

[DESCRIPTION]

[Title of Invention] COMMUNICATION ANALYSIS SYSTEM AND
COMMUNICATION ANALYSIS METHOD

5 [Technical Field]

[0001]

The present invention relates to a communication analysis
system and a communication analysis method.

[Background Art]

10 [0002]

In an organization such as a company, it is important for
employees to communicate closely with each other and work on their
own tasks. For example, Patent Literature (PTL) 1 discloses a
communication evaluation system that determines and analyzes
15 communication among people.

[Citation List]

[Patent Literature]

[0003]

[PTL 1] International Patent Publication No. 2019/155629

20 [Summary of Invention]

[Technical Problem]

[0004]

The present invention provides a communication analysis
system and a communication analysis method that can help improve
25 the quality of communication.

[Solution to Problem]

[0005]

A communication analysis system according to an aspect of
the present invention includes: a voice obtainer that obtains voice
30 information in which conversations among a plurality of people
during a target period are recorded; a video obtainer that obtains
video information in which states of the plurality of people during the
target period are recorded; an identifier; and a visualizer, wherein
the identifier identifies, based on the obtained voice information, at
35 least one of: (a) a ratio of a length of a period of a presentation, a

length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent; (b) a total number of people who participated in the question-and-answer session; (c) a tempo of the question-and-answer session; (d) a total
5 number of question-and-answer sessions; (e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session; (f) the length of the period during which all the plurality of people were silent; or (g) a total number of overlapping periods of speech by the plurality of people, the
10 identifier identifies, based on the video information obtained, at least one of: (h) a length of a period during which a reporter among the plurality of people were watched by others; (i) a total number of times the plurality of people nodded; (j) a total number of times the plurality of people yawned; (k) a total number of times the plurality
15 of people dozed off or a length of a period during which the plurality of people dozed off; (l) a length of a period during which the plurality of people were working; (m) a total number of times the plurality of people smiled; or (n) a length of a period during which the plurality of people were operating personal computers, and the visualizer
20 visualizes at least one of (a) to (g) identified and at least one of (h) to (n) identified.

[0006]

A communication analysis system according to an aspect of the present invention includes: a voice obtainer that obtains voice
25 information in which conversations among a plurality of people during a target period are recorded; a video obtainer that obtains video information in which states of the plurality of people during the target period are recorded; an identifier; and a calculator, wherein the identifier identifies, based on the obtained voice information, at
30 least one of: (a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent; (b) a total number of people who participated in the question-and-answer session; (c) a tempo of the question-and-answer session; (d) a total
35 number of question-and-answer sessions; (e) a ratio of speaking

times of the plurality of people during the period of the question-and-answer session; (f) the length of the period during which all the plurality of people were silent; or (g) a total number of overlapping periods people of speech by the plurality of people, the identifier identifies, based on the video information obtained, at least one of: (h) a length of a period during which a reporter among the plurality of people were watched by others; (i) a total number of times the plurality of people nodded; (j) a total number of times the plurality of people yawned; (k) a total number of times the plurality of people dozed off or a length of a period during which the plurality of people dozed off; (l) a length of a period during which the plurality of people were working; (m) a total number of times the plurality of people smiled; or (n) a length of a period during which the plurality of people were operating personal computers, and the calculator calculates a score indicating a quality of communication among the plurality of people during the target period based on at least one of (a) to (g) identified and at least one of (h) to (n) identified.

[0007]

A communication analysis method according to an aspect of the present invention includes: obtaining voice information in which conversations among a plurality of people during a target period are recorded; obtaining video information in which states of the plurality of people during the target period are recorded; identifying; and visualizing, wherein the identifying includes identifying, based on the voice information obtained, at least one of: (a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent; (b) a total number of people who participated in the question-and-answer session; (c) a tempo of the question-and-answer session; (d) a total number of question-and-answer sessions; (e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session; (f) the length of the period during which all the plurality of people were silent; or (g) a total number of overlapping periods people of speech by the plurality of people, the identifying includes

identifying, based on the video information obtained, at least one of:
(h) a length of a period during which a reporter among the plurality
of people were watched by others; (i) a total number of times the
plurality of people nodded; (j) a total number of times the plurality of
5 people yawned; (k) a total number of times the plurality of people
dozed off or a length of a period during which the plurality of people
dozed off; (l) a length of a period during which the plurality of people
were working; (m) a total number of times the plurality of people
smiled; or (n) a length of a period during which the plurality of people
10 were operating personal computers, and the visualizing includes
visualizing at least one of (a) to (g) identified and at least one of (h)
to (n) identified.

[0008]

A communication analysis method according to an aspect of
15 the present invention includes: obtaining voice information in which
conversations among a plurality of people during a target period are
recorded; obtaining video information in which states of the plurality
of people during the target period are recorded; identifying; and
calculating, wherein the identifying includes identifying, based on
20 the voice information obtained, at least one of: (a) a ratio of a length
of a period of a presentation, a length of a period of a
question-and-answer session, and a length of a period during which
all the plurality of people were silent; (b) a total number of people
who participated in the question-and-answer session; (c) a tempo of
25 the question-and-answer session; (d) a total number of
question-and-answer sessions; (e) a ratio of speaking times of the
plurality of people during the period of the question-and-answer
session; (f) the length of the period during which all the plurality of
people were silent; or (g) a total number of overlapping periods of
30 speech by the plurality of people, the identifying includes identifying,
based on the video information obtained, at least one of: (h) a length
of a period during which a reporter among the plurality of people
were watched by others; (i) a total number of times the plurality of
people nodded; (j) a total number of times the plurality of people
35 yawned; (k) a total number of times the plurality of people dozed off

or a length of a period during which the plurality of people dozed off;
(l) a length of a period during which the plurality of people were
working; (m) a total number of times the plurality of people smiled;
or (n) a length of a period during which the plurality of people were
operating personal computers, and the calculating includes
calculating a score indicating a quality of communication among the
plurality of people during the target period based on at least one of
(a) to (g) identified and at least one of (h) to (n) identified.

[0009]

A program according to one aspect of the present invention is
a program for causing a computer to execute the communication
analysis method.

[Advantageous Effects of Invention]

[0010]

The communication analysis system and communication
analysis method of the present invention can help improve the
quality of communication.

[Brief Description of Drawings]

[0011]

[FIG. 1]

FIG. 1 is a diagram showing a schematic configuration of a
communication analysis system according to an embodiment.

[FIG. 2]

FIG. 2 is a block diagram showing a functional configuration of
the communication analysis system according to the embodiment.

[FIG. 3]

FIG. 3 is a flow chart of the operation of identifying parameters
related to the quality of communication.

[FIG. 4]

FIG. 4 is a diagram showing an example of the division of the
target period.

[FIG. 5A]

FIG. 5A is a first diagram showing parameters that can be
identified based on voice information among parameters related to
the quality of communication.

[FIG. 5B]

FIG. 5B is a second diagram showing parameters that can be identified based on voice information among the parameters related to the quality of communication.

5 [FIG. 6A]

FIG. 6A is a first diagram showing parameters that can be identified based on video information among parameters related to the quality of communication.

[FIG. 6B]

10 FIG. 6B is a second diagram showing parameters that can be identified based on video information among parameters related to the quality of communication.

[FIG. 7]

15 FIG. 7 is a flowchart of the visualization operation of the quality of communication.

[FIG. 8]

FIG. 8 is a diagram showing an example of a display screen of parameters related to the quality of communication.

[FIG. 9]

20 FIG. 9 is a diagram showing another example of a display screen of parameters related to the quality of communication.

[FIG. 10]

FIG. 10 is a diagram showing an example of a method of calculating a score indicating the quality of communication.

25 [FIG. 11]

FIG. 11 is a diagram showing an example of a display screen of the score indicating the quality of communication.

[FIG. 12]

30 FIG. 12 is a flowchart of Operation example 1 of the environmental control based on the quality of communication.

[FIG. 13]

FIG. 13 is a flowchart of Operation example 2 of the environmental control based on the quality of communication.

[FIG. 14]

35 FIG. 14 is a flowchart of Operation example 3 of the

environmental control based on the quality of communication.

[FIG. 15]

FIG. 15 is a flowchart of Operation example 4 of the environmental control based on the quality of communication.

5 [FIG. 16]

FIG. 16 is a flowchart of Operation example 5 of the environmental control based on the quality of communication.

[FIG. 17]

FIG. 17 is a block diagram showing a functional configuration
10 of a communication analysis system according to a variation.

[Description of Embodiments]

[0012]

Hereinafter, embodiments will be specifically described with
15 reference to the drawings. It should be noted that all of the
embodiments described below show comprehensive or specific
examples. Numerical values, shapes, materials, components,
arrangement positions and connection forms of components, steps,
order of steps, and the like shown in the following embodiments are
20 examples and are not intended to limit the present invention. In
addition, among the components in the following embodiments,
components not described in independent claims will be described as
arbitrary components.

[0013]

25 It should be noted that each figure is a schematic diagram and
is not necessarily strictly illustrated. In addition, in each figure, the
same reference numeral is denoted for substantially the same
structure, and the overlapping description may be omitted or
simplified.

30 [Embodiment]

[0014]

[Configuration]

First, the configuration of the communication analysis system
according to an embodiment will be described. FIG. 1 is a diagram
35 showing a schematic configuration of a communication analysis

system according to an embodiment. FIG. 2 is a block diagram showing a functional configuration of the communication analysis system according to the embodiment.

[0015]

5 As shown in FIG. 1 and FIG. 2, communication analysis system 10 is a system, which is used in an office or the like having space 70 such as a conference room, for analyzing the quality of communication among a plurality of people positioned in space 70. Space 70 is, for example, a closed space, but may be an open space.
10 In addition to a conference room, another example of space 70 is an open rest area in an office space (where chairs and tables are placed in part of the office space). In addition, space 70 does not have to be physically separated, and may be an area of the space separated by illumination light, airflow, or the like. For example, in an office
15 space illuminated with 5000K daylight color temperature light, space 70 may be provided as an area illuminated with 3000K warm color temperature light in a corner of the office space.

[0016]

 Communication analysis system 10 includes voice collecting
20 device 20, a plurality of photographing devices 30, server device 40, information terminal 50, and environmental control equipment 60.

[0017]

 Voice collecting device 20 is provided within space 70. Voice
collecting device 20 is provided, for example, on a desk placed in
25 space 70, but may be provided on a ceiling or a wall. Voice
collecting device 20 obtains voices when a plurality of people
positioned in space 70 are having a conversation and transmits voice
information in which the voices are recorded to server device 40 via
wide area communication network 80 such as the Internet. Voice
30 collecting device 20 is realized by, for example, a microphone array.
It should be noted that the function of voice collecting device 20 to
communicate with server device 40 may be realized by a device
(personal computer, router, and the like) separate from voice
collecting device 20.

35 [0018]

Photographing device 30 is provided within space 70. Photographing device 30 is provided, for example, on a desk placed in space 70, but may be provided on the ceiling or the wall. Photographing device 30 photographs a state of conversations of a plurality of people positioned in space 70, and transmits video information (in other words, moving image information) recording this state through wide area communication network 80 to server device 40. Photographing device 30 is, for example, a WEB camera. The function of photographing device 30 to communicate with server device 40 may be achieved by a device (personal computer, router, and the like) separate from photographing device 30.

[0019]

It should be noted that in the example of FIG. 1, communication analysis system 10 includes three photographing devices 30 for photographing all the plurality of people. When one photographing device 30 photographs a range of 120 degrees in a plan view, three photographing devices 30 can photograph a range of 360 degrees (all directions) in a plan view. However, communication analysis system 10 only needs to include at least one photographing device 30 so as to be able to photograph all the plurality of people.

[0020]

Server device 40 is a cloud server provided outside space 70. Server device 40 specifically includes communicator 41, information processor 42, and storage 43.

[0021]

Communicator 41 is a communication circuit (communication module) for server device 40 to communicate with voice collecting device 20 and photographing device 30 via wide area communication network 80. Specifically, communicator 41 receives voice information from voice collecting device 20 and receives video information from photographing device 30. Communicator 41 is, for example, a wired communication circuit that performs wired communication, but may be a wireless communication circuit that performs wireless communication. A communication standard for

communication performed by communicator 41 is not particularly limited. Communicator 41 specifically includes voice obtainer 44 and video obtainer 45.

[0022]

5 Voice obtainer 44 obtains voice information output by voice collecting device 20. Video obtainer 45 obtains video information output by photographing device 30.

[0023]

10 Information processor 42 performs information processing for analyzing the quality of communication among a plurality of people. Information processor 42 is realized by, for example, a microcomputer, but may be realized by a processor or a dedicated circuit. Information processor 42 specifically includes identifier 46, visualizer 47, calculator 48, and controller 49.

15 [0024]

 Identifier 46 identifies parameters related to the quality of communication based on the voice information obtained by voice obtainer 44 and the video information obtained by video obtainer 45. Visualizer 47 visualizes the parameters identified by identifier 46, and calculator 48 calculates a score indicating the quality of communication based on the parameters identified by identifier 46. Controller 49 controls the environment of space 70 based on the calculated score. Specific processing executed by identifier 46, visualizer 47, calculator 48, and controller 49 will be described later.

25 [0025]

 Storage 43 is a storage device that stores control programs executed by information processor 42, various types of information registered through information terminal 50, and the like. Storage 43 is achieved by, for example, a hard disk drive (HDD), but may be achieved by a semiconductor memory.

[0026]

 Information terminal 50 is an information terminal that is used by a user (who may be either one of the plurality of people described above or a person other than the plurality of people described above) to access server device 40. Information terminal 50 functions as a

user interface in communication analysis system 10 and is used for registering various types of information with server device 40, and the like. Information terminal 50 is, for example, a portable information terminal such as a smart phone or a tablet terminal, but
5 may be a stationary information terminal such as a personal computer.

[0027]

Information terminal 50 includes display 51 that displays parameters related to the quality of communication or a score
10 indicating the quality of communication. Display 51 is achieved by a display panel such as a liquid crystal panel or an organic electro luminescence (EL) panel.

[0028]

Environmental control equipment 60 is equipment that
15 controls the environment of space 70 and is controlled by server device 40. The environment of space 70 includes temperature environment, light environment (brightness), wind direction, odor, voice, and the like. As environmental control equipment 60, an air conditioning device (air conditioner) that controls the temperature of
20 space 70, lighting equipment that controls the brightness of space 70, a blower such as a circulator that controls the airflow of space 70, a scent generator such as an aroma diffuser that controls the odor in space 70, and a music player that controls the voice in space 70 are exemplified.

25 [0029]

[Operations of identifying parameters related to the quality of communication]

Next, the operation of identifying parameters related to the quality of communication performed by communication analysis
30 system 10 will be described. FIG. 3 is a flowchart of the operation of identifying parameters related to the quality of communication.

[0030]

Voice obtainer 44 of server device 40 obtains voice information (to which the ID of voice collecting device 20 and the recording date
35 and time information are assigned) generated by voice collecting

device 20 from voice collecting device 20, and identifier 46 stores the received voice information in storage 43 (S11). This voice information is voice information in which conversations during a target period (for example, the entire period from the beginning to the end of one conference) among a plurality of people (that is, participants of the one conference) are recorded.

[0031]

Similarly, video obtainer 45 obtains video information (to which the ID of photographing device 30 and the recording date and time information are assigned) generated by three photographing devices 30 from each of the three photographing devices 30, and identifier 46 stores the received video information in storage 43 (S12). This video information is voice information in which states among a plurality of people during the target period described above are recorded.

[0032]

Next, identifier 46 identifies participants in the one conference based on the obtained video information (S13). Identifier 46 first reads out the video information from storage 43, performs person extraction processing (for example, face recognition processing) on the video information, identifies the participants, and assigns IDs to the identified participants. In the following description, it is assumed that a total of four participants are identified and IDs A to D are assigned thereto.

[0033]

Next, identifier 46 identifies the positions of the participants (S14). For example, the arrangement of three photographing devices 30 and the arrangement of voice collecting device 20 are registered in advance in storage 43, and identifier 46 identifies in which direction four participants A to D are positioned with respect to voice collecting device 20 based on the registered information.

[0034]

As described above, voice collecting device 20 is achieved by a microphone array, and the voice information includes voice signals of a plurality of channels corresponding to a plurality of microphone

elements included in the microphone array. Identifier 46 can recognize from which direction the voice included in the voice information comes from, based on the voice signals of the plurality of channels. Then, if identifier 46 identifies in which direction participants A to D are positioned with respect to voice collecting device 20 in step S14, it is possible to identify which of participants A to D uttered the voice included in the voice information. In the following description, it is assumed that the voice included in the voice information is distinguished by such a method as to which of participants A to D uttered the voice.

[0035]

Next, identifier 46 divides the entire target period into three periods of a period during which the presentation was given (hereinafter also referred to as the presentation period), a period during which the question-and-answer session was conducted (hereinafter also referred to as the Q&A period), and a period during which all the participants are silent (hereinafter also referred to as the silent period) (S15). That is, identifier 46 divides the target period into a plurality of periods with different conversation types (trends). FIG. 4 is a diagram showing an example of division of the target period.

[0036]

Identifier 46 first identifies a period during which no one speaks for a first predetermined time or more (for example, the voice level is lower than or equal to a predetermined value) as a silent period. Next, identifier 46 identifies a period during which one participant speaks continuously for a second predetermined time or longer as a presentation period. The term "continuously" here means that substantially one participant continues speaking, and the presentation period includes a period during which the speech of one participant is slightly stopped (a period shorter than the first predetermined time).

[0037]

Then, identifier 46 identifies a period other than the silent period and the presentation period as a Q&A period. Similar to the

presentation period, the Q&A period includes a period during which the conversation is slightly stopped (a period shorter than the first predetermined time). If the Q&A period includes a period shorter than the first predetermined time and longer than the third predetermined time during which all the participants are silent (that is, a period during which the conversation is stopped for a slightly longer time), it is distinguished into a plurality of Q&A periods with this period as a boundary. In the example of FIG. 4, the Q&A period (1) is one Q&A period when the conversation is stopped for a period slightly longer after participant C, participant B, participant D, and participant A speak in this order. It should be noted that in FIG. 4, a hatched portion indicates a period during which the conversation is stopped.

[0038]

It should be noted that the first predetermined time, second predetermined time, and third predetermined time, which are thresholds for dividing the above three periods, are appropriately determined empirically or experimentally.

[0039]

Next, identifier 46 identifies parameters related to the quality of communication (S16). FIG. 5A and FIG. 5B are diagrams showing parameters that can be identified based on the voice information obtained in step S11 among the parameters related to the quality of communication. FIG. 6A and FIG. 6B are diagrams showing parameters that can be identified based on the video information obtained in step S12 among the parameters related to the quality of communication. It should be noted that a detailed method of identifying these parameters will be described later. It should be noted that identifier 46 does not need to identify all the parameters shown in FIG. 5A, FIG. 5B, FIG. 6A, and FIG. 6B, and at least one of the parameters shown in FIG. 5A or FIG. 5B as well as at least one of the parameters shown in FIG. 6A or FIG. 6B are only needed to be identified.

[0040]

Next, identifier 46 assigns the conference ID to the identified

parameters and stores them in storage 43 (S17). For example, the user registers the correspondence between (i) the ID of voice collecting device 20 and the IDs of the three photographing devices 30 and (ii) space 70 (a room such as a conference room) (that is, where the ID of voice collecting device 20 and the IDs of the three photographing devices 30 are provided) in advance. As such, based on the ID of voice collecting device 20 assigned to the voice information and the IDs of photographing devices 30 assigned to the video information, identifier 46 identifies which space 70 the identified parameters are targeted for conversation in and the identified parameters can be used as conference IDs. In addition, identifier 46 can include the date and time zone information in the conference ID based on the voice recording date and time information assigned to the voice information and the video recording date and time information assigned to the video information (see FIG. 5A, FIG. 5B, FIG. 6A and FIG. 6B).

[0041]

[Parameters identified based on voice information]

Here, parameters that can be identified based on the voice information obtained in step S11 will be described with reference to FIG. 5A and FIG. 5B.

[0042]

Parameter (a) is the ratio of a length of a period during which the presentation was given (presentation period), a length of a period during which the question-and-answer session was conducted (Q&A period), and a length of a period during which all of participants A to D were substantially silent (silent period). More specifically, identifier 46 identifies the ratio of the total length of the presentation period, the total length of the Q&A period, and the total length of the silent period in the target period as Parameter (a).

[0043]

Parameter (b) is the average number of participants A to D who participated in one question-and-answer session (that is, one Q&A period). Identifier 46 identifies Parameter (b) by averaging the total number of participants in all Q&A periods included in the target

period. In the example of FIG. 4, the total number of participants in the Q&A period (1) is four, the total number of participants in the Q&A period (2) is two, and the average number of participants in these two Q&A periods is three.

5 [0044]

Parameter (c) is the tempo of the question-and-answer (Q&A) session. Identifier 46 can identify, as Parameter (c), the average length of periods during which the conversation is stopped due to speaker changes in all Q&A periods included in the target period. In the example of FIG. 4, the Q&A period (1) includes four periods during which conversation is stopped, and the Q&A period (2) includes four periods during which the conversation is stopped. In this case, the average length of these eight periods during which the conversation is stopped is identified as Parameter (c). It should be noted that Parameter (c) means that the smaller the average value of the period during which the conversation is stopped, the better the tempo of the question-and-answer session.

[0045]

Parameter (d) is the total number of periods during which the question-and-answer session was conducted (Q&A periods). Identifier 46 identifies the total number of Q&A periods included in the target period as Parameter (d).

[0046]

Parameter (e) is the ratio of the speaking time of participants A to D in a period during which the question-and-answer session was conducted (Q&A period). In all the Q&A periods included in the target period, identifier 46 identifies the total length of the periods during which participant A was speaking, the total length of the periods during which participant B was speaking, the total length of the periods during which participant C was speaking, and the total length of the periods during which participant D was speaking, respectively. Identifier 46 then identifies the ratio of these four totals as Parameter (e).

[0047]

Parameter (f) is the total time during which all of participants

A to D were substantially silent during the target period, that is, the total length of silent periods during the target period.

[0048]

Parameter (g) is the total number of overlapping periods during which participants A to D were speaking during the target period. For example, when participant B speaks while participant A speaks and the voices of participant A and participant B overlap, the number of times corresponding to Parameter (g) is counted up. When the number of overlapping is large, it can be said that the communication is active.

[0049]

[Parameters identified based on video information]

Next, parameters that can be identified based on the video information obtained in step S12 will be described with reference to FIG. 6A and FIG. 6B which are described above.

[0050]

Parameter (h) is a length of a period during which the reporter is watched by participants other than the reporter. The reporter here means, for example, one of participants A to D who is giving a presentation during the presentation period. When participant A is giving a presentation, identifier 46 makes up the length of the period during which each of participant B to participant D is watching participant A as Parameter (h). Specifically, identifier 46 identifies whether other participants are watching the reporter by performing line-of-sight detection processing of other participants based on the video information.

[0051]

It should be noted that in the case where report materials related to the presentation of the reporter are displayed on the display provided in space 70, Parameter (h) may be the total of the length of the period during which other participants other than the reporter are watching the reporter and the length of the period during which other participants are watching the reporting material (display).

[0052]

Parameter (i) is the number of times participants A to D nodded during the target period. Identifier 46 identifies whether participants A to D nod, for example, using a machine learning model whose input information is video information (more specifically, video feature values of participants A to D obtained from video information). Identifier 46 counts the number of times each of participants A to D nods, and identifies it as Parameter (i).

[0053]

Parameter (j) is the number of times participants A to D yawned during the target period. Identifier 46 identifies whether each of participants A to D yawned, for example, using a machine learning model whose input information is video information (more specifically, the video feature values of participants A to D obtained from the video information). Identifier 46 makes up the number of times each of participants A to D yawned and identifies it as Parameter (j).

[0054]

Parameter (k) is the length of the period during which participants A to D dozed off during the target period. Identifier 46 identifies whether each of participants A to D dozed off, for example, using a machine learning model whose input information is video information (more specifically, the video feature values of participants A to D obtained from the video information). Identifier 46 makes up the length of the period during which each of participants A to D dozed off, and identifies it as Parameter (k). It should be noted that identifier 46 may identify the number of times each of participants A to D dozed off as Parameter (k).

[0055]

Parameter (l) is the length of the period during which participants A to D are working without participating in the conversation during the target period. The work here specifically means touching a mobile terminal or typing on the keyboard of a laptop computer, and means a work that is presumed to be irrelevant to the conversation during the target period. Identifier 46 identifies whether each of participants A to D is working, for example, using a

machine learning model whose input information is video information (more specifically, the video feature values of participants A to D obtained from the video information). Identifier 46 makes up the length of the period during which each of participants A to D worked and identifies it as Parameter (l).

[0056]

Parameter (m) is the number of times participants A to D smiled during the target period. Identifier 46 identifies whether each of participants A to D smiled, for example, using a machine learning model whose input information is video information (more specifically, the video feature values of participants A to D obtained from the video information). Identifier 46 makes up the number of times each of participants A to D smiled, and identifies it as Parameter (m). It is considered that the greater the number of smiles, the better the atmosphere in which it is easy to speak.

[0057]

Parameter (n) is the length of the period during which participants A to D are operating their own personal computers (PCs) during the target period. Identifier 46 identifies whether each of participants A to D is operating, for example, using a machine learning model whose input information is video information (more specifically, the video feature values of participants A to D obtained from the video information). Identifier 46 makes up the length of the period during which each of participants A to D was operating the PC, and identifies it as Parameter (n). It is considered that the longer the period of operating the PC, the less motivated participants A to D, and the worse the quality of communication.

[0058]

[Visualization operation]

Next, the quality of communication visualization operation executed by communication analysis system 10 will be described. FIG. 7 is a flow chart of the quality of communication visualization operation.

[0059]

When a user (who may be either one of participants A to D or

a person other than participants A to D) performs an operation to instruct information terminal 50 to visualize the quality of communication, information terminal 50 transmits a display request to server device 40. Communicator 41 of server device 40 obtains
5 the display request from information terminal 50 (S21). The operation described above includes identifying a conference ID (the location and time of the conference room), and the display request includes the conference ID identified by this identifying operation.

[0060]

10 Visualizer 47 causes communicator 41 to transmit display information for displaying parameters associated with the conference ID included in the display request obtained by communicator 41 among the parameters related to the quality of communication stored in storage 43 to information terminal 50 (S22).
15 As a result, a display screen as shown in FIG. 8 or FIG. 9 is displayed on display 51 of information terminal 50.

[0061]

FIG. 8 is a diagram showing an example of a display screen of a parameter related to the quality of communication, and this display
20 screen shows the speaking times of participants A to D (the parameter obtained by converting Parameter (e) described above into absolute values) in a bar graph. FIG. 9 is a diagram showing another example of a display screen of a parameter related to the quality of communication. This display screen shows the ratio of the
25 above three periods (Parameter (a) described above) in a pie chart.

[0062]

It should be noted that although not shown, other parameters may be displayed on display 51. The user can select, for example, which parameter to display by operating information terminal 50.

30 [0063]

In this way, visualizer 47 can visualize at least one of the parameters related to the quality of communication identified by identifier 46. Visualizing the parameters related to the quality of communication in this way allows the user to easily recognize the
35 quality of communication (the state of the conference).

[0064]

[Score calculation operation]

Next, the operation of calculating a score indicating the quality of communication, which is executed by communication analysis system 10, will be described. FIG. 10 is a diagram showing an example of a method of calculating a score indicating the quality of communication.

[0065]

As shown in the example of FIG. 10, calculator 48 determines whether each of the grading items P1 to P8 corresponds to good (+5 points), standard (0 points), or poor (-5 points). Then, calculator 48 calculates a score indicating the calculation formula: $\text{Score} = 50 + w1 \times S(P1) + w2 \times S(P2) + \dots + w8 \times S(P8)$ ($w1$ to $w8$ are weighting factors), where $S(Pn)$ is the individual scores (points) for grading item Pn . It can be said that the higher the score, the better the quality of communication (the more active the communication).

[0066]

Hereinafter, the grading items in Fig. 10 will be described. Grading item P1 relates to the ratio of the length of the Q&A period identified as Parameter (a). Calculator 48 increases the individual score for grading item P1 as the ratio of the length of the Q&A period is larger.

[0067]

Grading item P2 relates to the ratio of the length of the silent period identified as Parameter (a). Calculator 48 increases the individual score for grading item P2 as the ratio of the length of the silent period to the target period is smaller.

[0068]

Grading item P3 relates to the ratio of the speaking times of participants A to D during the Q&A period identified as Parameter (e), specifically to the minimum value / maximum value of this ratio. Calculator 48 increases the individual score for grading item P3 as the minimum value / maximum value is closer to 1 (that is, participants A to D speak more evenly).

[0069]

Grading item P4 relates to the average number of participants A to D who participated in one Q&A period, identified as Parameter (b). Calculator 48 increases the individual score for grading item P4 as the average number of participants A to D participating in one Q&A period is larger.

[0070]

Grading item P5 relates to the total number of Q&A periods identified as Parameter (d). Calculator 48 increases the individual score for grading item P5 as the total number of Q&A periods is larger.

[0071]

Grading item P6 relates to the length of the period during which participants other than the reporter are watching the reporter, which is identified as Parameter (h), and is specifically the average of the percentage of the period during which the reporter is watched by other participants other than the reporter during the presentation period. For example, it is assumed that during a period when participant A is giving a presentation, participant B watches participant A for 80% of this period, participant C watches participant A for 60% of this period, and participant C watches participant A for 70% of this period. In this case, the percentage average of the periods during which the reporter is watched by participants other than the reporter during the presentation period is $(80 + 60 + 70) / 3 = 60\%$. Calculator 48 increases the individual score for grading item P6 as the percentage average is larger.

[0072]

Grading item P7 relates to the average number of yawns of participants A to D, identified as Parameter (j). Calculator 48 increases the individual score for grading item P7 as the average number of yawns of participants A to D is smaller.

[0073]

Grading item P8 relates to the length of the period during which participants A to D dozed off, identified as Parameter (k), and specifically relates to the number of people who dozed off. Calculator 48 increases the individual score for grading item P8 as

the number of people who dozed off is smaller.

[0074]

As described above, calculator 48 increases the score as the communication is more active. The score calculated in this way is visualized by visualizer 47, for example, in the same way as Parameter (a) to Parameter (n). FIG. 11 is a diagram showing an example of the display screen for the score indicating the quality of communication. If the score indicating the quality of communication is visualized in this way, the user can recognize the quality (activity) of communication.

[0075]

It should be noted that the score calculation method shown in FIG. 10 is an example, and calculator 48 is only needed to calculate the quality of communication among participants A to D during the target period based on at least one of Parameters (a) to (n).

[0076]

[Operation example 1 of the environmental control]

In addition, the score calculated by calculator 48 may be used for the environmental control of space 70. FIG. 12 is a flowchart of Operation example 1 of the environmental control.

[0077]

The processing of step S31 to step S36 is the same as the processing of step S11 to step S16. However, although the processing of step S11 to step S16 are performed after the conference ends, the processing of step S31 to step S36 are performed every several minutes to several tens of minutes during the conference. That is, the processing of step S31 to step S36 has real-time properties.

[0078]

Following step S36, calculator 48 calculates a score indicating the quality of communication based on the identified parameters (S37). Controller 49 determines whether the calculated score is greater than or equal to a predetermined value (S38). When controller 49 determines that the calculated score is greater than or equal to the predetermined value (that is, the communication is

active) (Yes in S38), controller 49 does not control the environment of space 70. On the other hand, when controller 49 determines that the calculated score is smaller than the predetermined value (that is, the communication is not active) (No in S38), controller 49 controls the environment of space 70 (S39). Specifically, controller 49 controls the environment of space 70 by causing communicator 41 to transmit a control signal to environmental control equipment 60.

[0079]

Controller 49 seeks to activate communication in space 70 by, for example, increasing the set temperature of an air conditioner that controls the temperature of space 70, or by making the lighting equipment provided in space 70 brighter than at present. In addition, controller 49 may seek to activate communication in space 70 by activating the scent generator provided in space 70 or by causing the music playback device provided in space 70 to reproduce a song.

[0080]

In this way, controller 49 can seek to activate communication in space 70 by controlling the environment of space 70 where participants A to D are positioned based on the calculated score.

[0081]

[Operation example 2 of the environmental control]

In addition, calculator 48 may perform environmental control of space 70 based on the parameters identified by identifier 46. FIG. 13 is a flow chart of Operation example 2 of environmental control.

[0082]

The processing of step S41 to step S45 is the same as the processing of step S31 to step S35.

[0083]

Following step S45, identifier 46 identifies the ratio of the speaking times of participants A to D during the Q&A period (S46). In other words, identifier 46 identifies Parameter (e) related to the quality of communication. In addition, identifier 46 identifies the participant with the longest speaking time as a target person based on the identified ratio of speaking times (S47).

[0084]

Next, controller 49 determines whether the speaking time of the target person is longer than or equal to a predetermined value (that is, whether the identified participant speaks too much compared to other participants) (S48). When controller 49 determines that the speaking time of the target person is shorter than a predetermined value (that is, the target person does not speak too much) (No in S48), controller 49 does not control the environment around the target person. On the other hand, when controller 49 determines that the speaking time of the target person is longer than or equal to the predetermined value (that is, the target person speaks too much) (Yes in S48), controller 49 controls the environment around the target person (S49).

[0085]

Specifically, controller 49 controls the environment around the target person by causing communicator 41 to transmit a control signal to environmental control equipment 60. Controlling the environment around the target person means, in other words, selectively stimulating only the target person among participants A to D.

[0086]

Controller 49 cools the target person down and prompting the target person to refrain from speaking, for example, by activating a blower provided in space 70 to generate wind toward the target person. In addition, controller 49 may cool the target person down and prompt the target person to refrain from speaking by making the lighting equipment that illuminates the arounds of the target person among the lighting equipment provided in space 70 darker than at present.

[0087]

In this way, controller 49 controls the environment around the participant whose speaking time is determined to be relatively long among participants A to D. Controller 49 can seek to create an atmosphere in which other participants can easily speak by making the participant aware that the participant is speaking too much.

[0088]

[Operation example 3 of the environmental control]

5 In addition, controller 49 may perform the environmental control around the participant who speaks little. FIG. 14 is a flow chart of Operation example 3 of the environmental control.

[0089]

The processing of step S51 to step S56 is the same as the processing of step S41 to step S46.

[0090]

10 Following step S56, identifier 46 identifies the participant with the shortest speaking time as a target person based on the ratio of the speaking times identified in step S56 (S57).

[0091]

15 Next, controller 49 determines whether the speaking time of the target person is shorter than a predetermined value (that is, whether the speaking time of the identified participant is too short compared to other participants) (S58). When controller 49 determines that the speaking time of the target person is longer than or equal to the predetermined value (that is, the speaking time is not
20 too short) (No in S58), controller 49 does not control the environmental control around the target person. On the other hand, when controller 49 determines that the speaking time of the target person is shorter than the predetermined value (that is, the speaking time is too short) (Yes in S58), controller 49 controls the
25 environment around the target person (S59).

[0092]

30 Controller 49 prompts the target person to speak actively by activating a blower provided in space 70 to create a wind toward the target person. In addition, controller 49 may prompt the target person to speak actively by making the lighting equipment that illuminates the arounds of the target person among the lighting equipment provided in space 70 brighter than at present.

[0093]

35 In this way, controller 49 controls the environment around the participant whose speaking time is determined to be relatively short

among participants A to D. Controller 49 can draw out the opinions of the participants evenly by making the participant aware that the participant does not speak much.

[0094]

5 [Operation example 4 of the environmental control]

In addition, controller 49 may perform the environmental control around the participant who is dozing off. FIG. 15 is a flowchart of Operation example 4 of the environmental control.

[0095]

10 The processing of step S61 to step S64 is the same as the processing of step S51 to step S54.

[0096]

Following step S65, identifier 46 identifies the length of the period during which participants A to D dozed off during the target
15 period (Parameter (k) related to the quality of communication) (S65). In addition, identifier 46 identifies a participant who is dozing off among participants A to D as a target person (S66). Controller 49 controls the environment around the identified target person (S67).

[0097]

20 Controller 49 prompts the target person not to doze off by activating the blower provided in space 70 to create a wind toward the target person. In addition, controller 49 may prompt the target person not to doze off by making the lighting equipment that illuminates the arounds of the target person among the lighting
25 equipment provided in space 70 brighter than at present.

[0098]

In this way, controller 49 controls the environment around the participant who is dozing off among participants A to D. Controller 49 can seek to activate communication in space 70 by suppressing
30 the participants from dozing off.

[0099]

[Operation example 5 of the environmental control]

In addition, controller 49 may perform the environmental control around a participant who is working without participating in
35 the conversation. FIG. 16 is a flow chart of Operational example 5 of

the environmental control.

[0100]

The processing of step S71 to step S74 is the same as the processing of step S61 to step S64.

5 [0101]

Following step S75, identifier 46 identifies Parameter (l) related to the quality of communication (S75). In addition, identifier 46 identifies, as a target person, a participant who is working without participating in the conversation among participants
10 A to D (S76). Controller 49 controls the environment around the target person (S77).

[0102]

Controller 49 prompts the target person not to work, for example, by activating the blower provided in space 70 to generate
15 wind toward the target person. In addition, controller 49 may prompt the target person not to work by making the lighting equipment that illuminates the arounds of the target person among the lighting equipment provided in space 70 brighter than at present.

[0103]

20 In this way, controller 49 controls the environment around the participant among participants A to D who is working without participating in the conversation. Controller 49 can seek to activate communication in space 70 by suppressing the participants from working without participating in the conversation.

25 [0104]

[Specific examples of applicable scenes]

Specific examples of application scenes of communication analysis system 10 will be described. As described above, communication analysis system 10 is specifically used when a
30 general conference is held in space 70 such as a conference room. In this case, it is advised that identifier 46 identifies Parameter (a): the ratio of the lengths of the three periods, Parameter (d): the total number of Q&A periods, Parameter (e): the ratio of the speaking times of participants A to D in the Q&A period, Parameter (g): the
35 number of overlapping periods during which participants A to D are

speaking, Parameter (h): the length of the period in which the reporter is watched by other participants other than the reporter, Parameter (i): the number of times participants A to D nodded, Parameter (m): the number of times participants A to D smiled, and
5 Parameter (n) the length of the period during which participants A to D operated the PCs.

[0105]

In addition, when a so-called one-on-one meeting held between a boss and a subordinate, brainstorming, or the like is held,
10 it is advised that identifier 46 identifies Parameter (e): the ratio of the speaking times of participants A to D in the Q&A period, Parameter (f): the length of the silent period, Parameter (g): the number of overlapping periods during which participants A to D are speaking, Parameter (h): the length of the period in which the
15 reporter is watched by other participants other than the reporter, Parameter (i): the number of times participants A to D nodded, and Parameter (m): the number of times participants A to D smiled.

[0106]

In addition, communication analysis system 10 may be applied
20 to space 70 for refreshing, such as a break room, instead of a conference room. In this case, identifier 46 identifies Parameter (e): the ratio of the speaking times of participants A to D in the Q&A period, or Parameter (m): the number of times participants A to D smile, and further identifies who each of the plurality of people
25 positioned in space 70 is (that is, identifies individuals) based on at least one of the voice information or the video information. Accordingly, communication analysis system 10 can store who frequently communicates with whom and the like in storage 43. It should be noted that a specific method for identifying individuals will
30 be described later.

[0107]

[Variation of the method for identifying the speaker]

In the above embodiment, the speaker is identified based on the positions of participants A to D based on the video information
35 and the direction of arrival of the voice based on the voice

information, but the method for identifying the speaker is not limited to such a method.

[0108]

For example, if face images and voice features of people who are likely to participate in the conference (such as all employees of a company) are registered in storage 43 in advance, identifier 46 can identify the speaker (individual) by face authentication based on the face images and voice authentication based on voice information. In this case, voice collecting device 20 does not need to be a microphone array, and the configuration of voice collecting device 20 can be simplified.

[0109]

[Variation of the system configuration]

In the above embodiment, the explanation has been given assuming that participants A to D gather in one space 70 and have a conversation. However, communication analysis system 10 can also be applied to a case such as a web conference where participants A to D are positioned in different spaces 70. FIG. 17 is a block diagram showing the functional configuration of the communication analysis system according to such a variation.

[0110]

As shown in FIG. 17, in communication analysis system 10a according to the variation, at least one participant is positioned in each of a plurality of spaces 70 different from each other. In addition, information terminal 50 and environmental control equipment 60 are provided in each of the plurality of spaces 70 different from each other. Information terminal 50 in this case is, for example, a personal computer, and includes voice collecting device 20 and photographing device 30. Voice collecting device 20 and photographing device 30 may be externally attached to information terminal 50 or may be built in information terminal 50.

[0111]

In such communication analysis system 10a, voice obtainer 44 of server device 40 obtains voice information output by each of the plurality of voice collecting devices 20. Video obtainer 45 obtains

video information output by each of the plurality of photographing devices 30. Accordingly, communication analysis system 10a can perform the same operation as communication analysis system 10. [0112]

5 [Effects, etc.]

As described above, communication analysis system 10 includes: voice obtainer 44 that obtains voice information with conversations among a plurality of people during a target period recorded; video obtainer 45 that obtains video information with a state among the plurality of people during the target period recorded; identifier 46; and visualizer 47. Identifier 46 identifies, based on the obtained voice information, at least one of: (a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent; (b) a total number of people who participated in the question-and-answer session; (c) a tempo of the question-and-answer session; (d) a total number of question-and-answer sessions; (e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session ; (f) the length of the period during which all the plurality of people were silent; or (g) a total number of overlapping periods of speech by the plurality of people. Identifier 46 identifies, based on the video information obtained, at least one of: (h) a length of a period during which a reporter among the plurality of people were watched by others; (i) a total number of times the plurality of people nodded; (j) a total number of times the plurality of people yawned; (k) a total number of times the plurality of people dozed off or a length of a period during which the plurality of people dozed off; (l) a length of a period during which the plurality of people were working; (m) a total number of times the plurality of people smiled; or (n) a length of a period during which the plurality of people were operating personal computers. Visualizer 47 visualizes at least one of the above (a) to (g) identified and at least one of the above (h) to (n) identified.

35 [0113]

Such communication analysis system 10 can help improve the quality of communication by visualizing the parameters related to the quality of communication such as the above (a) to (n).

[0114]

5 In addition, for example, communication analysis system 10 further includes calculator 48 that calculates a score indicating the quality of communication among the plurality of people during the target period based on at least one of the above (a) to (g) identified and at least one of the above (h) to (n) identified. Visualizer 47 may
10 visualize the calculated score.

[0115]

Such communication analysis system 10 can help improve the quality of communication by visualizing the score that indicates the quality of communication.

15 [0116]

In addition, for example, communication analysis system 10 further includes controller 49 that controls an environment of space 70 where the plurality of people are positioned based on the calculated score.

20 [0117]

Such communication analysis system 10 can seek to activate communication.

[0118]

In addition, for example, communication analysis system 10
25 further include controller 49 that identifies the above (e) based on the voice information obtained, and controls an environment around a person whose speaking time is determined to be relatively long among the plurality of people based on the above (e) identified.

[0119]

30 Such communication analysis system 10 can make a person determined to have a relatively long speaking time notice that the person speaks too much, thereby seeking to create an atmosphere in which other people can easily speak.

[0120]

35 In addition, for example, communication analysis system 10

further includes controller 49 that identifies the above (e) based on the voice information obtained, and controls an environment around a person whose speaking time is determined to be relatively short among the plurality of people based on the above (e) identified.

5 [0121]

Such communication analysis system 10 can make a person of a plurality of people whose speaking time is determined to be relatively short notice that the person speaks less, thereby evenly extracting the opinions of the plurality of people.

10 [0122]

In addition, for example, communication analysis system 10 further includes controller 49 that identifies the above (k) based on the video information obtained, and controls an environment around a person who is dozing off among the plurality of people based on the

15 above (k) identified.

[0123]

Such communication analysis system 10 can seek to activate communication by suppressing dozing off by controlling the environment.

20 [0124]

In addition, for example, communication analysis system 10 further includes controller 49 that identifies the above (l) based on the video information obtained, and controls an environment around a person who is working among the plurality of people based on the

25 above (l) identified.

[0125]

Such communication analysis system 10 can seek to activate communication by prompting the person to stop working by controlling the environment.

30 [0126]

In addition, for example, in communication analysis system 10, voice obtainer 44 obtains the voice information output by voice collecting device 20 provided in space 70 where the plurality of people are positioned. Video obtainer 45 obtains the video

35 information output by photographing device 30 provided in space 70

where the plurality of people are positioned.

[0127]

5 In this way, communication analysis system 10 can visualize parameters related to the quality of communication, and the like, for space 70 where a plurality of people are positioned, such as a conference room.

[0128]

10 In addition, for example, in communication analysis system 10a, at least one person of the plurality of people are positioned in each of a plurality of spaces 70 that are different from each other, and voice collecting device 20 and photographing device 30 are provided in each of the plurality of spaces 70. Voice obtainer 44 obtains the voice information output by each of a plurality of voice collecting devices 20 and video obtainer 45 obtains the video
15 information output by each of a plurality of photographing devices 30.

[0129]

In this way, communication analysis system 10a can also be applied to cases where a plurality of people are positioned in different
20 spaces 70, such as web conferences.

[0130]

In addition, for example, identifier 46 identifies the above (a), the above (d), the above (e), the above (g), the above (h), the above (i), the above (m), and the above (n).
25 [0131]

Such communication analysis system 10 can identify parameters suitable for improving the quality of communication in general conferences.

[0132]

30 In addition, for example, identifier 46 identifies the above (e), the above (f), the above (g), the above (h), the above (i), and the above (m).

[0133]

Such communication analysis system 10 can identify
35 parameters suitable for improving the quality of communication in

brainstorming or one-on-one conferences.

[0134]

In addition, for example, identifier 46 identifies the above (e) or the above (g), and further identifies who each of the plurality of people are based on at least one of the voice information or the video information.

[0135]

Such communication analysis system 10 can identify parameters suitable for improving the quality of communication in places such as break rooms where people switch their feelings.

[Other Embodiments]

[0136]

Although the embodiments have been described above, the present invention is not limited to the above embodiments.

[0137]

For example, in the above embodiments, the communication analysis system was achieved by a plurality of devices, but it may be achieved as a single device. For example, the communication analysis system may be achieved as a single device that corresponds to a server device. When the communication analysis system is achieved by a plurality of devices, the components included in the communication analysis system may be distributed to the plurality of devices in any way. For example, the components included in the server device in the above embodiments may be included in an information terminal provided in space. That is, the present invention may be realized by cloud computing or may be realized by edge computing.

[0138]

For example, the communication method between devices in the above embodiments is not particularly limited. In addition, a relay device (not shown) may intervene in communication between devices.

[0139]

In addition, in the above embodiments, a process executed by a specific processor may be executed by another processor. In

addition, the order of a plurality of processes may be changed, and a plurality of processes may be executed in parallel.

[0140]

In addition, in the above embodiments, each component may be realized by executing a software program suitable for each component. Each component may be realized by a program executer, such as a CPU or processor, reading and executing a software program recorded on a recording medium such as a hard disk or a semiconductor memory.

[0141]

In addition, each component may be realized by a hardware. For example, each component may be a circuit (or integrated circuit). These circuits may form one circuit as a whole, or may be separate circuits. In addition, each of these circuits may be a general-purpose circuit or a dedicated circuit.

[0142]

In addition, general or specific aspects of the present invention may be realized with a system, device, method, integrated circuit, computer program, or recording medium such as a computer-readable CD-ROM. In addition, they may be realized with any combination of systems, devices, methods, integrated circuits, computer programs, and recording media.

[0143]

For example, the present invention may be realized as a communication analysis method executed by a computer such as a communication analysis system, as a program for causing a computer to execute such a communication analysis method, or as a computer-readable non-transitory recording medium having such a program recorded thereon.

[0144]

In addition, forms obtained by applying various modifications to each embodiment conceived by a person skilled in the art or forms realized by arbitrarily combining the components and functions in each embodiment without departing from the spirit of the present invention are also included in the present invention.

[Reference Signs List]

[0145]

	10, 10a	Communication analysis system
	20	Voice collecting device
5	30	Photographing device
	44	Voice obtainer
	45	Video obtainer
	46	Identifier
	47	Visualizer
10	48	Calculator
	49	Controller
	70	Space

[CLAIMS]

[Claim 1]

A communication analysis system comprising:

a voice obtainer that obtains voice information in which
5 conversations among a plurality of people during a target period are
recorded;

a video obtainer that obtains video information in which states
of the plurality of people during the target period are recorded;

an identifier; and

10 a visualizer,

wherein the identifier identifies, based on the obtained voice
information, at least one of:

(a) a ratio of a length of a period of a presentation, a
length of a period of a question-and-answer session, and a length of
15 a period during which all the plurality of people were silent;

(b) a total number of people who participated in the
question-and-answer session;

(c) a tempo of the question-and-answer session;

(d) a total number of question-and-answer sessions;

20 (e) a ratio of speaking times of the plurality of people
during the period of the question-and-answer session;

(f) the length of the period during which all the plurality
of people were silent; or

(g) a total number of overlapping periods of speech by
25 the plurality of people,

the identifier identifies, based on the video information
obtained, at least one of:

(h) a length of a period during which a reporter among
the plurality of people were watched by others;

30 (i) a total number of times the plurality of people
nodded;

(j) a total number of times the plurality of people
yawned;

(k) a total number of times the plurality of people dozed
35 off or a length of a period during which the plurality of people dozed

off;

(l) a length of a period during which the plurality of people were working;

5 (m) a total number of times the plurality of people smiled; or

(n) a length of a period during which the plurality of people were operating personal computers, and

the visualizer visualizes at least one of (a) to (g) identified and at least one of (h) to (n) identified.

10

[Claim 2]

The communication analysis system according to claim 1, further comprising:

15 a calculator that calculates a score indicating a quality of communication among the plurality of people during the target period based on at least one of (a) to (g) identified and at least one of (h) to (n) identified,

wherein the visualizer further visualizes the score calculated.

20 [Claim 3]

A communication analysis system comprising:

a voice obtainer that obtains voice information in which conversations among a plurality of people during a target period are recorded;

25 a video obtainer that obtains video information in which states of the plurality of people during the target period are recorded;

an identifier; and

a calculator,

30 wherein the identifier identifies, based on the obtained voice information, at least one of:

(a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent;

35 (b) a total number of people who participated in the question-and-answer session;

(c) a tempo of the question-and-answer session;
(d) a total number of question-and-answer sessions;
(e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session;

5 (f) the length of the period during which all the plurality of people were silent; or

(g) a total number of overlapping periods people of speech by the plurality of people,

10 the identifier identifies, based on the video information obtained, at least one of:

(h) a length of a period during which a reporter among the plurality of people were watched by others;

(i) a total number of times the plurality of people nodded;

15 (j) a total number of times the plurality of people yawned;

(k) a total number of times the plurality of people dozed off or a length of a period during which the plurality of people dozed off;

20 (l) a length of a period during which the plurality of people were working;

(m) a total number of times the plurality of people smiled; or

25 (n) a length of a period during which the plurality of people were operating personal computers, and

the calculator calculates a score indicating a quality of communication among the plurality of people during the target period based on at least one of (a) to (g) identified and at least one of (h) to (n) identified.

30

[Claim 4]

The communication analysis system according to claim 2 or 3, further comprising:

35 a controller that controls an environment of a space where the plurality of people are positioned based on the score calculated.

[Claim 5]

The communication analysis system according to any one of claims 1 to 4, further comprising:

- 5 a controller that identifies (e) based on the voice information obtained, and controls an environment around a person whose speaking time is determined to be relatively long among the plurality of people based on (e) identified.

10 [Claim 6]

The communication analysis system according to any one of claims 1 to 5, further comprising:

- a controller that identifies (e) based on the voice information obtained, and controls an environment around a person whose
15 speaking time is determined to be relatively short among the plurality of people based on (e) identified.

[Claim 7]

- 20 The communication analysis system according to any one of claims 1 to 6, further comprising:

 a controller that identifies (k) based on the video information obtained, and controls an environment around a person who is dozing off among the plurality of people based on (k) identified.

25 [Claim 8]

The communication analysis system according to any one of claims 1 to 7, further comprising:

- a controller that identifies (l) based on the video information obtained, and controls an environment around a person who is
30 working among the plurality of people based on (l) identified.

[Claim 9]

The communication analysis system according to any one of claims 1 to 8,

- 35 wherein the voice obtainer obtains the voice information

output by a voice collecting device provided in a space where the plurality of people are positioned, and

the video obtainer obtains the video information output by a photographing device provided in the space where the plurality of people are positioned.

[Claim 10]

The communication analysis system according to any one of claims 1 to 8,

wherein the plurality of people are positioned in a plurality of spaces different from one another, the plurality of spaces each accommodating at least one person,

a voice collecting device and a photographing device are provided in each of the plurality of spaces,

the voice obtainer obtains the voice information output by each of the voice collecting devices, and

the video obtainer obtains the video information output by each of the photographing devices.

[Claim 11]

The communication analysis system according to any one of claims 1 to 10,

wherein the identifier identifies (a), (d), (e), (g), (h), (i), (m), and (n).

[Claim 12]

The communication analysis system according to any one of claims 1 to 10,

wherein the identifier identifies (e), (f), (g), (h), (i), and (m).

[Claim 13]

The communication analysis system according to any one of claims 1 to 10,

wherein the identifier identifies (e) or (m) and further identifies who each of the plurality of people are based on at least

one of the voice information or the video information.

[Claim 14]

A communication analysis method comprising:

- 5 obtaining voice information in which conversations among a plurality of people during a target period are recorded;
obtaining video information in which states of the plurality of people during the target period are recorded;
identifying; and
10 visualizing,
wherein the identifying includes identifying, based on the voice information obtained, at least one of:
- (a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of
15 a period during which all the plurality of people were silent;
 - (b) a total number of people who participated in the question-and-answer session;
 - (c) a tempo of the question-and-answer session;
 - (d) a total number of question-and-answer sessions;
 - 20 (e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session;
 - (f) the length of the period during which all the plurality of people were silent; or
 - (g) a total number of overlapping periods people of
25 speech by the plurality of people,
- the identifying includes identifying, based on the video information obtained, at least one of:
- (h) a length of a period during which a reporter among the plurality of people were watched by others;
 - 30 (i) a total number of times the plurality of people nodded;
 - (j) a total number of times the plurality of people yawned;
 - (k) a total number of times the plurality of people dozed
35 off or a length of a period during which the plurality of people dozed

off;

(l) a length of a period during which the plurality of people were working;

5 (m) a total number of times the plurality of people smiled; or

(n) a length of a period during which the plurality of people were operating personal computers, and

the visualizing includes visualizing at least one of (a) to (g) identified and at least one of (h) to (n) identified.

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[Claim 15]

A communication analysis method comprising:

obtaining voice information in which conversations among a plurality of people during a target period are recorded;

15 obtaining video information in which states of the plurality of people during the target period are recorded;

identifying; and

calculating,

20 wherein the identifying includes identifying, based on the voice information obtained, at least one of:

(a) a ratio of a length of a period of a presentation, a length of a period of a question-and-answer session, and a length of a period during which all the plurality of people were silent;

25 (b) a total number of people who participated in the question-and-answer session;

(c) a tempo of the question-and-answer session;

(d) a total number of question-and-answer sessions;

(e) a ratio of speaking times of the plurality of people during the period of the question-and-answer session;

30 (f) the length of the period during which all the plurality of people were silent; or

(g) a total number of overlapping periods of speech by the plurality of people,

35 the identifying includes identifying, based on the video information obtained, at least one of:

(h) a length of a period during which a reporter among the plurality of people were watched by others;

(i) a total number of times the plurality of people nodded;

5 (j) a total number of times the plurality of people yawned;

(k) a total number of times the plurality of people dozed off or a length of a period during which the plurality of people dozed off;

10 (l) a length of a period during which the plurality of people were working;

(m) a total number of times the plurality of people smiled; or

15 (n) a length of a period during which the plurality of people were operating personal computers, and

the calculating includes calculating a score indicating a quality of communication among the plurality of people during the target period based on at least one of (a) to (g) identified and at least one of (h) to (n) identified.

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[Claim 16]

A program for causing a computer to execute the communication analysis method according to claim 14 or 15.