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"IMAGE PROCESSING APPARATUS"

The present invention generally relates to an image processing apparatus. More specifically, the present invention is directed to an image processing apparatus suitable for detecting the number of waiting passengers in a group-controlled or supervised elevator system.

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Various types of apparatus for detecting an object by processing image information have been proposed. For instance, as a traffic flow measuring system for aiming at an automobile, one conventional technique has been opened in a publication of The Institute of Electronics and Communication Engineers of Japan, '85/3 Vol. J68-D No. 3, pages 308 to 315 (referred to as a "publication 1"), in which the images photographed over the highways are processed based on the algorithm with various defined constants (parameters).

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Also, another conventional image processing system as an apparatus for measuring man flows has been described in another publication of The Institute of Electronics and Communication Engineers of Japan, IE80-

1 73 (1980, 11) (referred to as a "publication 2"), in
which various sorts of threshold values and weight
employed in the image processing algorithm are
determined by way of the learning and then the image
5 process operation is performed by utilizing these
determined threshold values and weight.

Furthermore, as disclosed in JP-A-1-241667
(referred to as a "publication 3"); when the neural
network is employed in the speech recognition technique,
10 the speech pattern whose answer has been known is
inputted in the learning mode, and the weight (coupling)
coefficients are corrected in such a manner that the
difference between this speech pattern and the prepared
answer is reduced to be zero.

15 As previously described, in accordance with
the above-mentioned conventional techniques, there are
provided a large quantity of input patterns the answers
of which have been recognized with respect to the
processed results, and these input patterns are
20 repeatedly entered so as to obtain the desirable answer.
As a consequence, even when the answers could be
obtained with respect to the prepared input patterns,
the conventional image processing apparatuses cannot
follow such cases that previously unexpected changes
25 happen to occur in the environment from which the input
information can be obtained.

For instance, there is such a conventional
image processing apparatus which cannot follow such an

environment that variations are given to the background (will be discussed late) and then produces the incorrect outputs.

5 According to the present invention there is provided an image processing apparatus including:

first image processing means into which image information is inputtable and a first image process is performable based on a predetermined algorithm;

10 means for generating teacher information, into which image information of the same image object as that of said first image processing means is inputtable, a second image process different from said first image process is performable, and a second image
15 processing result as teacher information is generatable; and

means for correcting either said predetermined algorithm, or a parameter thereof, based upon said teacher information and an output of said first image
20 processing means.

Preferably, the correcting means includes means for selecting one of a plurality of algorithms, and one of a plurality of parameters thereof, which have been previously prepared.

25 Also, the first image processing means may include a plurality of image processing means for receiving image information different from each other. Then, the means for generating teacher information includes means commonly provided with said plural

image processing means, for selectively generating as teacher information one of image-processed results by said plural image processing means.

5 The present invention thus enables an image processing apparatus to be provided which is capable of producing correct processed outputs by following variations in environment for an object to be image-processed under actual operation states.

10 The present invention also enables a group-controlled elevator system to be provided in which the number of passengers can be correctly determined, so that the group supervising control for elevator callings may be achieved at a higher efficiency.

15 It should be noted that the parameter may involve a constant, a threshold value and a weight coefficient employed in the algorithm.

As the teacher information generating means, either the image processing means with higher
20 precision, for inputting the same image information as that processed by the image processing means for a processing purpose, or detecting means for inputting information other than the image and for obtaining the same sorts of outputs based on the completely
25 different principle. If necessary, the output of the image processing means is compared with the output of the teacher information means. For instance, in case that these outputs are not coincident with each other, either the algorithm of the

1 image processing means, or the parameters such as
various sorts of threshold values and weight
coefficients used in this algorithm are corrected.

In general, in an image processing apparatus
5 for requiring simplicity and high speed processing
operation, errors may be readily produced due to such
variations in the environment for the object used for
the image information, for instance, changes in
illumination, presence of incident light, variations in
10 background, changes in passengers clothings depending
upon seasons and confusion degrees. To the contrary, in
another image processing apparatus for executing a
process operation with higher difficulties and requiring
a high speed process operation, even when there are
15 changes in the above-described environment, it is rather
difficult to produce such errors.

As a consequence, if the former is employed as
the online image processing means and the latter is
utilized as the teacher information generating means,
20 the process algorithm of the image processing means may
be grown in the online mode, whereby more correct image
processing operation may be achieved.

The present invention will now be described in
greater detail by way of examples with reference to the
25 accompanying drawings, wherein

Fig. 1 is a schematic block diagram for

1 representing a basic idea of an image processing
apparatus according to the present invention;

Fig. 2 is a detailed block diagram of a
portion of the image processing apparatus shown in

5 Fig. 1;

Fig. 3 is a schematic block diagram for
showing an overall arrangement of a group-controlled
elevator to which the image processing apparatus
according to the present invention has been applied;

10 Fig. 4 is a detailed block diagram of a major
portion of the group-controlled elevator shown in
Fig. 3;

Fig. 5 is a cross-sectional view for showing
an elevator hall in which a detector for detecting the
15 number of waiting visitors is installed;

Fig. 6 illustrates an example of an imaged
screen;

Fig. 7 illustratively explains an image
processing sequence for obtaining the number of waiting
20 visitors from the imaged screen;

Fig. 8 is a flowchart for explaining an image
processing operation of an image supervising apparatus
according to one preferred embodiment;

Fig. 9 explanatorily shows a process for
25 correcting parameters of an image processing algorithm
according to one preferred embodiment;

Fig. 10 explanatorily shows a process for
correcting parameters of an image processing algorithm

1 according to another preferred embodiment;

Fig. 11 is an explanatory diagram of the parameter correcting operation;

Fig. 12 explanatorily represents a process for
5 correcting parameters of the image processing algorithm according to a further preferred embodiment;

Fig. 13 explanatorily shows a means for producing teacher information with respect to a quantity of waiting visitors at an elevator hall by employing a
10 weight detector;

Fig. 14 is a flowchart for explaining the teacher information producing operation;

Fig. 15 is a schematic block diagram for showing a major arrangement of a system in which an
15 image processing apparatus with employment of a neural network, according to the present invention, has been employed as the detector for detecting the number of waiting visitors for the group-controlled elevator;

Fig. 16 is an explanatory diagram for
20 representing an image process by way of the neural network;

Fig. 17 is a detailed block diagram of an image processing apparatus 331 according one preferred embodiment;

25 Fig. 18 is a flowchart for explaining an image processing operation of the image processing apparatus 331;

1 Fig. 19 is a schematic block diagram of an
image processing apparatus according to another
preferred embodiment; and,

 Figs. 20 and 21 are flowchart for explaining
5 an image processing operation of the image processing
apparatus shown in Fig. 19.

 First, with reference to Fig. 1, a basic
construction of an image processing apparatus according
10 to the present invention will now be described.

 Image information photographed by a plurality
of photographing (imaging) means 111 to 11n is processed
in image processing apparatuses 121 to 12n,
respectively. A plurality of resultant information "a1"
15 to "an" inputted via a transmission path 13 to a control
apparatus 14. This control apparatus 14 corresponds to,
for instance, a group supervising (managing) control
apparatus.

 The above-described information "a1" to "an",
20 and information 14a representative of operation condi-
tions of the control apparatus 14 are inputted into a
strange (suspicious) information detecting means 151
employed in a teacher (professor) information generating
unit 15.

25 Both an output 151a of the above-described
strange information detecting (sensing) means 151 and
output information 14a of the control apparatus 14 are

1 inputted into a teacher information generating means 152
employed in a teacher information generating unit 15,
and an output information 152a of this teacher
information generating means 152 is inputted to the
5 image processing apparatuses 121 to 12n.

On the other hand, the above-described
information "a1" to "an", an output 16a of an illumi-
nance detecting means 16, and an output 17a of a time
output means 17 are inputted to a condition judging
10 means 18, and an output of this condition judging means
18 is inputted to the image processing apparatuses 121
to 12n.

An operation of the image processing apparatus
121 will now be described.

15 Image information "b1" which has been photo-
graphed, or imaged by the photographing means 111 is
inputted to the image processing means 1211 of the image
processing apparatus 121 so as to be processed. This
process is carried out in such a manner that with
20 employment of data stored in a coefficient table 1212,
the image information "b1" is converted into either
information related to such features as a quantity and a
shape of an object to be detected, or processed informa-
tion in which a binary process has been effected. With
25 employment of this processed information "a1", the
control apparatus 14 may control the object to be
controlled in optimum states.

1 On the other hand, the control apparatus 14
outputs information 14a indicative of a condition of the
object under control at this time instant. The above-
described processed information "a1" of the image

5 processing means 1211 is inputted into the strange
information detecting means 151, and then is compared
with the above-described information 14a indicative of
the condition of the object under control, whereby the
information is monitored.

10 That is to say, the strange information
detecting means 151 judges whether or not the processed
result made by the image processing means 1211 is
coincident with the condition of the object under
control. In the case when the comparison result is not
15 coincident therewith, the strange information detecting
means 151 outputs the processed information "a1" of the
image processing means 1211, a signal for indicating
that this processed information "a1" is strange, and
also information 151a containing the image information
20 "b1" originated from this information "a1" to the
teacher information generating means 152.

 The teacher information generating means 152
analyzes in detail both the strange information "a1" and
the image information "b1" contained in the above-
25 described information 151a so as to obtain correct
processed information (referred to as a "teacher
information" hereinafter) which corresponds to the image
information "b1" photographed by the photographing means

1 111. This teacher information 152 is outputted to a
learning means 1213 in the image processing apparatus
121.

The learning means 1213 obtains either an
5 image processing algorithm used in the image processing
means 121, or correct values for various threshold
values and also weighting coefficients employed in this
image processing algorithm, and then corrects contents
of a coefficient table 1212 for storing therein these
10 weighting coefficients.

Also, the teacher information generating means
152 may obtain the teacher information 152a from
information 14a representative of control states of the
control apparatus 14 in response to the output infor-
15 mation 151a of the strange information detecting means
151 (will be discussed later).

Based upon the output information "a1" of the
image processing means 1211, the output information
"16a" of the illuminance detecting means 16, and the
20 output information "17a" of the time output means 17,
the condition judging means 18 judges environment of a
photographed region aimed by the photographing means
111, and then outputs coefficient selecting information
to the coefficient table 1212. The operations of this
25 condition judging means 18 will now be explained with
reference to Fig. 2.

Fig. 2 is a detailed block diagram of a major
portion of the above-described image processing

1 apparatus 121 shown in Fig. 1. In this image processing
apparatus 121, there are employed a plurality of
coefficient tables 191, 192, ---, 19n. A selection is
made of an optimum coefficient table from these
5 coefficient tables 191 to 19n based on the output
information of the condition judging means 18.

Now, the condition judging means 18 judges
from the output information "a1" of the image processing
means 1211, rough information such that, for instance,
10 whether or not a ratio of an area occupied by an object
under detection to a screen area is large; judges
whether or not illumination (including incident light)
is bright based upon the output information "16a" of the
luminance detecting means 16; or judges whether it is
15 now evening or daytime, otherwise summer or winter based
upon the output information "17a" of the time output
means 17. Further, the condition judging means 18
outputs coefficient selecting information "18a" for
selecting the coefficient table coincident with the
20 above environment information.

It should be noted that the function of the
learning means 1213 is to correct the contents of
coefficients stored in the corresponding coefficient
table under use based upon the above- described teacher
25 information 152a, or to correct the contents stored in
all of the coefficient tables with respect to the common
coefficients.

1 Referring now to Fig. 3, a group-controlled
elevator system to which the image processing apparatus
according to the present invention has been applied,
will be described as a preferred embodiment.

5 In this preferred embodiment, a description
will now be made of the elevator group supervising
(managing) control system for managing 4 sets of
elevators.

A group supervising control apparatus 20,
10 elevator control apparatuses 211 to 214 for controlling
each elevator, display unit control apparatuses 221 to
224, and an image supervising apparatus 23 are connected
to a serial transmission path 24 in a multi-dropping
method. Standard input/output devices such as calling
15 buttons 261 to 264 installed in a hall are connected to
one ends of the serial transmission paths connected to
the respective elevator control apparatus 211 to 214.
Operation panels 291 to 294 employed in cars or cabs 281
to 284 are connected to other ends of the serial
20 transmission paths 271 to 274.

Also, to transmission paths 301 to 304
connected to the display unit control apparatuses 221 to
224, LED (light emitting diode) display units 311 to 318
to be positioned at a n-th floor and an m-th floor of a
25 building are connected.

Similarly, image processing apparatuses 331 to
338 to be positioned at the n-th and moth floors are
connected to the series transmission paths 321 to 324

1 connected to the image supervising apparatus 23.
Photographing means 341 to 348 are connected to the
respective image processing apparatuses 331 to 338.
Image processing apparatuses 3391 to 3394 to be
5 positioned at each car of the elevators are connected to
another serial transmission path 325. Photographing
means 3491 to 3494 are connected to the respective image
processing apparatuses 3391 to 3394. Reference numerals
351 to 354 denote weight detecting means employed in the
10 respective cars.

Operations of the above-described group-
controlled elevator system with the above-mentioned
arrangements will now be described.

The group supervising control apparatus 20
15 receives the information derived from the calling
buttons 261 to 264 installed at the hall and also the
operation panels 291 to 294 provided within the cars via
the respective elevator control apparatuses 221 to 224.
Also, the group supervising control apparatus 20
20 receives via the image supervising apparatus 23 both the
number of waiting visitors which have been detected by
the image processing apparatuses 331 to 338 installed at
the n-th and m-th floors, and the number of passengers
within the cars which have been detected by the image
25 processing apparatuses 3391 to 3394, and then controls
operations of these elevators based on the above-
described various information. The display unit control
apparatuses 221 to 224 output guide information to the

1 display units 311 to 318 installed at the n-th and m-th
floors in order to provide services to these waiting
visitors (passengers).

It should be understood that the above-
5 described image processing apparatuses 331 to 338 and
3391 to 3394 perform simple and rough processing
operations for the sake of simplifying the software used
in this system, of the transmission velocities and also
processing velocities.

10 The elevator control apparatuses 211 to 214
controls operations of the elevators and also the
input/output devices employed in the respective floors
and cars based upon the instructions issued from the
group managing control apparatus 20.

15 Fig. 4 is a detailed block diagram of a major
portion of the system shown in Fig. 3, consisting of
mainly the image supervising apparatus 23.

The image processing apparatus 331 is arranged
by an image input unit 3311, an image processing unit
20 3312, and a transfer processing unit 3313. The image
input unit 3311 converts image information (analog
amount) outputted from the photographing means 341 into
a corresponding digital amount. Based upon this digital
amount, a detection is made of the number of passengers
25 who wait at an elevator hall. In other words, based on
the relationship between a background image which has
been taken at a time instant when no passenger exists in
the elevator hall, and also image information taken at

1 an arbitrary time instant after the first-mentioned time
instant, such a process operation is executed so as to
obtain a quantity of visitors present in this image
information. Since this process operation is used for
5 the on-line control, a high speed characteristic is
demanded and therefore it may be rough process
operation.

The transfer processing unit 3313 transmits
the information on the waiting passengers acquired in
10 the above-described method to the image supervising
apparatus 23 in accordance with a predetermined format.
This image supervising apparatus 23 corresponds to the
teacher information generating unit 15 shown in Fig. 1.
This image supervising apparatus 23 receives the
15 information about the number of the waiting passengers
via the transfer processing units 231 to 235 from the
respective image processing apparatuses 331 to 338 and
3391 to 3394. The image processing unit 236 arranges
the received information and transmits the arranged
20 information via the transfer processing unit 237 to the
group supervising control apparatus 20. As a result,
the group supervising control apparatus 20 controls to
allocate the cars of the elevators based on the quantity
of waiting passengers at the n-th and m-th elevator
25 halls and also the total number of passengers present in
the cars, and thus performs the proper group managing
control. On the other hand, in the case when strange
information is present, the image information which has

1 been used to be processed is acquired from a memory (not
shown) employed in the relevant image processing
apparatus, and a further detailed process operation
thereof will be executed by the image processing unit
5 236. As a result, the resultant correct information,
namely teacher information is transmitted to the group
supervising control apparatus 20 and also to the image
processing apparatus from which the above-described
strange information has been outputted. It should be
10 noted that with respect to an algorithm for a detailed
process operation, for instance, the algorithm as
described in the publication 2 may be utilized.

The image processing apparatus which has
outputted the above-described strange information,
15 corrects parameters used for the process operation,
i.e., various sorts of threshold values and also
weighting (coupling) coefficients in order to reduce
deviation between the detected results and the correct
information (teacher information), whereby detecting
20 precision may be increased. A detailed operation of
this parameter correction will be described later.

Fig. 5 represents a setting condition of the
image processing apparatus according to the preferred
embodiment.

25 The photographing means 341 is set on a
ceiling of an elevator hall at an n-th floor, and this
image processing apparatus 331 is installed within an
elevator path or guide rail along which a car 281 of the

1 elevator is transported, and also an imaging signal
cable is employed so as to connect the photographing
means 341 and image processing apparatus 331 with each
other. Then, the image processing apparatus 331 is
5 connected to the transmission path 321 provided within
the elevator path, and thus transfers the information
via this transmission path 321 to the image supervising
apparatus 23.

Under such a setting condition, a method for
10 detecting, for instance, waiting visitors 361 to 363 at
this hall will now be explained.

In Fig. 6, there is shown an image imaged by
the photographing apparatus 341, in which a screen 37 is
so arranged that 256 unit pixels are arranged in a
15 horizontal direction, whereas 240 unit pixels are
arranged in a vertical direction.

It should be noted that although total numbers
of pixels of photographing apparatuses are different
from each other, resolution of the image input unit 331
20 in this preferred embodiment is defined by 256 X 240
pixels. Furthermore, it is assumed in this drawing that
the background corresponds to gray, e.g., the binary
number indicative of 128; the head portion corresponds
to black, e.g., the binary number of 0; and the cloth
25 corresponds to white, e.g., the binary number of 255.

Fig. 7 pictorially represents the processing
operations of the image processing apparatus 331.

1 The image processing apparatus 331 first
obtains a difference image $h(x,y)$ expressed by the
following equation with employment of the background
image $g(x,y)$ which was acquired at the time instant
5 when no visitor or passenger is present during the
initiation operation, and also the image information $f(x,y)$ which has been acquired at an arbitrary time
instant after the acquisition of the background image $g(x,y)$:

10
$$h(x,y) = |f(x,y) - g(x,y)| .$$

As a result, the background portion becomes
black and the object becomes gray. Subsequently, this
image is compared with the proper threshold value "B"
and then a binary image $i(x,y)$ indicated by the below-
15 mentioned formulae is obtained. As a consequence, the
background portion becomes black and the object becomes
white.

$$h(x,y) \geq B \quad \text{region:}$$

$$i(x,y) = 255 \quad \dots \text{white.}$$

20
$$h(x,y) < B \quad \text{region:}$$

$$i(x,y) = 0 \quad \dots \text{black,}$$

where symbol "x" indicates 0 to 255 and symbol "y"
denotes 0 to 239.

25 An area (pixel number) " S_k " occupied by the
object is obtained from the above-described binary image
based upon the white pixel number, and this calculated
area is divided by a pixel number "S" per one passenger.

1 so as to calculate the number of passengers "Nm" based
upon the following equation:

$$Nm = \frac{\sum_{k=1}^n S_k}{S}$$

Assuming now that, for instance, the area for
the waiting visitor 361 is S_1 , that for the visitor 362
5 is S_2 and that for the visitor 363 is S_3 as shown in
Fig. 7, "n" in the above-described formula becomes 3.

The numbers of waiting visitors in the cars
281 to 284 are obtained in the similar method.

The above-explained process operations of the
10 image supervising apparatus 23 are expressed by a
flowchart shown in Fig. 8.

That is, the information about both the
waiting visitors and the passengers is acquired from the
respective image processing apparatuses 331 to 3312 at a
15 step 400, and then is arranged and stored in a trans-
mission memory (not shown) of the transfer processing
unit 237 shown in Fig. 4. At a step 401, a judgement is
made whether or not strange information is present by
comparing the above-described information with the
20 present elevator operating conditions. As a result, if
the strange information exists, a message that the
information derived from the relevant image processing
apparatus is strange is first set to the transmission
memory of the transfer processing unit 237 at a step

1 402. Subsequently, the image information is taken out
from the corresponding image processing apparatus at a
step 403, and this image information is processed more
in detail at a step 404 so as to correctly obtain either
5 the waiting visitors, or the number of passengers.

At a step 405, a comparison is made between
the information of the corresponding image processing
apparatus acquired at the step 400 and the teacher
information obtained at the previous step 404. In the
10 case when the comparison result becomes incoincident,
the results obtained at the step 404 are stored into the
transmission memories (not shown) of the relevant
transfer processing units 237, and 231 to 235. As a
consequence, the correct information may be transferred
15 to the group supervising control apparatus 20 and the
parameters of the relevant image processing apparatuses
such as threshold values may be corrected.

Referring now to Fig. 9, one example of a
process for correcting threshold values employed in the
20 image processing algorithm for the image processing
apparatus 331 will be explained.

In general, the image processing unit 3312
converts the image information inputted from the
photographing apparatus 341 into the digital amount at
25 the image input unit 3311, and stores the digital amount
into the image information storage means 41. Based upon
this image information " $f(x,y)$ " and the background image
information " $g(x,y)$ " which has been previously stored in

1 the background image storage means 42, a calculation
means 43 obtains the difference image " $h(x,y)$ ". The
comparing means 44 compares this calculation result with
a proper binary-coding level "B" to obtain a binary-
5 coded image $i(x,y)$. Based on this binary-coded image
 $i(x,y)$, the area S_k occupied by the object is obtained
by a calculating means 45. The calculated area " S_k " is
divided by an area "S" per one visitor in a calculating
means 46, so that the number of waiting visitors " N_m " is
10 obtained. As a consequence, as adjusting elements
(parameters) in this preferred embodiment, there are
conceived both the binary-coding level "B" and the
area "B" per one visitor.

Then, when the image supervising apparatus 23
15 judges that the calculated visitor's number is
incorrect, and thus transmits the teacher information
" N_s ", the image processing unit 3312 performs learning
by utilizing idle time for detecting the number of
visitors. That is, a deviation detecting means 471
20 employed in a correcting-amount calculating means 47
obtains deviation between the number of waiting visitors
" N_m " and the teacher information " N_s ". In a connecting-
amount calculating means 472, a correcting amount is
calculated in such a manner that if the above-described
25 deviation " Δn " is positive (or negative), the above-
described binary-coding level "B" is set to be higher
(or lower), otherwise the area "S" per one visitor is

- 1 set to be larger (or smaller). The deviation Δn is
C expressed by the following equation (1):

$$\Delta n = N_m - N_s \quad \dots (1).$$

- Based on this deviation Δn , either an adjusting value
"AB" or "AS" obtained in the calculating means 472 is
5 subtracted from an initial value "B₀" or "S₀" set in the
corresponding setting means 54 or 55, or added thereto.
The resultant value is stored in the respective storage
means 48 or 49 and held therein until the subsequent
teacher information "N_s" is inputted. The above-
10 described method for correcting two threshold values "B"
and "S" based on the deviation Δn , has such a difficulty
that distribution of two different correcting amounts
becomes complex. Therefore, another method capable of
simply correcting the two threshold values will now be
15 explained.

- First of all, the area "S" per one visitor is
fixed and then the binary-coding level "B" is adjusted.
That is to say, a value "S_{k0}" required for making the
number of waiting passenger "N_m" coincident with the
20 teacher information "N_s" is obtained by way of the
following equation (2) in the correcting-amount
calculating means 472:

$$S_{k0} = N_s \cdot S_0 \quad \dots (2)$$

1 Thus, the binary coding process is repeated until an
area " S_k " of white which has been binary-coded,
approximates to the value " S_{k0} " while changing the
adjusting value ΔB . In other words, according to the
5 calculating means 472, the area " S " per one passenger
which is required to make the number of waiting
passenger " N_m " coincident with the teacher information
" N_s ", is obtained from the following equation (3), and
further the adjusting value ΔS is calculated by the
10 following equation (4):

$$S = S_k / N_s \quad \dots(3),$$

$$S = S - S_0 \quad \dots(4).$$

Although the binary-coding level " B " was first
adjusted in the above-described preferred embodiment,
the area per one passenger may be adjusted prior to the
level adjustment. Alternatively, only one of these
15 binary-coding level and area per one passenger may be
adjusted.

Since both the binary-coding level and the
area per one visitor may be adjusted to be optimum
values in accordance with this preferred embodiment, the
20 output of this elevator managing system may be improved
in that this output approximates to the teacher
information " N_s ".

1 Referring now to Fig. 10, a procedure for
correcting threshold values according to another
preferred embodiment will be explained.

There are some possibilities in the above-
5 described preferred embodiment shown in Fig. 9 that the
corrections are not optimized, because the threshold
values are corrected at only one time instant when the
strange data happens to occur, and also no care is taken
for distributing a plurality of correcting amounts.

10 In another preferred embodiment, a means 473
for storing both the number of waiting passenger "Nm"
and the corresponding teacher information "Ns" is
additionally employed in addition to the various circuit
means of the previous preferred embodiment, so that
15 after input/output characteristics of the image
processing apparatus 331 have been grasped, corrections
of threshold values are performed. As a result, such
threshold value corrections may be optimized.

The storage means 473 temporarily stores
20 therein both the waiting passenger information "Nm"
outputted from the image processing unit 3312 and the
teacher information "Ns" inputted when a judgement is
made that this waiting passenger information "Nm" is
strange.

25 Subsequently, the correcting-amount calculat-
ing means 472 learns what difference the above-described
waiting passenger information has with respect to the
answer (teacher information). As a result, the input/

1 output characteristic of the image processing unit 3312,
namely the unit per se may be grasped.

Fig. 11 is a characteristic representation for
the thus obtained input/output characteristics.

5 Assuming now that for instance, a field angle of the
photographing means is selected to be 120° and also a
setting position thereof is selected to be 3 meters from
the floor plane, approximately 25 passengers (including
head portions) may be detected by the photographing
10 means at maximum.

Accordingly, as shown in a solid line 50 of
Fig. 11, the waiting passenger information is preferably
extended in a linear fashion up to 0 to 25 passengers
under an ideal state.

15 However, even when the coefficients and the
like have been actually optimized, if the number of
waiting passengers is increased, an error may occur as
represented in a dot and dash line 51 because an image
overlapping phenomenon will occur.

20 In case that a sharp difference image may be
readily obtained due to various conditions of background
or lighting, as represented by a dot line 52, an output
higher than the output denoted by the above-described
dot and dash line 51 is produced, whereas an output
25 lower than that denoted by the dot and dash line 51 is
produced when a obscure difference image is obtained.

Therefore, after the input/output character-
istics of the image processing apparatus at the actual

- 1 setting place have been learned by the teacher informa-
tion "Ns", a point of inflection is obtained from the
input/output characteristics, namely the number of
waiting passengers is calculated when the overlap
5 phenomenon occurs.

The correction is carried out based upon the
teacher information "Ns" which is entered after the
above-described process operation has been accomplished.
In other words, when the teacher information "Ns"
10 corresponds to the number of waiting passenger below
than the point of inflection, the correction is executed
in the similar method to that of the previous embodi-
ment, whereby both an optimum binary-coding level "B"
and an area S_1 per one passenger are obtained. As a
15 result, an input/output characteristic after the
corrections have been executed approximates to the curve
indicated by the dot and dash line 51.

Next, when the teacher information "Ns"
corresponds to the number of waiting passenger higher
20 than the point of inflection, an optimum area S_2 per one
passenger is obtained. As a consequence, an input/
output characteristic approximates to the solid line 50.

After the above-described process has been
completed, both a single binary-coding level "B" and two
25 sets of areas S_1 and S_2 per one passenger are obtained.
Thus, the process is first carried out with employment
of the binary coding level "B" and the area S_1 per one
passenger, and thereafter if this result corresponds to

1 the number of waiting passengers higher than the point
of inflection, the area per one passenger is substituted
by "S₂", whereby the process is again performed.

In accordance with this preferred embodiment,
5 since the optimum corrections may be achieved by
performing less process operation, there is no case that
the detecting results become unstable (i.e., the correc-
tions are repeated).

In Fig. 12, there is shown a further
10 correcting method according to the present invention.

This preferred embodiment corresponds to the
previous preferred embodiments shown in Figs. 9 and 10
in which a correcting amount calculating unit 47 is
constructed by a storage means 473 only. This storage
15 means 473 comprises an external detachable storage
medium, for instance, an IC card 474.

With this arrangement, for instance, a person
refers to a content of a nonvolatile memory (IC card)
474 and performs the corrections at other place in
20 accordance with the processing method as represented in
Fig. 10. The result of this correction is stored in
another storage region of the nonvolatile memory and the
nonvolatile memory is again mounted on the apparatus.

As a result, the corrected contents correspond
25 to ΔB and ΔS as shown in Fig. 12.

According to this preferred embodiment, since
the cumbersome corrections are performed by a person,
the more accurate corrections may be achieved and the

1 overall arrangement of the apparatus may be furthermore
simplified.

Referring now to Figs. 13 to 14, teacher
information generating means according to another
5 preferred embodiment of the present invention will be
described. In this preferred embodiment, both
algorithms and parameters for the image processing
apparatuses 331 to 3312 are corrected with employment of
outputs from weight detectors 351 to 354 provided within
10 cars of elevators.

A differential transform type weight detector
for detecting weight of passengers is mounted under a
floor of a car or cab of an elevator. An elevator
control apparatus performs various controls by utilizing
15 outputs from this weight detector. For instance, it is
normally understood that precision on a passenger
converting output for this weight detector is ± 0.1
passenger, and therefore may be sufficiently utilized as
the teacher information generating means according to
20 the present invention.

To adjust the image processing apparatuses 331
to 338 mounted in a hall by the outputs derived from the
weight detectors 351 to 354 of the cars, it should be
checked how many persons are present in this hall,
25 namely how many passengers have ridden the cars.

As represented in Fig. 5, it is now assumed
that, for instance, two passengers ride the car, three
visitors are waiting for the elevator at the n-th hall,

- 1 one passenger takes off the car at the n-th hall and
also three visitors ride the car. The output from the
weight detector 351 provided with the car 281 varies, as
represented in Fig. 13, a state "a" of two passengers; a
5 state "b" under which one passenger takes off (or a
state "c" under which three passengers ride); a state
"d" under which three passengers ride (or a state "e"
under which one passenger takes off the car 281); and a
state "f" under which 4 passengers ride in this order.
- 10 When a period "d" (or "c") indicative of a positive
gradient is extracted from the graph shown in Fig. 13, a
total number of visitors who have ridden the car, namely
a total number of visitors which are waiting for the
arrival of this car 281 may be grasped. As previously
15 described, if an attention is given to a time period "T"
defined by one time when the elevator has arrived at the
n-th hall and also the other time when the elevator
departs therefrom, the total number of visitors who had
waited for the elevator at the n-th hall before the
20 arrival of the elevator may be surely detected by
detecting the weight within the car. It should be noted
that since this weight detection timing is rather delay,
the detected weight cannot be directly utilized for the
group supervising control of the elevator, but may be
25 usefully utilized as the teacher information generating
means.

A process flowchart, shown in Fig. 14, of the
group supervising control apparatus 20 for causing the

1 calculated number of riding passengers to be used as the
teacher information will now be described.

From a time instant where confirmation is made
whether or not the elevator has arrived at the n-th hall
5 at a step 600, a detection is commenced to check the
number of visitors who ride the elevator at a step 601.
Then, this number detecting process is continued until a
next step 602 where confirmation is established that the
door of the elevator is closed. Subsequently, when it
10 is confirmed that the door of the elevator is confirmed
at the step 602, a comparison is then made between the
total number of visitors who have ridden therein,
calculated at the previous step 603 (see Fig. 13), and
also the detection result of the image processing
15 apparatus 331 mounted in the hall. If this result is
coincident with the calculated visitor's number, this
process is completed, and no teacher information is
outputted. To the contrary, if this result is not
coincident with the visitor's number, a check is made at
20 the step 604 that no visitor remains at the hall by
sensing no call at this hall. Then, the above-described
number of visitors who have ridden the elevator is
outputted as the teacher information to the supervising
apparatus 23.

25 In accordance with this preferred embodiment,
since the weight detectors which have been previously
installed on the cars of the elevators are utilized as
the teacher information output means, there is no need

1 to newly employ the above-described teacher information
output means, and therefore the reliable teacher
information with the acceptable precision may be
acquired.

5 It should be noted that the image processing
apparatuses 3391 to 3394 mounted on the respective cars
can detect the number of passengers present within these
cars under such a condition that the doors of these cars
are closed, and thus the passenger's number may be
10 detected at higher precision since the environment is
always constant. Accordingly, these image processing
apparatuses may be employed as the teacher information
generating means instead of the weight detector.

Referring now to Fig. 15, another method for
15 detecting the number of visitors who are waiting for
elevators at elevator halls, according to a further
preferred embodiment of the present invention, will be
described. This preferred embodiment is realized in
such a way that the image processing unit 3312 is
20 arranged by a neural network.

The number of visitors waiting for the
elevators is detected by inputting a plurality of input
data 61a to 61l derived from the image input unit 3311
into the image processing unit 3312 arranged by the
25 neural network, which will now be described more in
detail.

The neural network is constructed of an input
layer, an intermediate layer and an output layer.

1 Furthermore, the input layer is arranged by 12 neurons
n₁₁ to n₁₁₂; the intermediate layer is constructed of 6
neurons n₂₁ to n₂₆; and the output layer is arranged by
two neurons n₃₁ to n₃₂. The outputs of the respective
5 neurons constituting the input layer are connected to
all of the neurons of the intermediate layer, whereas
the outputs of the respective neurons for the
intermediate layer are connected to all of the neurons
of the output layer. At this time, values obtained by
10 multiplying the outputs from the respective neurons of
the input layer and intermediate layer by weight
(coupling) coefficients k₁₁ to k₈₆ (-∞ to +∞) are
inputted to the respective neurons of both the
intermediate layer and output layer. For instant, a
15 value "U_{n21}" to be inputted to the neuron n₂₁ of the
intermediate layer is calculated based on the following
equations (5):

$$U_{n21} = \sum_{i=1}^{12} V_{n1i} K_{1i} \quad \dots (5)$$

where symbol V_{n1i} indicates the outputs (0 to 1) of the
neurons n₁₁ to n₁₁₂ for the input layer.

20 Then, this value U_{n21} is substituted for the
following equation (6), and thus the resultant values of
"0" to "1" are inputted to the respective neurons n₃₁ to
n₃₂ for the output layer as an output V_{n21} of this neuron
n₂₁. In the output layer, output values of the neurons

1 n_{31} and n_{32} are obtained in the similar manner to that of the above-described neuron n_{21} .

$$V_{n21} = \frac{1}{1 + e^{-U_{n12}}} \quad \dots (6)$$

Based on these outputs V_{n31} and V_{n32} , the number of waiting passengers "Nm" is calculated in accordance with the below-mentioned equation (7) and then is outputted:

$$Nm = 100 \cdot V_{n31} + 10 \cdot V_{n32} \quad \dots (7)$$

As a result, in the case when, for example, $V_{n31} = 0.1$ and $V_{n32} = 0.2$, the number of waiting passengers Nm is given by:

10 $Nm = 10 + 2 = 12$ (passengers).

That is to say, the neuron n_{31} denotes 10th order whereas the neuron n_{32} indicates 1st order in this preferred embodiment.

The resultant value is transferred by the transfer processing unit 3313 to the image supervising apparatus 23 and also the teacher information generating means 15 employed therein (image processing unit 236 shown in Fig. 4). Also, this value is transferred via the image supervising apparatus 23 to the group managing control apparatus 20.

As the input data 61a to 61l entered into the image processing unit 3312, various sorts of featured

1 amounts extracted from the image may be employed, or the
data related to the pixels of the image may be directly
employed. As represented in Fig. 16, for instance, a
screen 37 may be subdivided into 12 blocks 701 to 712,
5 and an area of an object obtained in each block may be
normalized based on the following equation (8) so as to
obtain the normalized value which will be utilized:

$$V_a = \frac{S_1}{N \cdot M / 12} \quad \dots (8)$$

where, V_a : value of input data 61a,

10 N : total number of pixel in the horizontal
direction (256),

M : total number of pixel in the vertical
direction (240), and

S_1 : area of object within block 701 (pixel
quantity).

15 In this preferred embodiment, when the
adjustments for weight (coupling) coefficients K_{11} to
 K_{86} are performed by the teacher information, the method
for learning the generally known neural network may be
employed. In other words, the back propagation method
20 is utilized in which the teacher information is inputted
to the neurons n_{31} to n_{32} of the output layer in the
reverse direction and the inputted teacher information
is propagated from the intermediate layer to the input

1 layer so as to adjust each of these coefficients. Since this back propagation method is known from the above-described publication 3 and the like, no further explanation thereof is made in the specification.

5 The teacher information generating means 15 employed in the image supervising apparatus 23 is periodically triggered by a timer 56, so that periodic learning effected by the timer interruption is performed.

10 According to this preferred embodiment, since the image processing unit is arranged by the neural networks, the number of waiting passengers may be detected at high speeds and furthermore, the proper weight coefficients may be automatically obtained by way
15 of the back propagation method. In particular, if the learning is periodically executed based on the teacher information, the pattern recognition effects may be expected and also such an image processing apparatus capable of following variations in the surrounding
20 environment may be realized.

Now, one example of a method for producing the above-described background image $g(x,y)$ will be explained with reference to Figs. 17 and 18.

25 In Fig. 17, the above-described image processing unit 3312 is arranged by memories 41, 42, 81 and 82, and a background image forming means 80 and furthermore a means 83 for detecting the number of

1 waiting visitors. The background image $g(x,y)$ is
produced by the background image forming means 80.

The forming process of the background image by
the background image forming means 80 will now be
5 explained with reference to a flowchart shown in Fig.
18.

In accordance with the present invention, the
background image forming means 80 produces the
background image based upon the process results of 5
10 continuous screens. As a consequence, the background
image forming means 80 is equipped with flag tables
BGT+0 to +4 corresponding to the five continuous
screens.

(1). After a background image production is
15 commenced, the background image forming means 80 sets an
initial value "FF" to these flag tables BGT+0 to +4
which correspond to the respective five screens (a step
500).

(2). Next, the first screen is fetched to be stored
20 into the memory 42 used for storing background images,
and also this image is stored into the work memory 81 as
a provisional background image (a step 501).

(3). Subsequently, the subsequent image is fetched
so as to be stored in the memory 41 for storing original
25 images as an original image, and then a difference
between the provisional background image and the
original image is obtained in the similar manner to that
of the above-described detection for the number of

1 waiting passengers, whereby the binary coding operation
is performed (steps 502 to 504).

(4). Based on the result obtained at the step 504,
an area "SO" of white is calculated, and also a

5 judgement is made whether or not the calculated area
"SO" is greater than a predetermined threshold value
"SH" (steps 505 and 506).

(5). If the judgement result at the step 506 is
true, it is understood that there is a difference

10 between the first image and the succeeding image larger
than a predetermined value. Then, "1" is set to the
above-described flag table "BGT+n", i.e., the flag table
BGT+0 in this case, and also the original image which
has been stored in the memory 41 is transferred to the
15 work memory 82 as a provisional image (steps 507 and
508).

(6). On the other hand, if the judgement result at
the previous step 506 becomes false, then it is
understood that there is substantially no difference

20 between the first image and the subsequent image, and
"0" is set to the flag table BGT+n, i.e., the flag table
BGT+0 in this case (step 509).

(7). Thereafter, the process operations as defined
from the step 502 to the step 509 are repeatedly

25 performed until it is judged $n=5$, namely the process
operations for 5 screens have been accomplished (step
510).

1 (8). Next, a summation S_1 of the flag tables BGT+0 to +4 is calculated, and a check is made whether or not this summation S_1 is equal to 0, namely $S_1 \neq 0$ (steps 511 and 512).

5 (9). In the case when the judgement result at the step 512 is false, namely $S_1=0$, since the 5 continuous screens are substantially identical to each other, the present provisional background image is understood as the real background image and this process operation is
10 ended. In this case, since there is no change in the images, as indicated by a dot line in Fig. 18, the process operation may be accomplished without executing modification of the real background image (step 515).

(10). If the judgement result at the step 512 is
15 true, namely $S_1 \neq 0$, a judgement is made whether or not $S_1=1$. If the judgement result is true, i.e., $S_1=1$, then a further check is made whether or not the flag table BGT+0=1. If this judgement result is also true, it implies that the screen having any changes corresponds
20 to only the original image which has been first processed, and also the remaining 4 images are stable. Accordingly, the provisional background image stored in the work memory 82 is transferred to the memory 42 for storing the background images as the real background
25 image, so that the process for forming background images is completed (steps 513 to 515).

(11). If the judgement result at the step 513 is false, namely it is conceivable that the screen is not

1 stable and a visitor is present, the process is returned
to the step 500 in such a case that the judgement result
at the step 514 is false, i.e., it may be supposed that
variations of images happen to occur in the five screens
5 and further other changes happen to occur in screens
after a sixth screen. Thus, the above-described process
operation is repeated.

In accordance with the above-described
background image forming method, such a judgement is
10 made that since no change is present in the 5 images
successively fetched, therefore there is no person
moving within the fetched images, namely no passenger
waits for the elevator. The image fetched at this stage
may be utilized as the background image. The number of
15 compared images is not equal to 5, but may be selected
to be other numbers.

Also, the image processing apparatus 331 can
surely produce the background image $g(x,y)$ under such a
condition that no passenger waits for the elevator by
20 executing the above-described background image forming
process based on the elevator information. In this
case, this image processing unit 3312 may be arranged as
shown in Fig. 19. This image processing unit 3312 may
be arranged based on the arrangement as described in the
25 previous embodiment in Fig. 17 by additionally employing
an information table 85 for storing information which
has been transferred from the image supervising
apparatus 23, and also a judging means 84 for judging

1 the background image produce timing based on this
information.

Therefore, only different arrangements from
those shown in Fig. 17 will now be made.

5 The image processing apparatus 331 shown in
Fig. 19 periodically receives from the image supervising
apparatus 23, the elevator information such as car
positioning information. The above-described informa-
tion is stored in the information table 85. The judging
10 means 84 judges the timing of no passenger who is
waiting for the elevator at the hall based on the memory
contents of the table 85. If no passenger waits for the
elevator, then the judging means 84 outputs "1" and
instructs the background image forming means 80 to allow
15 the formation of the background image.

In response to this instruction, the back-
ground image forming means 80 forms the background
image, the forming process of which is similar to that
of Fig. 18.

20 Then, operations of the judging means 84 will
now be described with reference to a flowchart shown in
Fig. 20. In Fig. 20, there are also shown the contents
of the information table 85 which stores therein the
information transferred from the image supervising
25 apparatus. In this information table 85, car position
information is stored at an address of TABLE+0; door
open/close information is stored at an address of +1;

1 and information about UP/DOWN callings is stored at
addresses of +2 and +3.

(1). With reference to the contents of the information table 85, the judging means 84 first judges whether
5 or not the car stops at the floor where a camera 341 has been installed (a step 520).

(2). If the judgement result at the step 520 is true, in other words, the car stops at the floor where the camera 341 has been installed, checks are made
10 whether or not the door of this car is closed, and also whether or not the elevator calling is made (steps 521 and 522).

(3). In the case when both of the judgement results at the step 521 and 522 are true, it may be judged that
15 "all of waiting passengers at the hall have been ridden on the elevator and thus no waiting passenger is present at the hall". After a predetermined time period has passed, "1" is set to a background image forming flag "F" shown in Fig. 20 (steps 523 and 524).

20 (4). On the other hand, in the case when the judgement result of either the step 521 or 522 is false, it may be judged that "all of the passengers waiting for the elevator at the hall are riding on the elevator, or could not ride thereon". Accordingly, since a judgement
25 is made that there are passengers at the hall, "0" is set to the above-described background image forming flag "F". This background image forming flag "F" becomes an output of the judging means 84 (step 525).

1 (5). If the judgement result of the above-described
step 520 is false, namely the car does not stop at the
floor where the camera 341 is mounted, further judge-
ments are made whether or not the position of the car is
5 separated from more than 2 floors, and also whether or
not the calling is made at the floor (steps 526 and
527).

(6). When the judgement results at the steps 526
and 527 are true (YES), it may be judged that "no
10 passenger waiting for the elevator is present at the
hall, and this elevator does not come to this floor for
the time being", so that "1" is set to the above-
described background image forming flag F (step 524).

(7). In the case when the judgement result of
15 either the step 526 or 527 is false, it may be judged
that "the elevator is positioned at another floor
separated from this floor by 1 floor, and therefor will
arrive soon at this floor, otherwise no passenger is
present at the hall", and thus "0" is set to the
20 background image forming flag "F" (step 525).

In the process operation of the above-
described judging means 84, a step to judge whether or
not the car is departing from this floor may be
interposed before or after the previous steps 526 and
25 527. With this additional step, it may be judged
whether or not the background image formation is further
precisely instructed.

1 In accordance with the above-described process
operation, the instruction signal (content of background
image forming flag "F") outputted from the judging means
84 is supplied to the background image forming means 80
5 which will perform the background forming process in
case that the above-described output is equal to "1".

 Subsequently, a series of processing operation
by the image processing unit 3312 shown in Fig. 19 will
now be explained with reference to a flowchart shown in
10 Fig. 21.

(1). First, the judgement process as explained in
Fig. 20 is executed, another judgement is made whether
or not $F=1$ with respect to the content of the background
image forming flag "F" which is set by receiving the
15 above-described judgement result. A judgement is made
whether or not there is no passenger in the hall during
the judging process (steps 530 and 531).

(2). At the step 531, if it is judged that $F=1$,
then a judgement is made that no waiting passenger is
20 present at the hall. Accordingly, the background image
forming means 80 performs the background image forming
process as described with reference to Fig. 18, and
stores the background image functioning as a reference
into the memory 41 (step 532).

25 (3). Subsequently, the waiting passenger detecting
means 83 repeatedly executes the image processing
sequence as explained with reference to Fig. 7 (step
533).

1 (4). On the other hand, if $F=0$ at the previous step
531, then the process operation as defined at the step
530 is repeatedly performed so as to detect the timing
at which $F=1$.

5 In accordance with the above-described this
preferred embodiment of the present invention, a
detection is made of the timing at which no waiting
passenger is present, whereby the background image can
be surely formed.

10 Furthermore, the background image may be
updated even when the background is changed due to
variations in the lighting conditions by executing both
the judging process and the background image forming
operation before and after the process to detect the
15 waiting passengers.

According to the above-explained background
image forming method, the image processing apparatus may
produce the background image under such a condition that
no waiting passenger is present at an arbitrary time
20 instant, and thus may correctly detect the number of
waiting passenger by employing this formed background
image.

The present invention may be widely utilized
not only in the above-described system for detecting the
25 passengers who wait for the elevators at the elevator
halls, but also in a system for recognizing characters
written on license plates, or number plates for

1 automobiles, otherwise a system for detecting confusion
conditions of exhibitions and the like.

According to the present invention, since the
teacher information generating means is employed with
5 respect to the image processing results which aim at not
previously set pattern, but the real images to be
processed, either the processing program required for
processing the images, or the parameters (for instance,
various threshold values or weighting coefficients) used
10 for this processing program may be corrected in
accordance with the conditions of the objects to be
image- processed. As a result, for instance, it may be
constructed such that the detecting precision of the
image processing system set under the actual operating
15 condition is improved in a online mode.

CLAIMS

1. An image processing apparatus including:

first image processing means into which image information is inputtable and a first image process is performable based on a predetermined algorithm;

means for generating teacher information, into which image information of the same image object as that of said first image processing means is inputtable, a second image process different from said first image process is performable, and a second image processing result as teach^{er} information is generatable; and

means for correcting either said predetermined algorithm, or a parameter thereof, based upon said teacher information and an output of said first image processing means.

2. An image processing apparatus as claimed in claim 1, wherein said teacher information generating means includes second image processing means for executing an image process with higher difficulties and a higher speed process operation than that of said first image processing means.

3. An image processing apparatus as claimed in claim 1, wherein said teacher information generating means includes second image processing means for producing a processed output with a delay as compared with said first image processing means.

4. An image processing apparatus as claimed in claim



1, wherein said first image processing means and said means for generating teacher information both include means for detecting objects.

5 1, further including:

means for judging a condition related to an image object to be processed; and,

10 means for correcting either said image processing algorithm, or a parameter thereof in response to an output from said judging means.

6. An image processing apparatus as claimed in claim 1, wherein said correcting means includes means for selecting one of a plurality of algorithms, and one of a plurality of parameters thereof, which have been
15 previously prepared.

7. An image processing apparatus as claimed in claim 1, further including:

means for adjusting a parameter of said image processing algorithm to give it a correct value.

20 8. An image processing apparatus as claimed in claim 1, wherein said first image processing means and said means for generating teacher information include means for receiving image information and for performing an image process to recognise the number of objects
25 present.

9. An image processing apparatus as claimed in claim 1, wherein said first image processing means includes a plurality of image processing means for receiving



image information different from each other; and
wherein said means for generating teacher information
includes means commonly provided with said plural
image processing means, for selectively generating as
5 teacher information one of image-processed results by
said plural image processing means.

10. An image processing apparatus as claimed in claim
9, wherein said teacher information generating means
includes means capable of selectively receiving the
10 input of said different image information.

11. An image processing apparatus as claimed in claim
1, wherein said first image processing means includes
a multi-layered neural network; and

wherein said connecting means includes learning
15 means for correcting a weight coefficient of said
neural network based upon said teacher information.

12. An image processing apparatus as claimed in claim
11, further comprising:

means for periodically initiating said learning
20 means.

13. An image processing apparatus as claimed in claim
1 for a group-supervised elevator including:

a plurality of elevator cars for providing
service to a plurality of floors;

25 destination calling means provided within each
elevator car for designating at least one destination
floor;

elevator control means for stopping the elevator



car at the one destination floor designated by the corresponding destination calling means of the car;

hall calling means provided at each floor;

group supervising control means for designating
5 one of the cars to be served in response to the output of the hall calling means;

a plurality of photographing means provided at arbitrary floors, said first image processing means including a plurality of image processing means
10 corresponding with said plurality of photographing means, respectively, for recognising the number of passengers waiting at said arbitrary floors;

means for transferring outputs of said first image processing means to said group supervising
15 control means; and

second image processing means for selectively receiving the image information corresponding to the outputs of the plurality of photographing means, and for recognising the number of passengers waiting at
20 the relevant floors based upon an algorithm or a parameter different from that used by said first image processing means;

wherein said correcting means is arranged to make use of an output of the second image processing means
25 for correcting either the algorithm or the parameter thereof used by the first image processing means.

14. An image processing apparatus as claimed in claim 1, including:



means for comparing the output from said first image processing means and the teacher information; and

means for executing the correction by said
5 correcting means based upon an output from said comparing means.

15. An image processing apparatus as claimed in any one of the preceding claims 1, 3, 5, 7, 8 and 14, wherein said first image processing means includes
10 background image forming means; and said background image forming means successively compares two successive images of image information which are input in a time series, and determines one of the compared images as a background image in case that difference
15 between the compared images are below a certain threshold value extending over a predetermined number of times of continuous comparison.

16. An image processing apparatus as claimed in claim 13, wherein at least one of said first image
20 processing means and second image processing means includes:

judging means for judging whether or not a waiting passenger is present at an elevator hall based on elevator information derived from either the group
25 supervising control means, or the elevator control means; and,

background image forming means for forming a background image in response to an output from said



judging means.

17. An image processing apparatus as claimed in claim 16, wherein said background image forming means fetches a plurality of hall images in a time series, 5 successively compares two successive hall images, and also determines one of the compared hall images as a background image in case that difference between the compared hall images is below a certain threshold value extending over a predetermined number of times 10 of continuous comparison.

18. An image processing apparatus as claimed in claims 16 or 17, wherein the elevator information corresponds to at least one of a state where a door of an elevator is opened/closed at the hall entrance, 15 hall calling information, and also car position information.

19. An image processing apparatus constructed substantially as herein described with reference to and as illustrated in the accompanying drawings.
