

CLAIMS

[Claim 1] A monitoring device that detects a change in an object in a monitoring region from an input image acquired by a video acquisition unit, comprising:

- a reference image generation unit that generates a reference image as a reference for an image recognition process based on the input image;
- a foreground extraction unit that compares the input image with the reference image to detect a foreground region different from the reference image;
- a non-moving region extraction unit that compares the foreground region with the input image to extract a non-moving region from the foreground region;
- a feature amount extraction unit that extracts a feature amount of the non-moving region;
- a feature amount accumulation unit that accumulates the feature amount in a direction of time;
- a stationary object detection unit that performs clustering of pixels in which the feature amount accumulated by the feature amount accumulation unit satisfies a predetermined standard to detect a stationary object, wherein, at the time of labeling, the stationary object detection unit observes temporal distances such as the magnitudes of accumulated feature amounts of the pixels as well as spatial distances, and sets the pixels within each of certain distances into groups;
- a left object determination unit that determines whether the stationary object is a left object based on the feature amount of the stationary object and an evaluation of a surrounding environment; and
- a management unit that manages an attribute of the stationary object determined as the left object.

[Claim 2] The monitoring device according to claim 1, comprising a display unit that superimposes at least one of a result of accumulation by the feature amount accumulation unit and a result of operation by the left object determination unit on the input image or the background image and displays and outputs a standstill state of the left object in an identifiable manner.

[Claim 3] The monitoring device according to claim 1, wherein the management unit

issues an alarm when the attribute of the stationary portion satisfies an alarm issuing condition.

[Claim 4] The monitoring device according to claim 2, wherein the management unit issues an alarm when the attribute of the stationary portion satisfies an alarm issuing condition.

[Claim 5] The monitoring device according to claim 1, wherein the feature amount accumulation unit averages feature amount accumulated images in every frame within a certain past range or averages residual errors.

[Claim 6] The monitoring device according to claim 1, wherein, to compare similarities between the input image and the background image in the same coordinates as those of the stationary candidate region, a degree of similarity is calculated by determining a distance of luminance value at a position of the stationary object by a template matching method such as normalized cross-correlation or sum of absolute difference (SAD) to discriminate between a background change and a left object.

[Claim 7] The monitoring device according to claim 1, wherein, as a means for indicating tendencies of standstill, congestion, and clogging of persons, for example, the feature amount accumulated image calculated by the feature accumulation unit is converted by an index of standstill degree, and the standstill degree is imaged and overlaid on the input image to visualize the tendencies of standstill.

[Claim 8] The monitoring device according to claim 1, wherein an image in which a standstill degree heat map image acquired by performing spatial processing with a Gaussian filter on a feature amount accumulated image expressed in pseudo colors is overlaid on the input image by α blending is displayed.

[Claim 9] The monitoring device according to claim 1, wherein, for a position of the left object, when a position, height, angle of depression, and focal distance of a shooting camera are known, the standstill degree heat map image is converted into a world coordinate system using camera parameters and the converted heat map image is mapped on a map to visualize positions and degrees of congestion and standstill.

[Claim 10] The monitoring device according to claim 1, wherein an image of a candidate region of the stationary object found for the first time is recorded in a recording device so that, when a left object is detected by the left object determination unit, the input image of the stationary object candidate region found for the first time in the recording device is referred to with respect to a person having left the left object.

[Claim 11] The monitoring device according to claim 10, wherein a face search system or a clothes search system is combined so that the recording device is searched for a person having left the left object.

[Claim 12] A monitoring device that detects a change in an object in a monitoring region from an input image acquired by a video acquisition unit, comprising:

a reference image generation unit that generates a reference image as a reference for an image recognition process based on the input image;

a foreground extraction unit that compares the input image with the reference image to detect a foreground region different from the reference image;

a non-moving region extraction unit that compares the foreground region with the input image to extract a non-moving region from the foreground region;

a feature amount extraction unit that extracts a feature amount of the non-moving region;

a feature amount accumulation unit that accumulates the feature amount in a direction of time;

a stationary object detection unit that performs clustering of pixels in which the feature amount accumulated by the feature amount accumulation unit satisfies a predetermined standard to detect a stationary object;

a left object determination unit that determines whether the stationary object is a left object based on the feature amount of the stationary object and an evaluation of a surrounding environment; and

a management unit that manages an attribute of the stationary object determined as the left object,

wherein, as a means for indicating tendencies of standstill, congestion, and clogging of

persons, for example, the feature amount accumulated image calculated by the feature accumulation unit is converted by an index of standstill degree, and the standstill degree is imaged and overlaid on the input image to visualize the tendencies of standstill.

[Claim 13] A monitoring device that detects a change in an object in a monitoring region from an input image acquired by a video acquisition unit, comprising:

a reference image generation unit that generates a reference image as a reference for an image recognition process based on the input image;

a foreground extraction unit that compares the input image with the reference image to detect a foreground region different from the reference image;

a non-moving region extraction unit that compares the foreground region with the input image to extract a non-moving region from the foreground region;

a feature amount extraction unit that extracts a feature amount of the non-moving region;

a feature amount accumulation unit that accumulates the feature amount in a direction of time;

a stationary object detection unit that performs clustering of pixels in which the feature amount accumulated by the feature amount accumulation unit satisfies a predetermined standard to detect a stationary object;

a left object determination unit that determines whether the stationary object is a left object based on the feature amount of the stationary object and an evaluation of a surrounding environment; and

a management unit that manages an attribute of the stationary object determined as the left object,

wherein an image in which a standstill degree heat map image acquired by performing spatial processing with a Gaussian filter on a feature amount accumulated image expressed in pseudo colors is overlaid on the input image by α blending is displayed.