

CLAIMS

[Claim 1] An image processing device that extracts information from a video image shot by a video device, comprising:

- a congestion degree estimator that estimates a congestion degree in a shooting region in real time based on the video image;

- a plurality of image analyzers that extracts information on an object other than a background from the video image using a plurality of image analysis techniques; and

- a controller that selects an image analyzer to be used for image analysis from the plurality of image analyzers according to the estimated congestion degree, wherein the plurality of image analysis techniques includes a first analysis technique for real-time processing and a second analysis technique for non-real-time processing, the non-real-time processing performed at a lower or higher rate than a shooting rate of the video image, the information on the object includes information relating to a region of a person and a region of a left object,

- the image processing device includes an image recorder that records the video image, and

- the image analyzer acquires a video image for use in the image analysis from the image recorder according to historical information on a change in the congestion degree and performs image analysis by the second analysis technique.

[Claim 2] The image processing device according to Claim 1, wherein, in case of detecting the left object, a foreground region is extracted as an interest region by background difference processing and, if the foreground region exists for at least a certain period of time, the foreground region is detected as the left object; and wherein, in case of detecting a region of a person, when a spatial size of the extracted interest region matches a presumed size of the person, the interest region is counted as one person.

[Claim 3] The image processing device according to Claim 1, further comprises at least one of:

- a counter that counts all persons in the video image or a counter that counts a number of persons passing through a determination line provided in the video image.

[Claim 4] The image processing device according to Claim 3, wherein, to count the number of persons by tracking feature points immediately after determining a congestion state of the video image, the controller process video images before the extracted video images determined as the congestion state.

[Claim 5] The image processing device according to Claim 4, wherein, when there exists a cluster of the feature points without motion in the screen for a certain period of time or more, the feature points are not detected from the background image, and when a spatial size of the cluster matches the presumed size of a left object, the cluster is detected as a left object; and wherein a cluster of feature points in a motion corresponding to a walking speed of a person is detected as one or more persons or a crowd according to the spatial size of the cluster.

[Claim 6] The image processing device according to claim 5, wherein, if a left object is detected, the feature points are tracked in a plurality of frames to extract paths of the feature points, and the extracted paths are clustered according to motion behavior of the paths to separately extract the objects.

[Claim 7] The image processing device according to claim 1, wherein congestion degree estimator includes a congestion degree calculation unit, the congestion degree calculation unit represents crowds by a heat map based on the video image and measures sizes of the crowds and congestion degrees in the individual crowds.

[Claim 8] The image processing device according to claim 7, further comprising a difference processing unit that takes a difference between two edge images input at different times to generate an edge difference image, wherein the heat map is formed by accumulating the edge difference image acquired from the difference processing unit for a predetermined time and applying a spatial filter; wherein, to measure precisely only crowds of persons, the image processing device performs a process by which to, before the accumulating, perform clustering of pixels with large edge differences and exclude moving objects smaller in size than person.

[Claim 9] The image processing device according to claim 1, wherein the image analyzer includes a congestion-time video analysis unit that analyzes an input image with a high congestion degree and a normal-time video analysis unit that analyzes an input image with a low congestion degree, each of the units performs real-time image analysis, high computing performance is distributed to the congestion-time video analysis unit and relatively low computing performance is distributed to the normal-time video analysis unit.