 12c determines that the predefined number of face images have not been acquired (step S126, NO), unless the time limit has elapsed (step S128, NO), the face image acquisition unit 12c enters step S110 described above to again attempt acquisition of face images. Note that, if the time limit has elapsed (step S128, YES), the process proceeds to step S138 described later.

[0085]

On the other hand, if the face image acquisition unit 12c determines that the predefined number of face images have been acquired (step S126, YES), the impersonation determination unit 12e performs impersonation determination (step S130), and the face recognition unit 12f performs face recognition (step S132). Note that any one of the impersonation determination by the impersonation determination unit 12e and the face recognition by the face recognition unit 12f may be performed earlier than the other and may be performed in parallel. Further, the face recognition unit 12f can perform face recognition by using already acquired face images at the time before the predefined number of face images are acquired by the face image acquisition unit 12c.

[0086]

Note that Fig. 8 illustrates one example of the face authentication window SF at completion of acquisition of the predefined number of face images performed by the face image acquisition unit 12c. As illustrated in Fig. 8, in the face authentication

window SF at the completion of acquisition of face images, the bar-like ~~gage~~gauge SF16 and the frame-like ~~gage~~gauges SF18L and SF18R have extended at the maximum, respectively. Further, the acquisition ratio of face images inside the bar-like ~~gage~~gauge SF16 is 100%. Further, in the face authentication window SF at the completion of acquisition of face images, a completion icon SF24 indicating the completion of acquisition of face images is displayed instead of the face icon SF144, and the completion of the process is visually indicated to the user.

[0087]

The impersonation determination unit 12e first estimates a three-dimensional shape of the user's face based on a plurality of face images acquired by the face image acquisition unit 12c as illustrated in Fig. 3 (step S202).

[0088]

Next, the impersonation determination unit 12e evaluates whether or not the estimated three-dimensional shape is three-dimensional (step S204).

[0089]

If the impersonation determination unit 12e evaluates that the estimated three-dimensional shape is three-dimensional (step S204, YES), the impersonation determination unit 12e determines that the user's face is a face of a living body and is not impersonated (step S206).

[0090]

On the other hand, if the impersonation determination unit 12e evaluates that the estimated three-dimensional shape is not three-dimensional, that is, is two-dimensional (step S204, NO), the impersonation determination unit 12e determines that the user's face is impersonated by a photograph, a moving image, or the like (step S208).

[0091]

S140).

[0104]

Fig. 10 illustrates the face authentication window SF at a face authentication failure when the face authentication failed because the predefined number of face images have not been acquired and the time limit has elapsed. As illustrated in Fig. 10, in the face authentication window SF at the face authentication failure, a failure icon SF26 such as an exclamation mark icon indicating that the predefined number of face images have not been acquired and thus the face authentication failed is displayed instead of the face icon SF144. Further, instead of the frame-like ~~gage~~gauges SF18L and SF18R, a failure frame SF28 indicating that the face authentication failed by using a different color or the like from the frame-like ~~gage~~gauges SF18L and SF18R is displayed around the moving image display region SF12, for example. Further, while displaying a color moving image captured by the capture unit 22 when face images are acquired, the moving image display region SF12 displays a grayscale frame or a black and white frame at a particular point of time of a moving image captured by the capture unit 22 when face authentication fails, for example. Thereby, the moving image display region SF12 indicates that face authentication failed.

[0105]

Furthermore, in the moving image display region SF12, a guidance message SF30 is displayed as guidance information provided by the information provide unit 12d. For example, the guidance message SF30 is a message having the content in accordance with a reason for a failure in acquisition of the predefined number of face images, such as "Motion is too fast", "It is too bright", or the like.

[0106]

In such a way, face authentication is performed

[CLAIMS]

[Claim 1]

An information processing apparatus comprising:

a memory configured to store instructions; and

a processor configured to execute the instructions to:

output first information to prompt a user to perform an action;

acquire, after the user has performed the action, second information corresponding to the action performed by the user, the second information including a plurality of face images and a face feature point of the user;

display a ~~frame~~gauge indicating a progress of acquiring the second information~~;~~ , wherein

the ~~frame~~gauge indicates that the action performed by the user is proper based on the second information ~~matching the first information~~being acquirable from the action, ~~and~~ the ~~frame~~gauge indicates that the action performed by the user is improper based on the second information not ~~matching the first information~~being acquirable from the action~~.~~, and the gauge increases as more face images of the plurality of face images required for an impersonation determination are acquired,

the gauge has a ring-like shape, and

the impersonation determination is whether or not the user is being impersonated by a non-living object, based on a change in the position of the face feature point in the plurality of face images.

[Claim 2]

The information processing apparatus according to claim 1, wherein the ~~movement instruction means indicates the movement by causing~~face feature point includes a ~~display means to display the display that instructs the user about the~~

~~movement, and~~

~~wherein the display control means controls the display that instructs the user about the movement in accordance with the movement status of the user~~nose.

[Claim 3]

The information processing apparatus according to claim 1 ~~or 2~~, wherein the ~~display control means causes a display means to display~~gauge having the ~~display indicating progress status~~ring-like shape is configured so that the gauge increases from bottom to top each of ~~acquisition~~a plurality of ~~the biometrics information in accordance with the movement status~~times one of the ~~user~~images required for the spoofing determination is acquired.

[Claim 4]

~~The information processing apparatus according to any one of claims 1 to 3 further comprising information provide means for providing guidance information when the information acquisition means is unable to acquire a predetermined amount of the biometrics information within a predetermined time period.~~

~~[Claim 5]~~

~~The information processing apparatus according to claim 4, wherein the guidance information is information regarding a movement or an environment of the user.~~

~~[Claim 6]~~

~~The information processing apparatus according to any one of claims 1 to 5,~~

~~wherein the movement instruction means instructs the user about the movement related to a head of the user, and~~

~~wherein the information acquisition means acquires multiple~~

~~pieces of face information as the biometrics information from the user.~~

~~[Claim 7]~~

~~The information processing apparatus according to any one of claims 1 to 6 further comprising impersonation determination means for determining, based on the biometrics information, whether or not the user is impersonated.~~

~~[Claim 8]~~

~~The information processing apparatus according to claim 7 further comprising comparison means for comparing the biometrics information acquired by the information acquisition means with registered biometrics information.~~

~~[Claim 9]~~

An information processing ~~method~~apparatus comprising:

~~outputting~~a memory configured to store instructions; and a processor configured to execute the instructions to:

display first information to prompt a user to perform an action, wherein the first information comprises instructions regarding a face movement of a face of the user;

~~acquiring~~acquire, after the user has performed the action, second information comprising a plurality of face images corresponding to ~~the action performed by the user;~~

~~displaying a frame indicating a progress of acquiring the second information;~~

~~wherein the frame indicates that the~~ a plurality of action ~~performed by the user is proper based on the second information matching the first information, and the frame indicates that the~~ movements associated with the action performed by the user ~~is improper based on the second information not matching the first information.~~;

~~[Claim 10]~~

~~A storage medium storing a program that causes a computer to perform:~~

~~outputting first information to prompt a user to perform an action;~~

~~acquiring second information corresponding to the action performed by the user;~~

~~displaying a frame~~display a progress status indicating a progress of acquiring the second information;

~~wherein the frame indicates that~~ display an action icon that indicates the action and the progress status;

change display of the action ~~performed by the user is proper based on the second information matching the first information,~~icon and the ~~frame indicates that~~progress status based on the action performed by the user ~~is improper~~being proper;

acquire biometrics information from the second information;

perform a first comparison of the acquired biometrics information with registered biometrics information prior to the number of the plurality of face images of the acquired biometrics information reaching a threshold number of face images;

stop acquiring the biometrics information when, prior to the number of the plurality of face images reaching the threshold number of face images, a result of the first comparison indicates that the acquired biometrics information does not match the registered biometrics information;

change display of the first information that prompts the user to perform the action based on the progress status of the action;

output an authentication result based on:

a result of an impersonation determination indicating whether an existence of the user is three-dimensional based on whether the threshold number of face images has been acquired in the second information; and

a result of a facial recognition determination based on ~~the~~

~~second information not matching the first information.~~a second comparison of the acquired biometrics information with the registered biometrics information performed after the threshold number of face images is acquired, wherein the impersonation determination is performed simultaneously with or after the facial recognition determination; and

~~display a completion icon different from the action icon after the impersonation determination is finished.~~