CLAIMS

[Claim 1]

An image processing apparatus comprising:

detecting means for detecting a plurality of predetermined parts of a subject from an image;

estimating means for estimating a cause of failed detection if any of the plurality of predetermined parts is not detected in a result of the detection made by the detecting means, wherein the cause of the failed detection is one of self-occlusion, the subject being partially outside the image, and the subject being shielded by another subject; and (0043)

determining means for determining a state of the subject based on a part detected by the detecting means and the cause estimated by the estimating means,

wherein the estimating means determines that the cause is the subject being partially outside the image when a distance between a representative point selected from among detected parts of the subject and an end portion of the image is less than a predetermined threshold (0056,0061,0064,0066),

wherein the estimating means determines that the cause is the subject being shielded by another subject when, for a parent part of a missing part of the subject, a region defined around the parent part contains a part of the other subject, and (0069,0070)

wherein the estimating means determines that the cause is self-occlusion of the subject when at least one of the plurality of predetermined parts is missing and the cause is determined to be neither the subject being partially outside the image nor the subject being shielded by another subject (0071).

[Claim 2]

The image processing apparatus according to Claim 1, wherein, in determining that the cause is the subject being partially outside the image,

the estimating means determines whether at least one of:

a distance between the representative point and a bottom end portion of the image is less than a predetermined threshold,

a distance between the representative point and a top end portion of the image is less than a predetermined threshold,

a distance between the representative point and a left end portion of the image is less than a predetermined threshold, and

a distance between the representative point and a right end portion of the image is less than a predetermined threshold (0056,0061,0064,0066).

[Claim 3]

The image processing apparatus according to Claim 1, wherein the estimating means estimates the cause of the failed detection based on a position of the subject in the

image.

[Claim 4]

The image processing apparatus according to Claim 3, wherein the estimating means estimates the cause of the failed detection based on a distance between the position of the subject in the image and an end portion of the image.

[Claim 5]

The image processing apparatus according to Claim 1, wherein the estimating means estimates the cause of the failed detection based on a position of the subject and a position of an object not being the subject.

[Claim 6]

The image processing apparatus according to Claim 1, wherein the determining means determines the state of the subject based on a position of the detected part and the estimated cause.

[Claim 7]

The image processing apparatus according to Claim 6, wherein the position of the part is a position relative to a reference position of the subject.

[Claim 8]

The image processing apparatus according to Claim 1, wherein the determining means determines whether the state of the subject is normal or abnormal.

[Claim 9]

The image processing apparatus according to Claim 1, wherein the determining means determines a pose of the subject.

[Claim 10]

The image processing apparatus according to Claim 9, wherein the determining means determines whether the pose of the subject is abnormal.

[Claim 11]

The image processing apparatus according to Claim 1, wherein the subject is a human, and the predetermined parts are joints or regions of the human.

[Claim 12]

The image processing apparatus according to Claim 1, further comprising:

extracting means for extracting a feature quantity of the subject based on the part detected by the detecting means;

classifying means for classifying the feature quantity into one of a plurality of categories based on the state determined by the determining means; and

characteristic recognizing means for recognizing a characteristic of the subject based on a result of the classification performed by the classifying means.

[Claim 13]

The image processing apparatus according to Claim 12,

wherein the characteristic recognizing means changes a method of recognition based on a result of the classification performed by the classifying means.

[Claim 14]

The image processing apparatus according to Claim 13, wherein the characteristic recognizing means excludes, from a target of recognition, a feature quantity classified into some of the categories.

[Claim 15]

The image processing apparatus according to Claim 13, wherein the characteristic recognizing means changes the method of recognition by changing a threshold used in the recognition.

[Claim 16]

The image processing apparatus according to Claim 13, wherein the characteristic recognizing means changes the method of recognition by changing a statistical model used in the recognition.

[Claim 17]

The image processing apparatus according to Claim 12, wherein the classifying means classifies the feature quantity for each of a plurality of images including the subject; and

the characteristic recognizing means recognizes the characteristic of the subject based on a result of the

classification performed for the plurality of images by the classifying means.

[Claim 18]

The image processing apparatus according to Claim 12, wherein the classifying means classifies the feature quantity of the subject using a plurality of chronological images.

[Claim 19]

The image processing apparatus according to Claim 12, further comprising tracking means for tracking the subject using the plurality of chronological images,

wherein the classifying means classifies the feature quantity of the subject based on a result of the tracking.

[Claim 20]

An image processing method comprising:

a detecting step of detecting a plurality of predetermined parts of a subject from an image;

an estimating step of estimating a cause of failed detection if any of the plurality of predetermined parts is not detected in a result of the detection made in the detecting step, wherein the cause of the failed detection is one of self-occlusion, the subject being partially outside the image, and the subject being shielded by another subject; and (0043)

a determining step of determining a state of the

subject based on a part detected in the detecting step and the estimated cause,

wherein the estimating means determines that the cause is the subject being partially outside the image when a distance between a representative point selected from among detected parts of the subject and an end portion of the image is less than a predetermined threshold (0056,0061,0064,0066),

wherein the estimating means determines that the cause is the subject being shielded by another subject when, for a parent part of a missing part of the subject, a region defined around the parent part contains a part of the other subject, and (0069,0070)

wherein the estimating means determines that the cause is self-occlusion of the subject when at least one of the plurality of predetermined parts is missing and the cause is determined to be neither the subject being partially outside the image nor the subject being shielded by another subject (0071).

[Claim 21]

A program causing a computer to execute:

a detecting step of detecting a plurality of predetermined parts of a subject from an image;

an estimating step of estimating a cause of failed detection if any of the plurality of predetermined parts is

not detected in a result of the detection made in the detecting step, wherein the cause of the failed detection is one of self-occlusion, the subject being partially outside the image, and the subject being shielded by another subject; and (0043)

a determining step of determining a state of the subject based on a part detected in the detecting step and the estimated cause,

wherein the estimating means determines that the cause is the subject being partially outside the image when a distance between a representative point selected from among detected parts of the subject and an end portion of the image is less than a predetermined threshold (0056,0061,0064,0066),

wherein the estimating means determines that the cause is the subject being shielded by another subject when, for a parent part of a missing part of the subject, a region defined around the parent part contains a part of the other subject, and (0069,0070)

wherein the estimating means determines that the cause is self-occlusion of the subject when at least one of the plurality of predetermined parts is missing and the cause is determined to be neither the subject being partially outside the image nor the subject being shielded by another subject (0071).