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Nishiyama et al.

(54) **INFORMATION PROCESSING APPARATUS, COMPUTER PROGRAM PRODUCT, AND INFORMATION PROCESSING METHOD**

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(57) **ABSTRACT**

According to an embodiment, an information processing apparatus includes a dividing unit, an assigning unit, and a generating unit. The dividing unit is configured to divide speech data into pieces of utterance data. The assigning unit is configured to assign speaker identification information to each piece of utterance data based on an acoustic feature of the each piece of utterance data. The generating unit is configured to generate a candidate list that indicates candidate speaker names so as to enable a user to determine a speaker name to be given to the piece of utterance data identified by instruction information, based on operation history information in which at least pieces of utterance identification information, pieces of the speaker identification information, and speaker names given by the user to the respective pieces of utterance data are associated with one another.

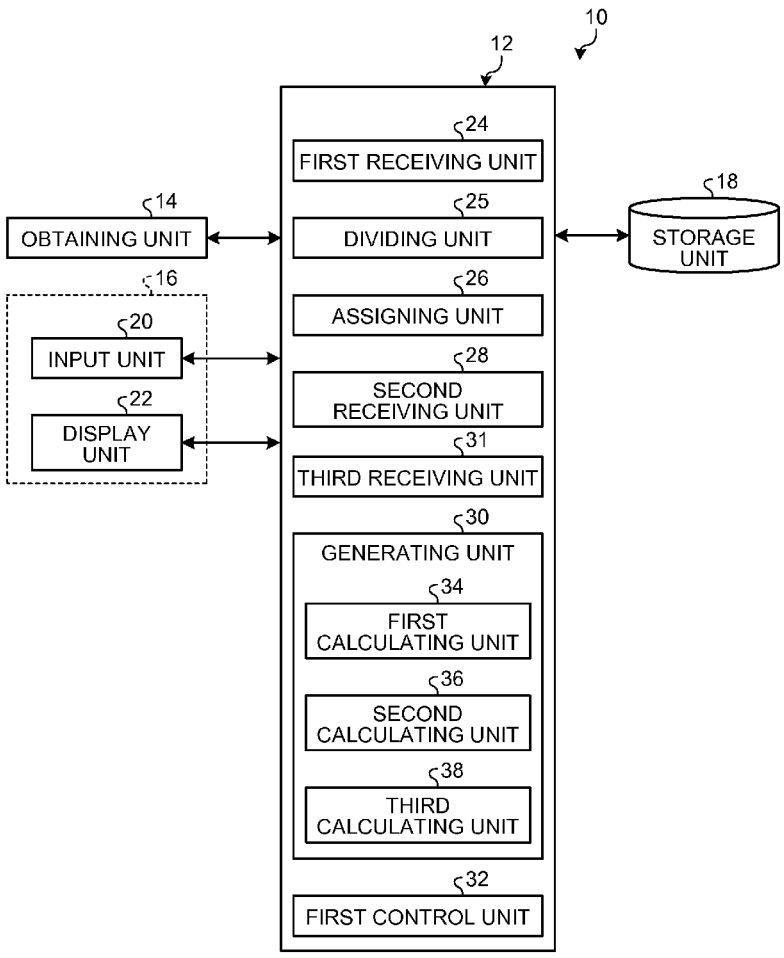


FIG.1

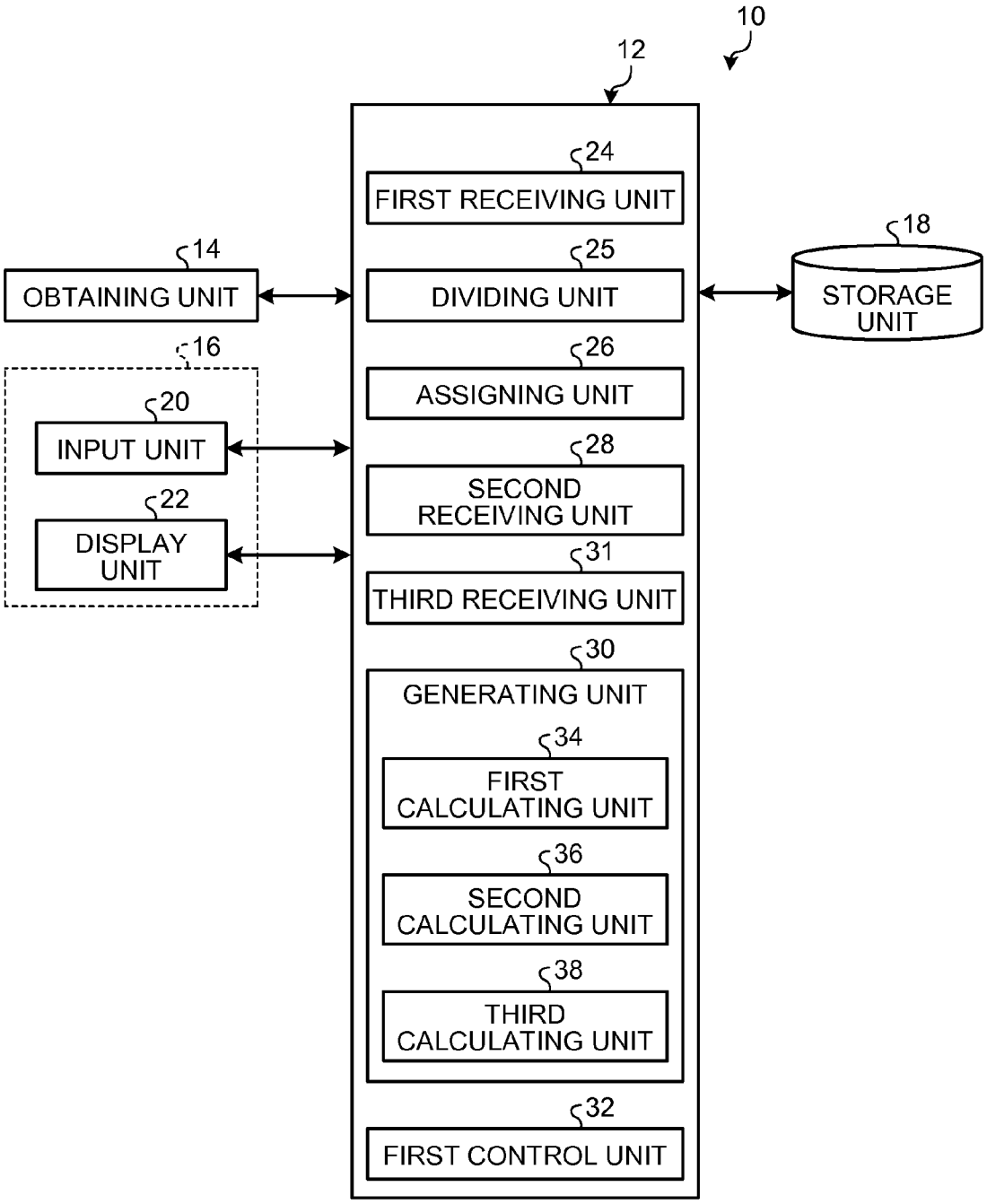

10
12
24
FIRST RECEIVING UNIT
25
DIVIDING UNIT
26
ASSIGNING UNIT
28
SECOND RECEIVING UNIT
31
THIRD RECEIVING UNIT
30
GENERATING UNIT
34
FIRST CALCULATING UNIT
36
SECOND CALCULATING UNIT
38
THIRD CALCULATING UNIT
32
FIRST CONTROL UNIT
14
OBTAINING UNIT
16
20
INPUT UNIT
22
DISPLAY UNIT
18
STORAGE UNIT

FIG.2

UTTERANCE ID	START TIMING	END TIMING	SPEAKER ID
1	0:00:03	0:00:05	A
2	0:00:06	0:00:09	B
3	0:00:12	0:00:17	C
4	0:00:18	0:00:20	A
5	0:00:21	0:00:23	D
6	0:00:23	0:00:28	C
7	0:00:29	0:00:31	E

FIG.3

UTTERANCE ID	SPEAKER ID	SPEAKER NAME
1	A	PRESENTER
2	B	JOURNALIST
3	C	LEADING PERFORMER
4	A	PRESENTER

FIG.4

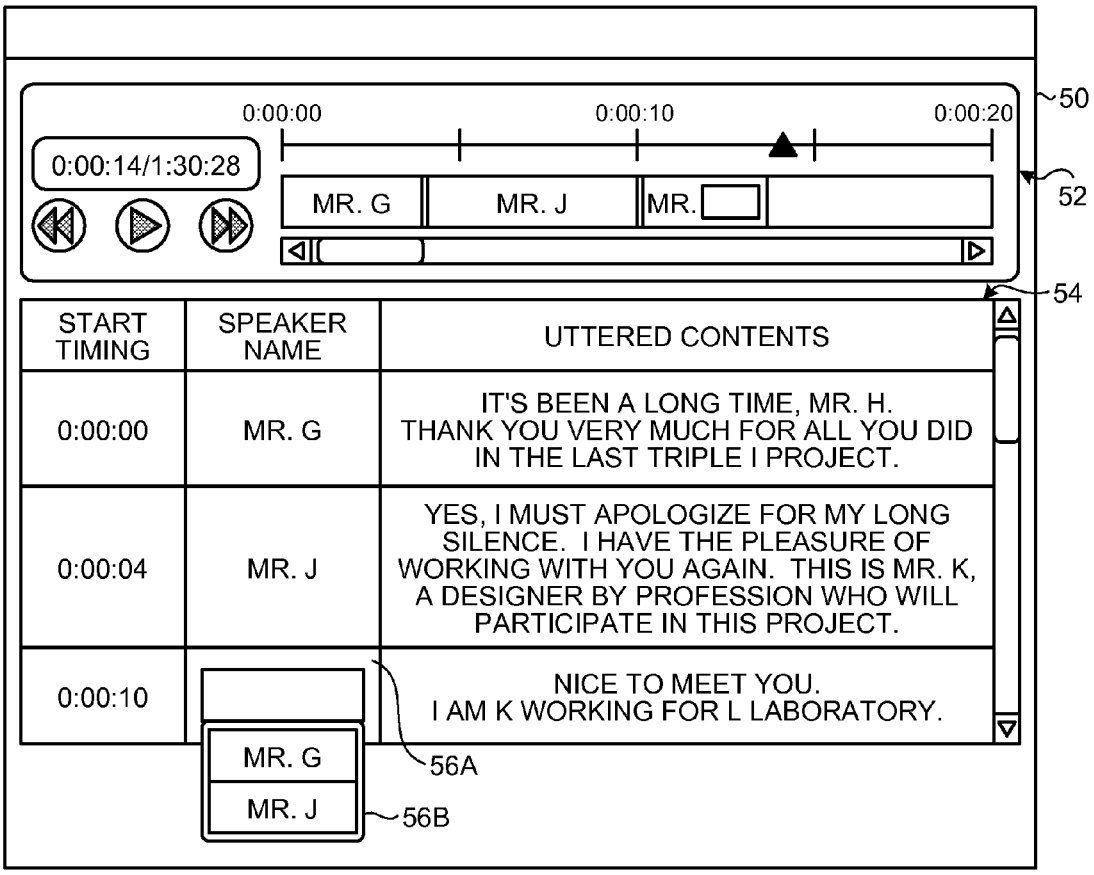

0:00:00
0:00:10
0:00:20
50
0:00:14/1:30:28
MR. G
MR. J
MR.
52
54
START TIMING
SPEAKER NAME
UTTERED CONTENTS
0:00:00
MR. G
IT'S BEEN A LONG TIME, MR. H. THANK YOU VERY MUCH FOR ALL YOU DID IN THE LAST TRIPLE I PROJECT.
0:00:04
MR. J
YES, I MUST APOLOGIZE FOR MY LONG SILENCE. I HAVE THE PLEASURE OF WORKING WITH YOU AGAIN. THIS IS MR. K, A DESIGNER BY PROFESSION WHO WILL PARTICIPATE IN THIS PROJECT.
0:00:10
NICE TO MEET YOU. I AM K WORKING FOR L LABORATORY.
MR. G
MR. J
56A
56B

FIG.5

SPEAKER NAME	SPEAKER ID	FIRST PROBABILITY
PRESENTER	A	1.0
JOURNALIST	B	1.0
LEADING PERFORMER	C	1.0

FIG.6

PREVIOUS \ SUBSEQUENT	PRESENTER	JOURNALIST	LEADING PERFORMER	<NEW>
PRESENTER	0	1.0	0	1.0
JOURNALIST	0	0	1.0	1.0
LEADING PERFORMER	1.0	0	0	0

FIG.7

SPEAKER NAME	SCORE	FIRST PROBABILITY	SECOND PROBABILITY
PRESENTER	0	0	0
JOURNALIST	1.0	0	1.0
LEADING PERFORMER	0	0	0
<NEW>	2.0	1.0	1.0

FIG.8

PRIORITY	SPEAKER NAME
1	<NEW>
2	JOURNALIST
3	LEADING PERFORMER
3	PRESENTER

FIG.9

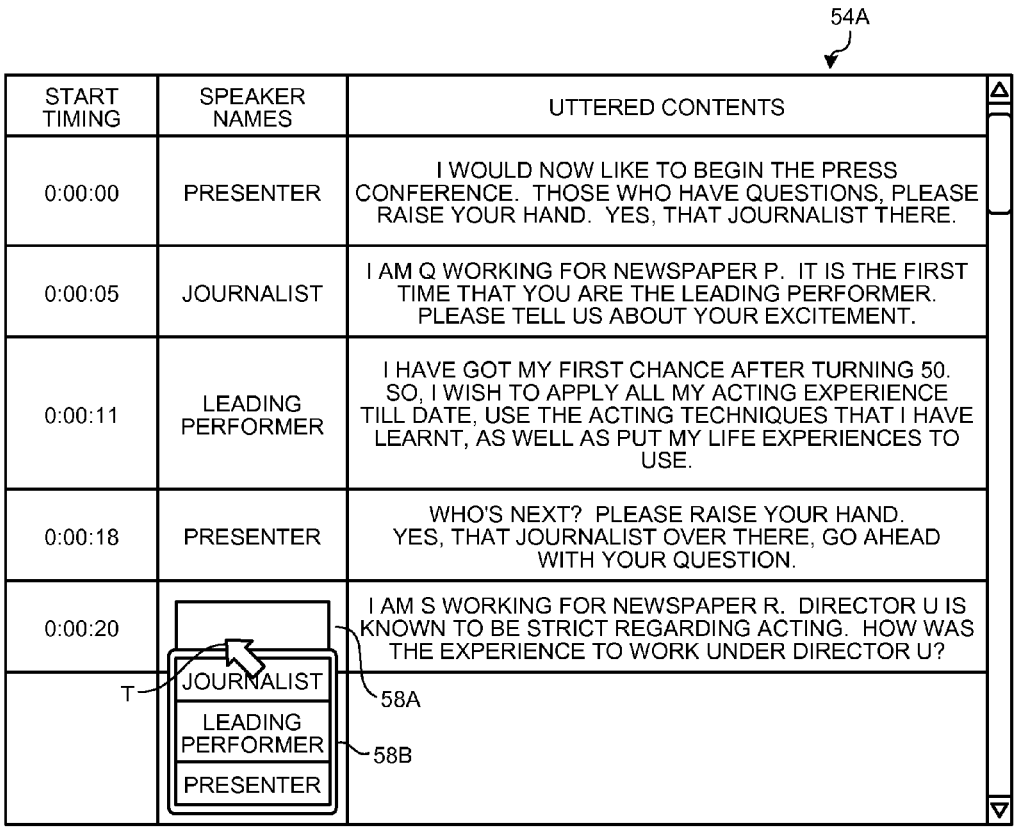

54A
START TIMING
SPEAKER NAMES
UTTERED CONTENTS
0:00:00
PRESENTER
I WOULD NOW LIKE TO BEGIN THE PRESS CONFERENCE. THOSE WHO HAVE QUESTIONS, PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST THERE.
0:00:05
JOURNALIST
I AM Q WORKING FOR NEWSPAPER P. IT IS THE FIRST TIME THAT YOU ARE THE LEADING PERFORMER. PLEASE TELL US ABOUT YOUR EXCITEMENT.
0:00:11
LEADING PERFORMER
I HAVE GOT MY FIRST CHANCE AFTER TURNING 50. SO, I WISH TO APPLY ALL MY ACTING EXPERIENCE TILL DATE, USE THE ACTING TECHNIQUES THAT I HAVE LEARNT, AS WELL AS PUT MY LIFE EXPERIENCES TO USE.
0:00:18
PRESENTER
WHO'S NEXT? PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST OVER THERE, GO AHEAD WITH YOUR QUESTION.
0:00:20
I AM S WORKING FOR NEWSPAPER R. DIRECTOR U IS KNOWN TO BE STRICT REGARDING ACTING. HOW WAS THE EXPERIENCE TO WORK UNDER DIRECTOR U?
T
JOURNALIST
LEADING PERFORMER
PRESENTER
58A
58B

FIG.10

54B

START TIMING	SPEAKER NAMES	UTTERED CONTENTS
0:00:00	PRESENTER	I WOULD NOW LIKE TO BEGIN THE PRESS CONFERENCE. THOSE WHO HAVE QUESTIONS, PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST THERE.
0:00:05	JOURNALIST	I AM Q WORKING FOR NEWSPAPER P. IT IS THE FIRST TIME THAT YOU ARE THE LEADING PERFORMER. PLEASE TELL US ABOUT YOUR EXCITEMENT.
0:00:11	LEADING PERFORMER	I HAVE GOT MY FIRST CHANCE AFTER TURNING 50. SO, I WISH TO APPLY ALL MY ACTING EXPERIENCE TILL DATE, USE THE ACTING TECHNIQUES THAT I HAVE LEARNT, AS WELL AS PUT MY LIFE EXPERIENCES TO USE.
0:00:18	PRESENTER	WHO'S NEXT? PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST OVER THERE, GO AHEAD WITH YOUR QUESTION.
0:00:20	JOURNALIST	I AM S WORKING FOR NEWSPAPER R. DIRECTOR U IS KNOWN TO BE STRICT REGARDING ACTING. HOW WAS THE EXPERIENCE TO WORK UNDER DIRECTOR U?
	58A	

FIG.11

UTTERANCE ID	SPEAKER ID	SPEAKER NAME
1	A	PRESENTER
2	B	JOURNALIST
3	C	LEADING PERFORMER
4	A	PRESENTER
5	D	JOURNALIST

FIG.12

PRIORITY	SPEAKER NAME
1	JOURNALIST
2	<NEW>
3	LEADING PERFORMER
3	PRESENTER

FIG.13

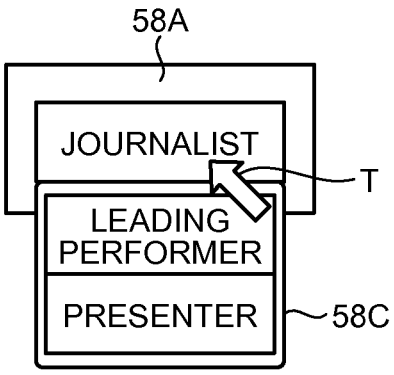

58A
JOURNALIST
T
LEADING PERFORMER
PRESENTER
58C

FIG.14

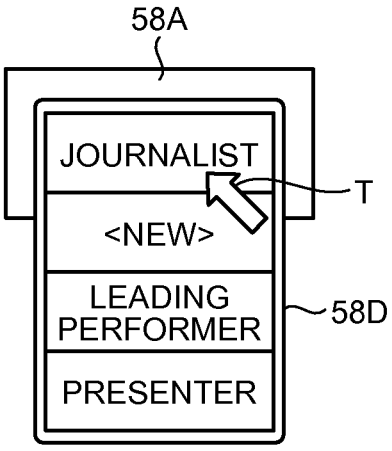

58A
JOURNALIST
T
<NEW>
LEADING PERFORMER
PRESENTER
58D

FIG.15

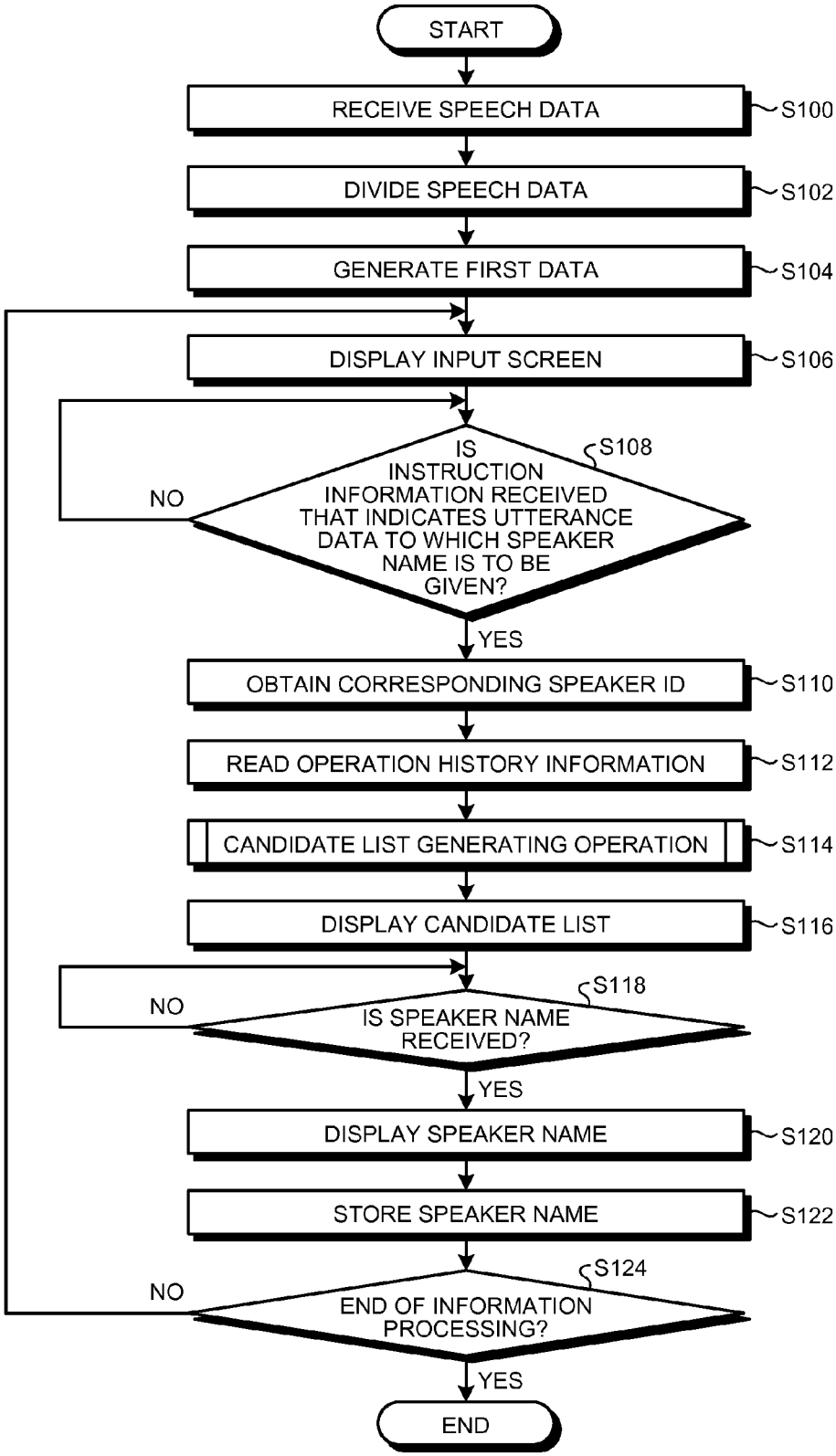

START
RECEIVE SPEECH DATA
S100
DIVIDE SPEECH DATA
S102
GENERATE FIRST DATA
S104
DISPLAY INPUT SCREEN
S106
IS INSTRUCTION INFORMATION RECEIVED THAT INDICATES UTTERANCE DATA TO WHICH SPEAKER NAME IS TO BE GIVEN?
S108
NO
YES
OBTAIN CORRESPONDING SPEAKER ID
S110
READ OPERATION HISTORY INFORMATION
S112
CANDIDATE LIST GENERATING OPERATION
S114
DISPLAY CANDIDATE LIST
S116
IS SPEAKER NAME RECEIVED?
S118
NO
YES
DISPLAY SPEAKER NAME
S120
STORE SPEAKER NAME
S122
END OF INFORMATION PROCESSING?
S124
NO
YES
END

FIG.16

54C

START TIMING	SPEAKER NAMES	UTTERED CONTENTS
0:00:00	PRESENTER	I WOULD NOW LIKE TO BEGIN THE PRESS CONFERENCE. THOSE WHO HAVE QUESTIONS, PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST THERE.
0:00:05	JOURNALIST	I AM Q WORKING FOR NEWSPAPER P. IT IS THE FIRST TIME THAT YOU ARE THE LEADING PERFORMER. PLEASE TELL US ABOUT YOUR EXCITEMENT.
0:00:11	LEADING PERFORMER	I HAVE GOT MY FIRST CHANCE AFTER TURNING 50. SO, I WISH TO APPLY ALL MY ACTING EXPERIENCE TILL DATE, USE THE ACTING TECHNIQUES THAT I HAVE LEARNT, AS WELL AS PUT MY LIFE EXPERIENCES TO USE.
0:00:18	PRESENTER	WHO'S NEXT? PLEASE RAISE YOUR HAND. YES, THAT JOURNALIST OVER THERE, GO AHEAD WITH YOUR QUESTION.
0:00:20		I AM S WORKING FOR NEWSPAPER R. DIRECTOR U IS KNOWN TO BE STRICT REGARDING ACTING. HOW WAS THE EXPERIENCE TO WORK UNDER DIRECTOR U?

FIG.17

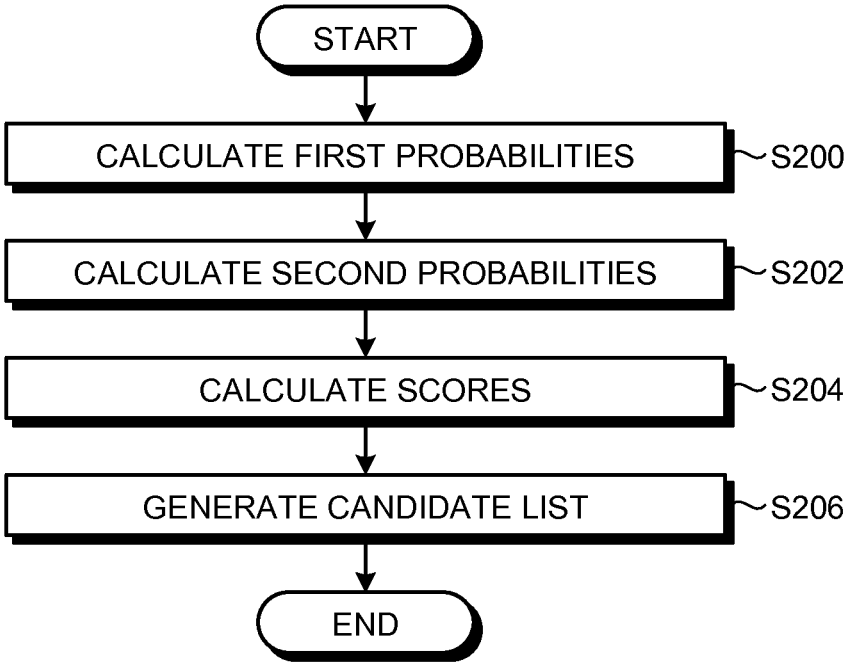

START
CALCULATE FIRST PROBABILITIES
S200
CALCULATE SECOND PROBABILITIES
S202
CALCULATE SCORES
S204
GENERATE CANDIDATE LIST
S206
END

FIG.18

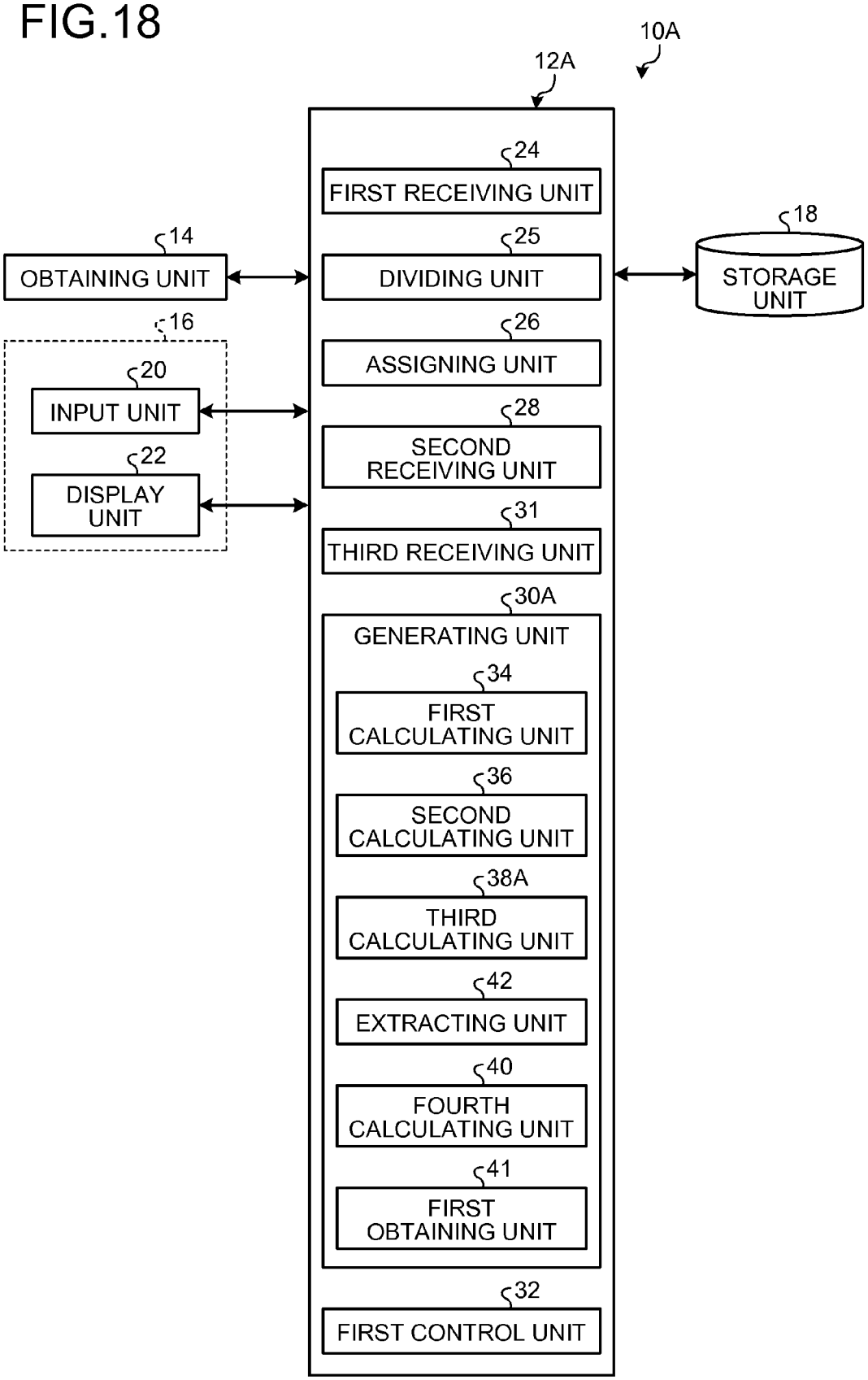

10A
12A
24
FIRST RECEIVING UNIT
25
DIVIDING UNIT
26
ASSIGNING UNIT
28
SECOND RECEIVING UNIT
31
THIRD RECEIVING UNIT
30A
GENERATING UNIT
34
FIRST CALCULATING UNIT
36
SECOND CALCULATING UNIT
38A
THIRD CALCULATING UNIT
42
EXTRACTING UNIT
40
FOURTH CALCULATING UNIT
41
FIRST OBTAINING UNIT
32
FIRST CONTROL UNIT
14
OBTAINING UNIT
16
20
INPUT UNIT
22
DISPLAY UNIT
18
STORAGE UNIT

FIG.19

SPEAKER IDENTIFICATION INFORMATION / SPEAKER NAME	NEWSPAPER R	S
PRESENTER	0	0
JOURNALIST	1.0	1.0
LEADING PERFORMER	0	0

FIG.20

SPEAKER NAME	SCORE	FIRST PROBABILITY	SECOND PROBABILITY	THIRD PROBABILITY
PRESENTER	0	0	0	0
JOURNALIST	3.0	0	1.0	2.0
LEADING PERFORMER	0	0	0	0
<NEW>	2.0	1.0	1.0	0

FIG.21

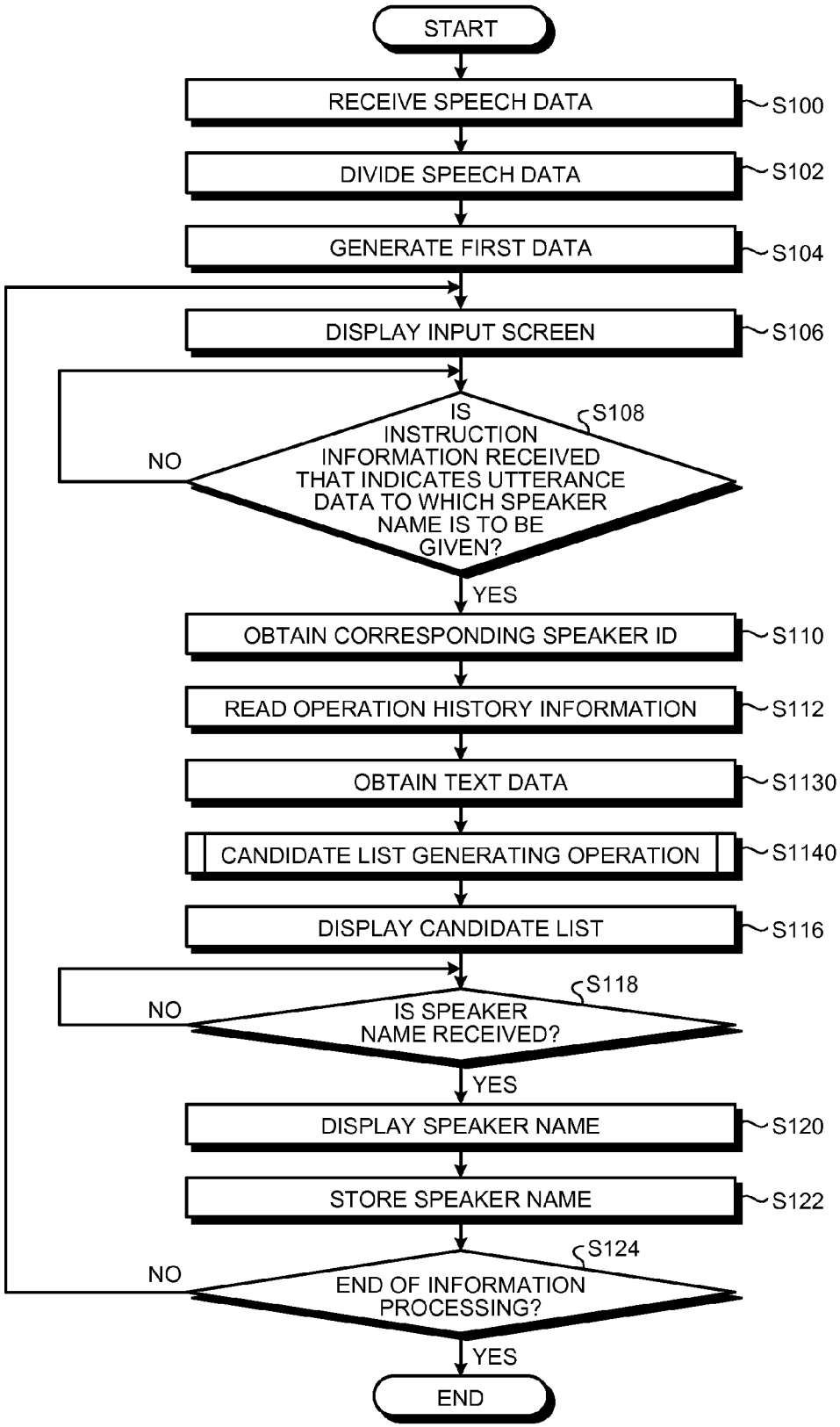

START
RECEIVE SPEECH DATA
S100
DIVIDE SPEECH DATA
S102
GENERATE FIRST DATA
S104
DISPLAY INPUT SCREEN
S106
IS INSTRUCTION INFORMATION RECEIVED THAT INDICATES UTTERANCE DATA TO WHICH SPEAKER NAME IS TO BE GIVEN?
S108
NO
YES
OBTAIN CORRESPONDING SPEAKER ID
S110
READ OPERATION HISTORY INFORMATION
S112
OBTAIN TEXT DATA
S1130
CANDIDATE LIST GENERATING OPERATION
S1140
DISPLAY CANDIDATE LIST
S116
IS SPEAKER NAME RECEIVED?
S118
NO
YES
DISPLAY SPEAKER NAME
S120
STORE SPEAKER NAME
S122
END OF INFORMATION PROCESSING?
S124
NO
YES
END

FIG.22

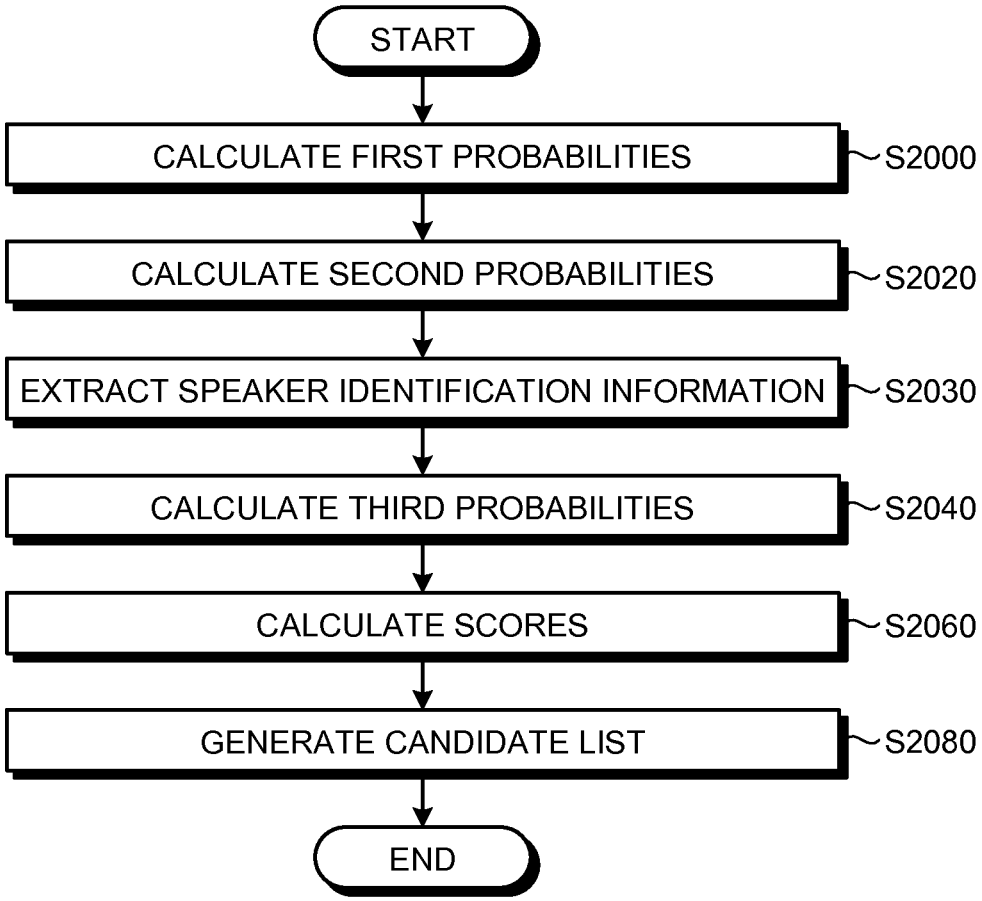

START
CALCULATE FIRST PROBABILITIES
S2000
CALCULATE SECOND PROBABILITIES
S2020
EXTRACT SPEAKER IDENTIFICATION INFORMATION
S2030
CALCULATE THIRD PROBABILITIES
S2040
CALCULATE SCORES
S2060
GENERATE CANDIDATE LIST
S2080
END

FIG.23

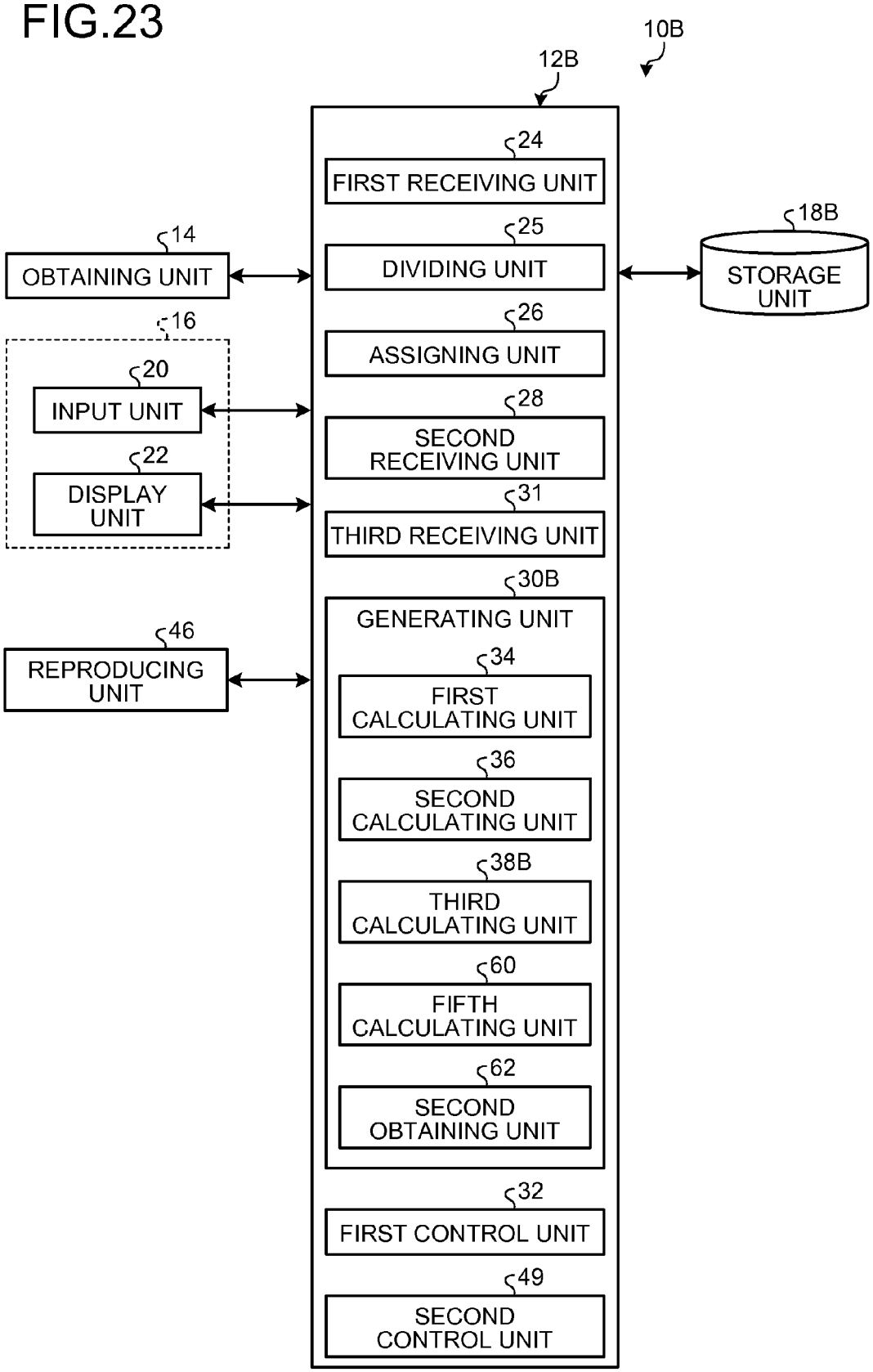

10B
12B
24
FIRST RECEIVING UNIT
25
DIVIDING UNIT
26
ASSIGNING UNIT
28
SECOND RECEIVING UNIT
31
THIRD RECEIVING UNIT
30B
GENERATING UNIT
34
FIRST CALCULATING UNIT
36
SECOND CALCULATING UNIT
38B
THIRD CALCULATING UNIT
60
FIFTH CALCULATING UNIT
62
SECOND OBTAINING UNIT
32
FIRST CONTROL UNIT
49
SECOND CONTROL UNIT
14
OBTAINING UNIT
16
20
INPUT UNIT
22
DISPLAY UNIT
46
REPRODUCING UNIT
18B
STORAGE UNIT

FIG.24

SPEAKER NAME	FOURTH PROBABILITY
PRESENTER	0
JOURNALIST	1.0
LEADING PERFORMER	0
<NEW>	0

FIG.25

SPEAKER NAME	SCORE	FIRST PROBABILITY	SECOND PROBABILITY	FOURTH PROBABILITY
PRESENTER	0	0	0	0
JOURNALIST	2.0	0	1.0	1.0
LEADING PERFORMER	0	0	0	0
<NEW>	2.0	1.0	1.0	0

FIG.26

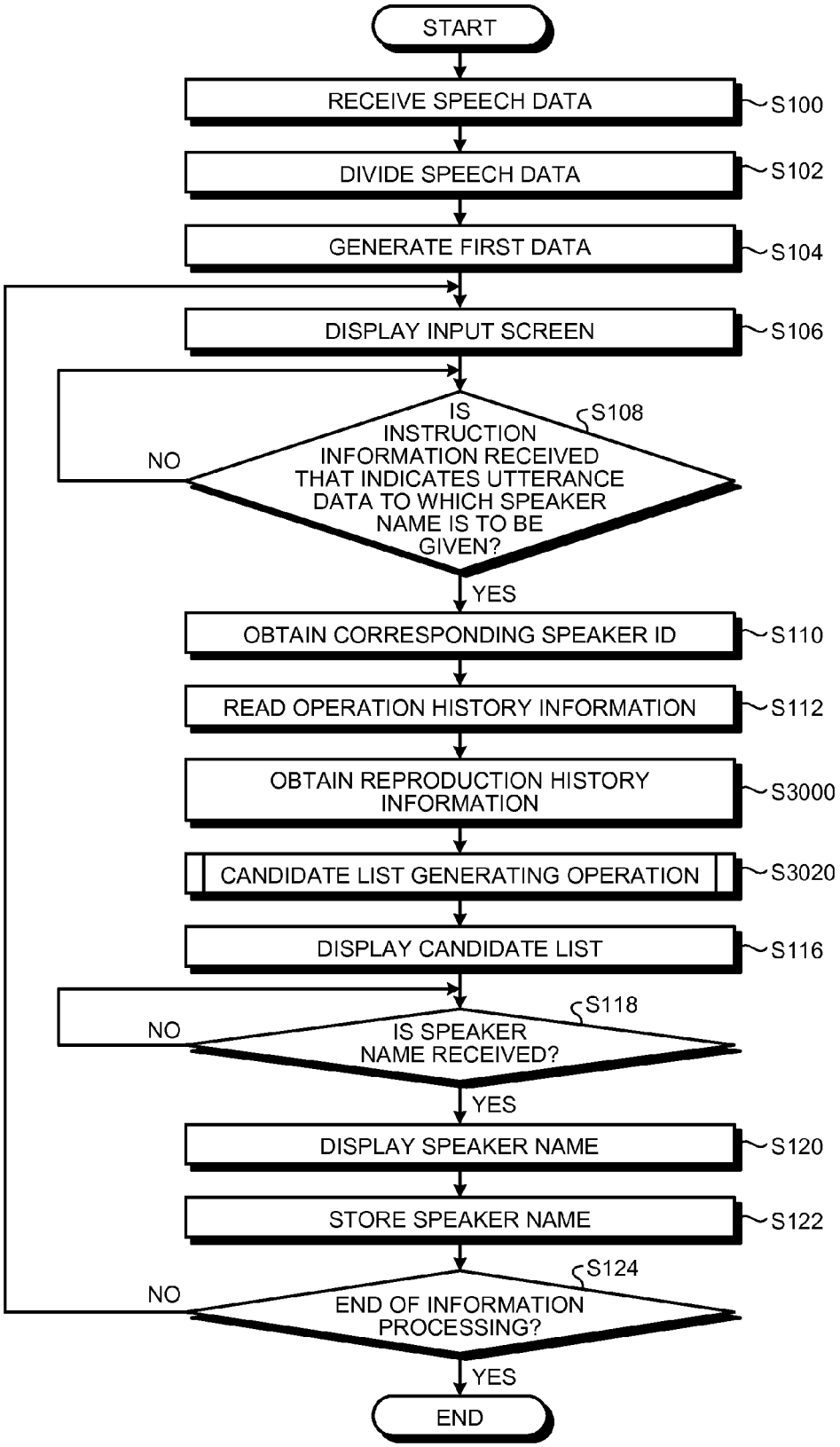

START
RECEIVE SPEECH DATA
S100
DIVIDE SPEECH DATA
S102
GENERATE FIRST DATA
S104
DISPLAY INPUT SCREEN
S106
IS INSTRUCTION INFORMATION RECEIVED THAT INDICATES UTTERANCE DATA TO WHICH SPEAKER NAME IS TO BE GIVEN?
S108
NO
YES
OBTAIN CORRESPONDING SPEAKER ID
S110
READ OPERATION HISTORY INFORMATION
S112
OBTAIN REPRODUCTION HISTORY INFORMATION
S3000
CANDIDATE LIST GENERATING OPERATION
S3020
DISPLAY CANDIDATE LIST
S116
IS SPEAKER NAME RECEIVED?
S118
NO
YES
DISPLAY SPEAKER NAME
S120
STORE SPEAKER NAME
S122
END OF INFORMATION PROCESSING?
S124
NO
YES
END

FIG.27

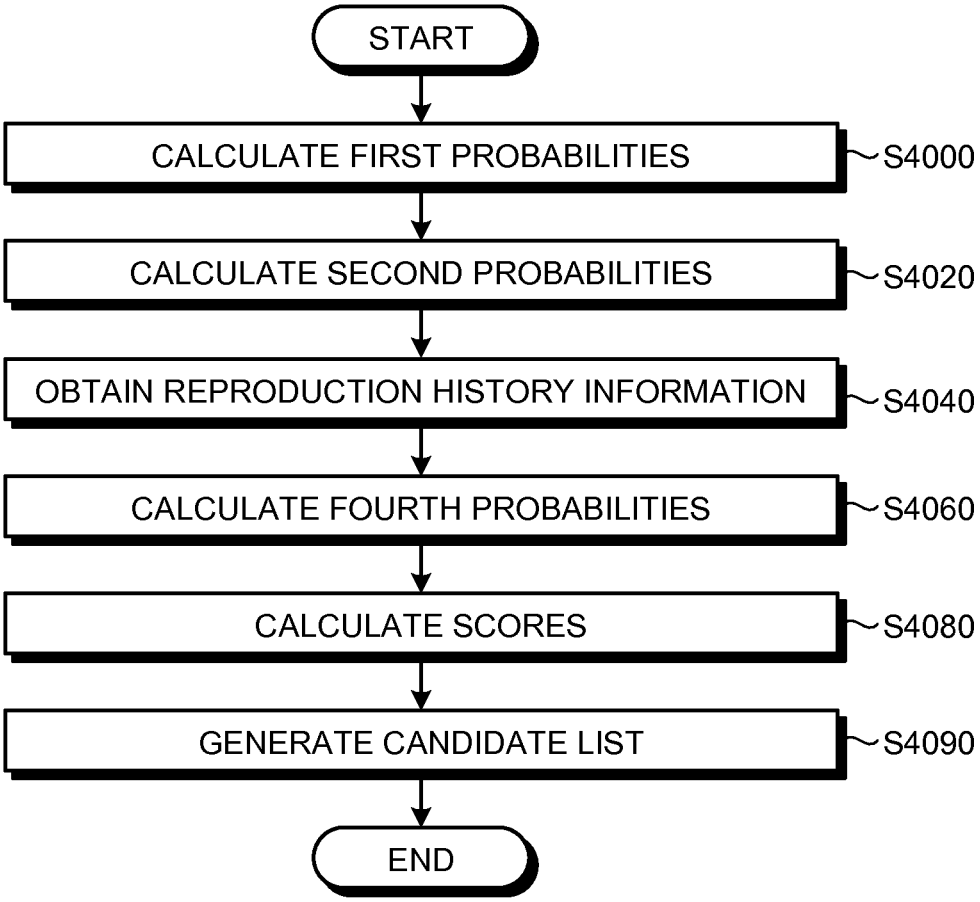

START
CALCULATE FIRST PROBABILITIES
S4000
CALCULATE SECOND PROBABILITIES
S4020
OBTAIN REPRODUCTION HISTORY INFORMATION
S4040
CALCULATE FOURTH PROBABILITIES
S4060
CALCULATE SCORES
S4080
GENERATE CANDIDATE LIST
S4090
END

FIG.28

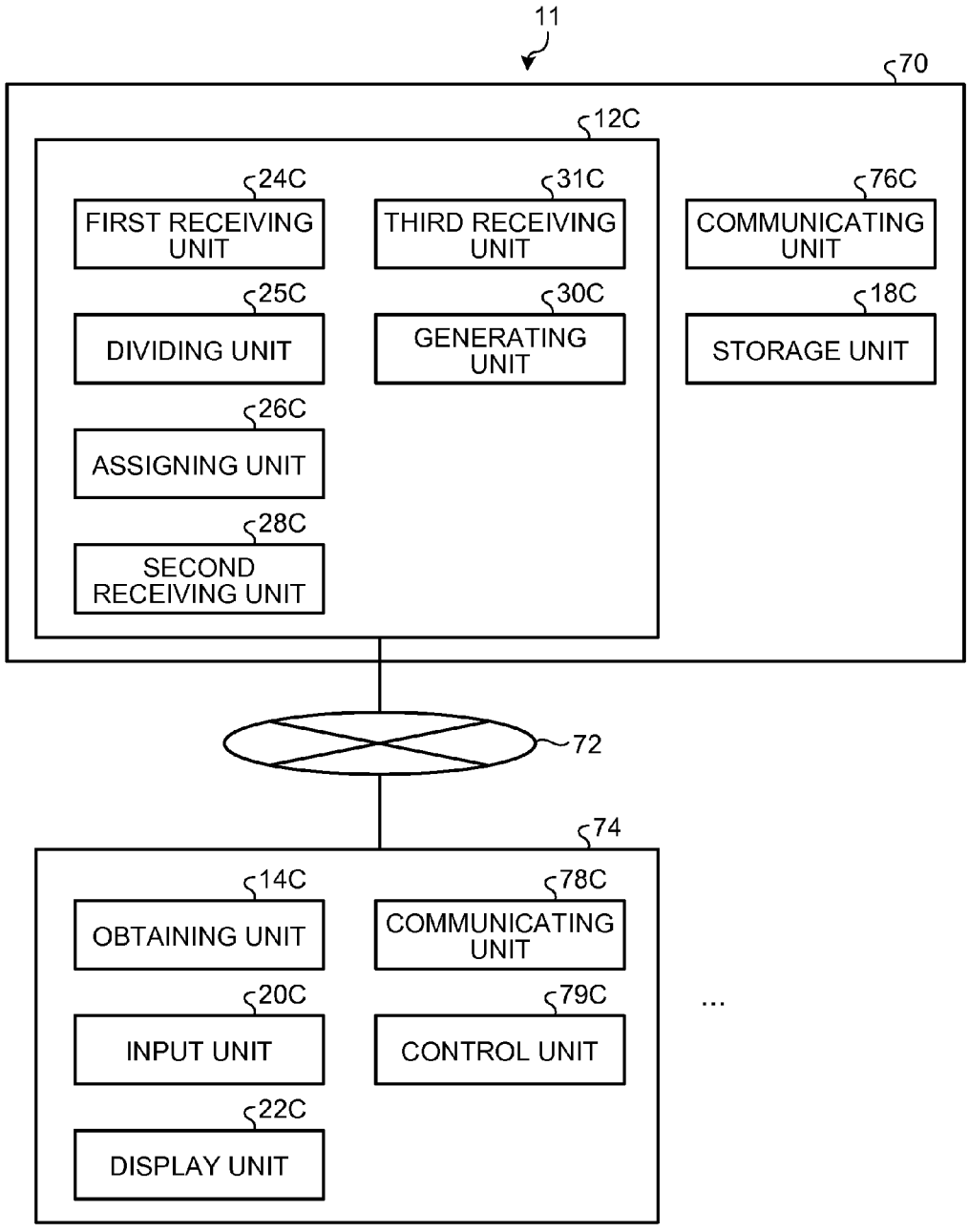

11
70
12C
24C
FIRST RECEIVING UNIT
31C
THIRD RECEIVING UNIT
76C
COMMUNICATING UNIT
25C
DIVIDING UNIT
30C
GENERATING UNIT
18C
STORAGE UNIT
26C
ASSIGNING UNIT
28C
SECOND RECEIVING UNIT
72
74
14C
OBTAINING UNIT
78C
COMMUNICATING UNIT
20C
INPUT UNIT
79C
CONTROL UNIT
22C
DISPLAY UNIT
...

FIG.29

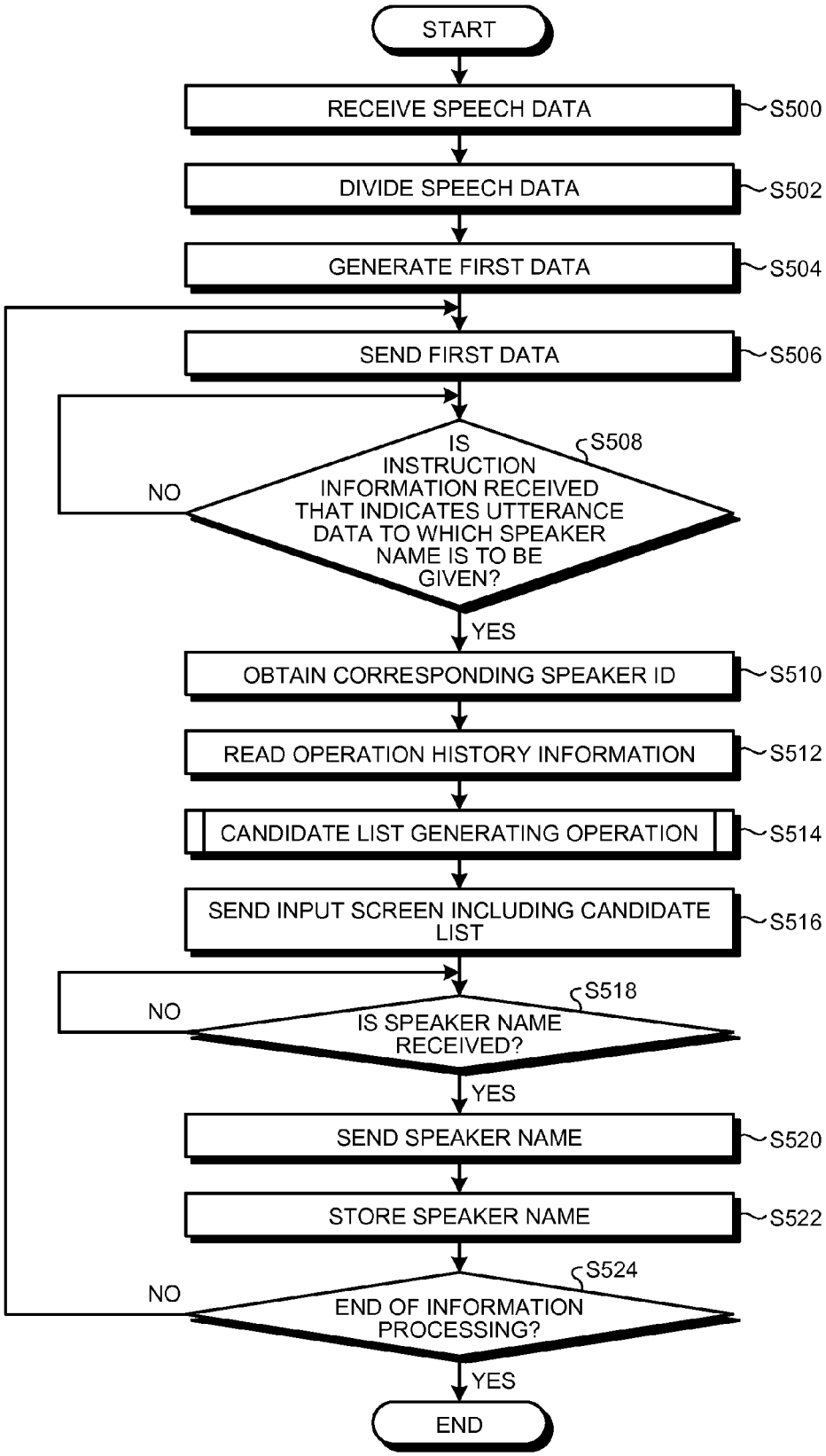
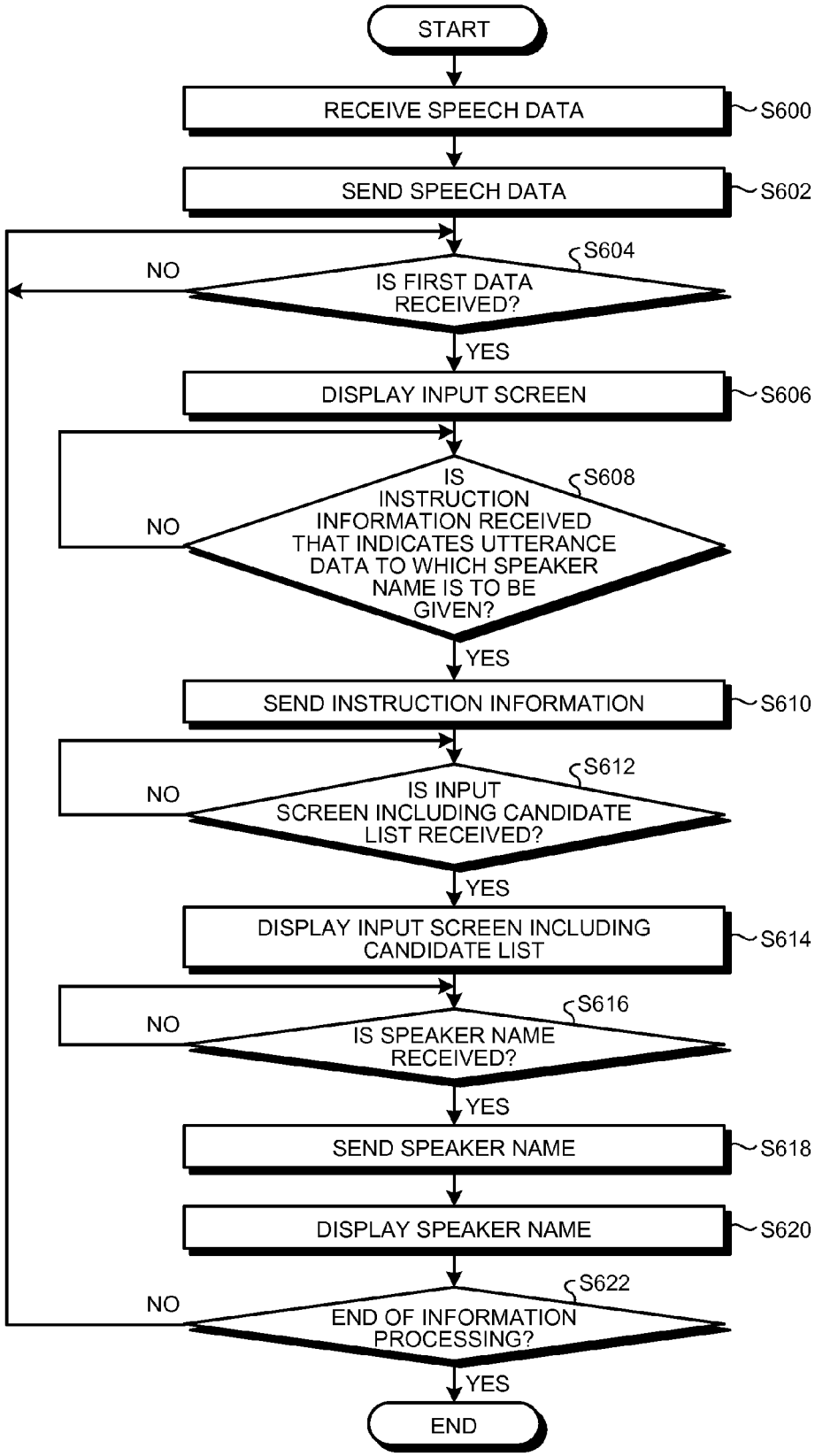

START
RECEIVE SPEECH DATA
S500
DIVIDE SPEECH DATA
S502
GENERATE FIRST DATA
S504
SEND FIRST DATA
S506
IS INSTRUCTION INFORMATION RECEIVED THAT INDICATES UTTERANCE DATA TO WHICH SPEAKER NAME IS TO BE GIVEN?
S508
NO
YES
OBTAIN CORRESPONDING SPEAKER ID
S510
READ OPERATION HISTORY INFORMATION
S512
CANDIDATE LIST GENERATING OPERATION
S514
SEND INPUT SCREEN INCLUDING CANDIDATE LIST
S516
IS SPEAKER NAME RECEIVED?
S518
NO
YES
SEND SPEAKER NAME
S520
STORE SPEAKER NAME
S522
END OF INFORMATION PROCESSING?
S524
NO
YES
END

FIG.30


START
RECEIVE SPEECH DATA
S600
SEND SPEECH DATA
S602
S604
NO
IS FIRST DATA RECEIVED?
YES
DISPLAY INPUT SCREEN
S606
S608
IS INSTRUCTION INFORMATION RECEIVED THAT INDICATES UTTERANCE DATA TO WHICH SPEAKER NAME IS TO BE GIVEN?
NO
YES
SEND INSTRUCTION INFORMATION
S610
S612
IS INPUT SCREEN INCLUDING CANDIDATE LIST RECEIVED?
NO
YES
DISPLAY INPUT SCREEN INCLUDING CANDIDATE LIST
S614
S616
IS SPEAKER NAME RECEIVED?
NO
YES
SEND SPEAKER NAME
S618
DISPLAY SPEAKER NAME
S620
S622
END OF INFORMATION PROCESSING?
NO
YES
END

INFORMATION PROCESSING APPARATUS, COMPUTER PROGRAM PRODUCT, AND INFORMATION PROCESSING METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2012-179023, filed on Aug. 10, 2012; the entire contents of which are incorporated herein by reference.

FIELD

[0002] Embodiments described herein relate generally to an information processing apparatus, a computer program product, and an information processing method.

BACKGROUND

[0003] Typically, speech data containing utterance data of a plurality of speakers is reproduced. Then, a user writes down the utterance data of each speaker in the form of a text and gives a speaker name of the corresponding speaker to each piece of utterance data. Moreover, there is also known a device that supports the user in the task of setting speaker names.

[0004] For example, a typical device classifies the speech data on the basis of speech features. Then, for each piece of speech data that is obtained by classification, the typical device assigns arbitrary speaker identification information and outputs the pieces of speech data so as to support the user in the task of setting speaker names. Moreover, in a typical device; speaker information, customer names, and speech data are stored in a corresponding manner on a customer-by-customer basis. Then, the typical device compares the speech data included in newly-received speaker information with the speech data that has been stored in advance, and accordingly displays a list of customers corresponding to the speech data having a high degree of phonetic similarity. Then, the user selects a customer name from the displayed list and gives a customer name to the speech data to which a customer name is to be given.

[0005] However, there are times when the speech features of speech data change according to the physical condition of the speaker. For that reason, there are times when the speaker identification information or the customer name obtained from the speech features or from the degree of phonetic similarity is different than the speaker corresponding to the utterance data to which a speaker name is to be given. That results in a lack of accuracy. As a result, there are times when it takes a lot of effort by the user to correct the speaker identification information that has been displayed or to correct the customer name that has been displayed. In this way, typically, it has been difficult to provide information that easily enables giving a speaker name to the utterance data to which a speaker name is to be given.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** is a block diagram of an information processing system according to a first embodiment;

[0007] FIG. **2** is a schematic diagram illustrating an exemplary data structure of first data;

[0008] FIG. **3** is a schematic diagram illustrating an exemplary data structure of operation history information;

[0009] FIG. **4** is schematic diagram illustrating an exemplary input screen;

[0010] FIG. **5** is an explanatory diagram for explaining first probabilities;

[0011] FIG. **6** is an explanatory diagram for explaining second probabilities;

[0012] FIG. **7** is an explanatory diagram for explaining score calculation performed according to the first embodiment;

[0013] FIG. **8** is a schematic diagram illustrating an exemplary data structure of a candidate list;

[0014] FIG. **9** is a schematic diagram illustrating an exemplary setting screen;

[0015] FIG. **10** is a schematic diagram illustrating an exemplary setting screen;

[0016] FIG. **11** is a schematic diagram of an exemplary data structure of the operation history information;

[0017] FIG. **12** is a schematic diagram illustrating an example of the candidate list;

[0018] FIG. **13** is a schematic diagram illustrating a display form of the candidate list;

[0019] FIG. **14** is a schematic diagram illustrating a display form of the candidate list;

[0020] FIG. **15** is a flowchart illustrating a sequence of operations performed according to the first embodiment;

[0021] FIG. **16** is a schematic diagram illustrating an exemplary input screen;

[0022] FIG. **17** is a flowchart for explaining a sequence of operations performed during a candidate list generating operation according to the first embodiment;

[0023] FIG. **18** is a block diagram of an information processing system according to a second embodiment;

[0024] FIG. **19** is an explanatory diagram for explaining third probabilities;

[0025] FIG. **20** is an explanatory diagram for explaining score calculation performed according to the second embodiment;

[0026] FIG. **21** is a flowchart illustrating a sequence of operations performed according to the second embodiment;

[0027] FIG. **22** is a flowchart for explaining a sequence of operations performed during a candidate list generating operation according to the second embodiment;

[0028] FIG. **23** is a block diagram of an information processing system according to a third embodiment;

[0029] FIG. **24** is an explanatory diagram for explaining fourth probabilities;

[0030] FIG. **25** is an explanatory diagram for explaining score calculation performed according to the third embodiment;

[0031] FIG. **26** is a flowchart illustrating a sequence of operations performed according to the third embodiment;

[0032] FIG. **27** is a flowchart for explaining a sequence of operations performed during a candidate list generating operation according to the third embodiment;

[0033] FIG. **28** is a schematic diagram of an information processing system according to a fourth embodiment;

[0034] FIG. **29** is a flowchart for explaining a sequence of operations performed according to the fourth embodiment; and

[0035] FIG. **30** is a flowchart for explaining a sequence of operations performed according to the fourth embodiment.

DETAILED DESCRIPTION

[0036] According to an embodiment, an information processing apparatus includes a first receiving unit, a dividing unit, an assigning unit, a second receiving unit, and a generating unit. The first receiving unit is configured to receive speech data containing pieces of utterance data of speakers. The dividing unit is configured to divide the speech data into the pieces of utterance data. The assigning unit is configured to assign speaker identification information to each piece of utterance data based on an acoustic feature of the each piece of utterance data. The second receiving unit is configured to receive, from a user, instruction information that indicates a piece of utterance data to which a speaker name is to be given from among the pieces of utterance data included in the speech data. The generating unit is configured to generate a candidate list that indicates candidate speaker names so as to enable the user to determine a speaker name to be given to the piece of utterance data identified by the instruction information, based on operation history information in which at least pieces of utterance identification information for identifying the respective pieces of utterance data, pieces of the speaker identification information that has been assigned to the respective pieces of utterance data, and speaker names given by the user to the respective pieces of utterance data identified by the pieces of speaker identification information are associated with one another.

[0037] Exemplary embodiments of an information processing apparatus, a computer program product, and an information processing method are described in detail with reference to the accompanying drawings.

First Embodiment

[0038] FIG. **1** is a block diagram illustrating a functional configuration of an information processing system **10** according to a first embodiment. The information processing system **10** includes an obtaining unit **14**, an input unit **20**, a display unit **22**, an information processing apparatus **12**, and a storage unit **18**.

[0039] In the first embodiment, the explanation is given for a case in which the information processing system **10** includes the information processing apparatus **12**, the obtaining unit **14**, the input unit **20**, the display unit **22**, and the storage unit **18** as separate constituent elements. However, alternatively, the information processing system **10** can include the information processing apparatus **12** that is configured in an integrated manner with at least one of the obtaining unit **14**, the input unit **20**, the display unit **22**, and the storage unit **18**.

[0040] The obtaining unit **14** obtains speech data. Thus, the obtaining unit **14** can be any device that is capable of obtaining speech data. For example, the obtaining unit **14** can be a known microphone.

[0041] The speech data contains utterance data of one or more speakers. Herein, a particular piece of utterance data points to the speech data uttered by a particular speaker, and is chronologically continuous in nature until separated by the speech data of another speaker.

[0042] The input unit **20** receives input of various instructions from the user. The input unit **20** can be configured, for example, by combining one or more of a mouse, buttons, a remote control, a keyboard, a voice recognition device such as a microphone, and an image recognition device.

[0043] The display unit **22** is a device for displaying various images. Herein, a known display device such as a liquid crystal display device is used as the display unit **22**.

[0044] Meanwhile, it is also possible to configure the input unit **20** in an integrated manner with the display unit **22**. More particularly, the input unit **20** and the display unit **22** can be configured in an integrated manner as a user interface (UI) unit **16** that is equipped with the input function as well as the display function. The UI unit **16** can be, for example, a liquid crystal display (LCD) having a touch-sensitive panel.

[0045] The storage unit **18** is a memory medium such as a hard disk drive (HDD). The storage unit **18** is used to store a variety of data such as speech data, first data, and operation history information.

[0046] FIG. **2** is a schematic diagram illustrating an exemplary data structure of the first data. Herein, the first data represents a table in which utterance identification information (hereinafter, referred to as "utterance IDs"), start timings and end timings, and speaker identification information (hereinafter, referred to as "speaker IDs") are held in a corresponding manner. The first data is created by the information processing apparatus **12** (described later in detail).

[0047] The utterance IDs represent the information that enables unique identification of the pieces of utterance data which are included in speech data. Moreover, the utterance IDs indicate the chronological sequence of the pieces of utterance data included in speech data. In the first embodiment, the explanation is given for a case in which the information processing apparatus **12** assigns, as utterance IDs, numbers in ascending order starting from the leading piece of utterance data in the speech data toward the last piece of utterance data in the speech data. The start timings and the end timings indicate the positions of the respective pieces of utterance data in the speech data. The speaker IDs represent the information that enables unique identification of the speakers. Herein, the utterance IDs and the speaker IDs are assigned by the information processing apparatus **12** (described later in detail).

[0048] The operation history information indicates the history of giving speaker names to the utterance data by the user. Every time the user gives a speaker name to a piece of utterance data, the information processing apparatus **12** updates the operation history information.

[0049] FIG. **3** is a schematic diagram illustrating an exemplary data structure of the operation history information. As illustrated in FIG. **3**, more particularly, the operation history information represents a table in which the utterance IDs, the speaker IDs, and the speaker names are held in a corresponding manner. In the operation history information, the utterance IDs and the speaker IDs represent the information assigned by the information processing apparatus (described later); while the speaker names represent the information that is set by the user to the pieces of utterance data as the information indicating the speakers corresponding to the pieces of utterance data.

[0050] In the exemplary operation history information illustrated in FIG. **3**, the user has given a speaker name to each of utterance IDs "1" to "4" that are chronologically continuous in nature.

[0051] Returning to the explanation with reference to FIG. **1**, the information processing apparatus **12** supports the user in giving the speaker names.

[0052] As for the brief overview, for example, the information processing apparatus **12** displays an input screen on the

display unit **22** so as to enable giving a speaker name to each piece of utterance data included in the speech data. FIG. **4** is schematic diagram illustrating an example of the input screen that is used by the user to give the speaker names.

[0053] As illustrated in FIG. **4**, for example, an input screen **50** includes a reproducing screen **52** and a setting screen **54**. The reproducing screen **52** includes a reproduction state of the speech data and includes the speaker names that have already been set to the pieces of utterance data included in the speech data. The setting screen **54** includes a list of pieces of utterance data that are included in the speech data; includes an entry field for entering speaker names; and includes an entry field for entering uttered contents. If a speaker name is already given by the user, then that speaker name is displayed in the entry field for entering speaker names. If any uttered contents are already set by the user or are retrieved as text data from the utterance data, then those uttered contents are displayed in the entry field for entering uttered contents. Meanwhile, in FIG. **4**, an item "start timing" indicates the start timing of each piece of utterance data included in the speech data.

[0054] The user operates the input unit **20** and selects a piece of utterance data to which a speaker name is to be given (in FIG. **4**, for example, selects the start timing "0:00:10"). Then, the user inputs a speaker name in an entry field **56**A that is the entry field for entering speaker names. At that time, in the information processing apparatus **12** according to the first embodiment, a candidate list **56**B containing the candidate speaker names is displayed to enable the user to select a speaker name. With that, the information processing apparatus **12** according to the first embodiment supports the user in giving the speaker name. According to the first embodiment, the information processing apparatus **12** generates a peculiar candidate list. The detailed explanation is given below.

[0055] Returning to the explanation with reference to FIG. **1**, the information processing apparatus **12** has the hardware configuration of a commonly-used computer in which a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), and an HDD are connected to each other via a bus.

[0056] The information processing apparatus **12** includes a first receiving unit **24**, a dividing unit **25**, an assigning unit **26**, a second receiving unit **28**, a third receiving unit **31**, a generating unit **30**, and a first control unit **32**.

[0057] The first receiving unit **24** receives speech data from the obtaining unit **14**. In the first embodiment, although the explanation is given for a case in which the first receiving unit **24** receives speech data from the obtaining unit **14**, it is not the only possible case of receiving speech data. Alternatively, for example, the first receiving unit **24** can receive speech data from an external device or an external memory medium via a communicating unit (not illustrated). Then, the first receiving unit **24** stores the speech data in the storage unit **18**. Herein, the speech data can also be stored in advance in the storage unit **18**.

[0058] The dividing unit **25** divides the speech data, which is received by the first receiving unit **24**, into a plurality of pieces of utterance data. For example, the dividing unit **25** analyzes the speech data in sequence from the start; identifies a range in which speech data belonging to a predetermined range of acoustic features is present in a continuous manner as a single piece of utterance data; and accordingly divides the speech data into a plurality of pieces of utterance data. Herein, the acoustic features are identified using a known technology.

[0059] The assigning unit **26** assigns a speaker ID to each piece of utterance data, which is obtained by the dividing unit **25** by dividing the speech data, based on the corresponding acoustic features. More particularly, the assigning unit **26** classifies the pieces of utterance data, which are obtained by the dividing unit **25** by dividing the speech data, into groups each belonging to a predetermined range of acoustic features. Then, to each such group, the assigning unit **26** assigns a speaker ID that represents unique identification information of that group. With that, the assigning unit **26** generates the first data mentioned above, and then stores the first data in the storage unit **18**. Meanwhile, such acoustic-feature-based classification is performed by combining one or more of a known acoustic feature quantity extraction technology, a known voice/non-voice determination technology, a known speaker classification technology, a known voice recognition technology, and a known linguistic processing technology.

[0060] The first control unit **32** performs control to display various screens such as input screens on the display unit **22**.

[0061] The second receiving unit **28** receives, from the user, instruction information that indicates the piece of utterance data to which a speaker name is to be given from among a plurality of pieces of utterance data that are included in the speech data. The instruction information contains, for example, the utterance ID of the utterance data to which a speaker name is to be given. More specifically, the user operates the input unit **20** and, from among a plurality of pieces of utterance data that are included in the speech data, specifies the piece of utterance data to which a speaker name is to be given. As a result, the input unit **20** sends the information indicating the specified utterance data to the second receiving unit **28**. That is, the second receiving unit **28** receives the information indicating the specified utterance data from the input unit **20**, and obtains the instruction information indicating the utterance data to which a speaker name is to be given.

[0062] More particularly, the first control unit **32** displays a list of pieces of utterance data, which are included in the speech data, on the display unit **22**. As long as the list of pieces of utterance data indicates the information enabling identification of utterance data, it serves the purpose. For example, the list of pieces of utterance data can contain the position (the start timing or the end timing) of each piece of utterance data in the speech data. Then, on the display unit **22**, the first control unit **32** displays a message that prompts the user to specify the utterance data to which a speaker name is to be given from the list of pieces of utterance data that is displayed. When the user operates the input unit **20** and selects the utterance data to which a speaker name is to be given, the input unit **20** sends the instruction information, which contains the utterance ID of the utterance data to which a speaker name is to be given, to the second receiving unit **28**.

[0063] Meanwhile, as the instruction information indicating the utterance data to which a speaker name is to be given, it is also possible to use information other than an utterance ID. For example, the instruction information can indicate the position (the timing) of the user-selected utterance data in the speech data. In that case, from the first data, the second receiving unit **28** obtains the utterance ID of the utterance data corresponding to the timing specified in the instruction information as the utterance ID of the utterance data to which a speaker name is to be given.

[0064] Meanwhile, without the first control unit **32** displaying a list of pieces of utterance data, the second receiving unit **28** can receive the utterance data to which a speaker name is

to be given from the user. In that case, the first control unit **32** displays a message that prompts the user to specify the utterance data to which a speaker name is to be given. Then, the user can operate the input unit **20** and input instruction information indicating the utterance data to which a speaker name is to be given.

[0065] When the second receiving unit **28** receives the instruction information indicating the utterance data to which a speaker name is to be given, the generating unit **30** generates a candidate list based on the operation history information. The candidate list contains the candidate speaker names from which the user can select a speaker name to be given to the utterance data that is identified by the utterance ID specified in the instruction information which is received by the second receiving unit **28**.

[0066] In the first embodiment, the generating unit **30** generates a candidate list that indicates the correspondence between the candidate speaker names and the probability at which each speaker name specified in the operation history information is given to the utterance data that is identified by the instruction information.

[0067] Regarding the probability at which each candidate speaker name is given to the utterance data to which a speaker name is to be given; numbers are used in such a way that, for example, higher the probability, higher is the priority indicated by the corresponding number.

[0068] Meanwhile, the generating unit **30** includes a first calculating unit **34**, a second calculating unit **36**, and a third calculating unit **38**.

[0069] The first calculating unit **34** calculates first probabilities based on the operation history information. Herein, the first probabilities indicate, from the correspondence relationship between speaker IDs and speaker names specified in the operation history information, the probabilities at which the speaker names are associated with the speaker IDs. In other words, for each speaker ID specified in the operation history information, the first probability indicates the probability at which the utterance data identified by the utterance ID corresponding to that speaker ID is given the speaker name corresponding to that speaker ID by the user. More particularly, from the operation history information, the first calculating unit **34** reads the correspondence relationship between the speaker IDs and the speaker names. Then, with respect to each speaker ID that has been read, the first calculating unit **34** calculates the first probability at which the corresponding speaker name is given.

[0070] Herein, assume that the operation history information is in the state illustrated in FIG. **3**. In that case, a speaker ID "A" every time has a speaker name "presenter" corresponding thereto; a speaker ID "B" has a speaker name "journalist" corresponding thereto; and a speaker ID "C" has a speaker name "leading performer" corresponding thereto. FIG. **5** is an explanatory diagram for explaining the first probabilities. Assume that the operation history information is in the state illustrated in FIG. **3**. Then, with respect to the piece of utterance data having the utterance ID "1" and the piece of utterance data having the utterance ID "4" that correspond to the speaker ID "A"; the first calculating unit **34** calculates "1.0" as the first probability that indicates the probability at which the user has given the speaker name "presenter". Similarly, with respect to the utterance data having the utterance ID "2" corresponding to the speaker ID "B", the first calculating unit **34** calculates "1.0" as the first probability that indicates the probability at which the user has given the speaker name "journalist". Moreover, with respect to the utterance data having the utterance ID "3" corresponding to the speaker ID "C", the first calculating unit **34** calculates "1.0" as the first probability that indicates the probability at which the user has given the speaker name "leading performer".

[0071] Meanwhile, for example, assume that the operation history information contains the history indicating that "presenter" is the speaker name corresponding to the speaker ID "A" as well as contains the history indicating that "journalist" is the speaker name corresponding to the speaker ID "A". In this case, with respect to the utterance data having the utterance ID corresponding to the speaker ID "A", the first calculating unit **34** calculates "0.5" as the first probability that indicates the probability at which the user has given the speaker name "presenter". Similarly, with respect to the utterance data having the utterance ID corresponding to the speaker ID "A", the first calculating unit **34** calculates "0.5" as the first probability that indicates the probability at which the user has given the speaker name "journalist".

[0072] Returning to the explanation with reference to FIG. **1**, the second calculating unit **36** calculates second probabilities. Herein, a second probability indicates the probability at which each speaker name specified in the operation history information is given subsequent to the speaker name that corresponds to chronologically previous piece of utterance data.

[0073] Assume that the operation history information is in the state illustrated in FIG. **3**. FIG. **6** is an explanatory diagram for explaining the second probabilities. When the operation history information is in the state illustrated in FIG. **3**, the utterance ID "2" has the speaker name "journalist" corresponding thereto. Moreover, the utterance ID "1", which points to the previous piece of utterance data to the utterance data having the utterance ID "2", has the speaker name "presenter" corresponding thereto. Furthermore, in the operation history information, only the utterance ID "2" is set as the utterance ID corresponding to the speaker name "journalist". For that reason, the second calculating unit **36** calculates "1.0" as the second probability that indicates the probability at which "presenter" is given as the speaker name to the previous piece of utterance data to the utterance data that is identified by the utterance ID corresponding to the speaker name "journalist" (i.e., in FIG. **6**, the utterance data in "subsequent" section).

[0074] That is, as illustrated in FIG. **6**, regarding the speaker name "presenter" that is specified in "previous" section and that corresponds to the speaker name "journalist" specified in "subsequent" section, the second probability becomes "1.0".

[0075] Moreover, the second calculating unit **36** calculates "0" as the second probabilities that indicates the probabilities at which "journalist" and "leading performer" are given as the speaker names to the previous piece of utterance data to the utterance data identified by the utterance ID corresponding to the speaker name "journalist" (i.e., in FIG. **6**, utterance data in "subsequent" section).

[0076] As illustrated in FIG. **6**, regarding the speaker names "journalist" and "leading performer" that are specified in "previous" section and that correspond to the speaker name "journalist" specified in "subsequent" section, the second probabilities become "0".

[0077] In an identical manner, regarding each speaker name (such as "presenter", "journalist", and "leading performer")

that is specified in the operation history information, the second calculating unit **36** calculates the second probability (see FIG. **6**).

[0078] Meanwhile, in FIG. **6**, "<new>" indicates a case in which, as against the speaker name given to the previous piece of utterance data, the speaker name given to the next piece of utterance data is a new speaker name that is different than the already-given speaker names which are specified in the operation history information. Regarding "<new>" too, the second calculating unit **36** calculates the second probability in an identical manner.

[0079] In the first embodiment, the explanation is given for a case in which the first calculating unit **34** and the second calculating unit **36** respectively calculate the first probabilities and the second probabilities by referring to all of the information specified in the operation history information. However, that is not the only possible case.

[0080] For example, with respect to the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given, the first calculating unit **34** and the second calculating unit **36** can respectively calculate the first probabilities and the second probabilities by referring to the operation history information of a predetermined number of pieces of utterance data that are chronologically earlier in the speech data. Alternatively, with respect to the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given, the first calculating unit **34** and the second calculating unit **36** can respectively calculate the first probabilities and the second probabilities by referring to the operation history information of the utterance IDs of a predetermined number of pieces of utterance data that are in chronological sequence before and after the utterance data to which a speaker name is to be given.

[0081] Returning to the explanation with reference to FIG. **1**, the third calculating unit **38** calculates a score for each speaker name specified in the operation history information. Herein, a score indicates the likelihood at which the corresponding speaker name that is specified in the operation history information is given by the user to the utterance data to which a speaker name is to be given as indicated by the instruction information. Thus, a speaker name having a higher score is more likely to be given to the utterance data to which a speaker name is to be given.

[0082] The third calculating unit **38** calculates the scores based on the following information: the instruction information that is received by the second receiving unit **28** and that indicates the utterance data to which a speaker name is to be given; the first probabilities calculated by the first calculating unit **34**; and the second probabilities calculated by the second calculating unit **36**.

[0083] More particularly, from the first data, the third calculating unit **38** the speaker ID corresponding to the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given. Then, from among the first probabilities calculated by the first calculating unit **34**, the third calculating unit **38** reads the speaker name and the first probability corresponding to the speaker ID that corresponds to the utterance ID which has been read.

[0084] Herein, it is assumed that, for each speaker ID, the first calculating unit **34** calculates the first probability as illustrated in FIG. **5**. Moreover, it is assumed that the utterance ID "5" in the first data illustrated in FIG. **2** is the utterance ID of the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given. In that case, in the first data, "D" represents the speaker ID corresponding to the utterance ID "5". However, in FIG. **5**, there is no mention of the first probability corresponding to the utterance ID "5". For that reason, the third calculating unit **38** reads "0" as the first probability corresponding to each of the speaker names "presenter", "journalist", and "leading performer" that correspond to the utterance ID "5".

[0085] FIG. **7** is an explanatory diagram for explaining the score calculation performed by the third calculating unit **38**. As illustrated in FIG. **7**, the third calculating unit **38** reads, as a target for score calculation, the first probability "0" corresponding to each of the speaker names ("presenter", "journalist", and "leading performer") specified in the operation history information. Moreover, the third calculating unit **38** reads, as a target for score calculation, the first probability "1.0" at which a new speaker name is given.

[0086] Herein, assume that the second calculating unit **36** calculates the second probabilities illustrated in FIG. **6**. Moreover, assume that the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given has the utterance ID "5". In this case, from the operation history information, the third calculating unit **38** reads the speaker name corresponding to the utterance ID "4" of the previous piece of utterance data. When the operation history information is in the state illustrated in FIG. **3**, the third calculating unit **38** reads the speaker name "presenter" corresponding to the utterance ID "4". Then, in the case when the previous piece of utterance data has the speaker name "presenter"; the third calculating unit **38** reads, as targets for score calculation, the second probabilities that are set subsequently to the speaker names specified in the operation history information from among the second probabilities calculated by the second calculating unit **36**.

[0087] More particularly, in the case when the previous piece of utterance data has the speaker name "presenter"; the third calculating unit **38** reads, as targets for score calculation from among the second probabilities illustrated in FIG. **6**, the second probabilities of "0", "1.0", "0", and "1.0" that are set subsequently to the speaker names ("presenter", "journalist", "leading performer", and a new speaker name "<new>", respectively) specified in the operation history information (see FIG. **7**).

[0088] Then, as the score corresponding to each speaker name, the third calculating unit **38** calculates the added value of the first probability and the second probability corresponding to that speaker name (see FIG. **7**).

[0089] Although, as the score corresponding to each speaker name, the third calculating unit **38** calculates the added value of the first probability and the second probability, that is not the only possible case. Alternatively, for example, as the score corresponding to each speaker name, the third calculating unit **38** can calculate a value obtained by firstly multiplying the first probability and the second portability corresponding to that speaker name with a predetermined weight coefficient and then adding the first probability and the second probability.

[0090] Besides, to the added value of the first probability and the second probability, the third calculating unit **38** can further add higher values in descending order of usage frequency of the speaker names or can add higher values in ascending order of periods in which no speaker name is set, and calculate the added value as the score.

[0091] Returning to the explanation with reference to FIG. **1**, the generating unit **30** selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**, and generates a candidate list in which the selected speaker names are listed as candidate speaker names. Herein, the predetermined number can be equal to or greater than one. For example, the generating unit **30** can set in advance two or three as the predetermined number.

[0092] Herein, for example, assume that the third calculating unit **38** calculates the scores illustrated in FIG. **7** as the scores of the speaker names that have already been given by the user. In this case, the generating unit **30** reads, for example, two speaker names ("<new>" and "journalist") in descending order of the scores. Then, the generating unit **30** generates a candidate list in which the selected speaker names are listed as candidate speaker names.

[0093] Alternatively, the generating unit **30** can generate a candidate list in which the speaker names reordered according to descending order of the scores, which are calculated by the third calculating unit **38**, serve as the candidate speaker names. FIG. **8** is a schematic diagram illustrating an exemplary data structure of the candidate list. Assume that the third calculating unit **38** calculates the scores illustrated in FIG. **7** as the scores of the speaker names that have already been given by the user. In this case, the generating unit **30** assigns priority in descending order of scores illustrated in FIG. **7**. Then, as illustrated in FIG. **8**, the generating unit **30** generates a candidate list in which the speaker names are reordered in descending order of priority.

[0094] Returning to the explanation with reference to FIG. **1**, the first control unit **32** performs control so as to display the candidate list, which is generated by the generating unit **30**, in an entry field for entering the speaker name that corresponds to the utterance data identified by the utterance ID which is specified in the instruction information of the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given.

[0095] FIG. **9** is a schematic diagram illustrating an example of a setting screen **54**A that is displayed on the input screen used in giving speaker names. In the example illustrated in FIG. **9**, a setting screen is illustrated in which speaker names have already been given to the pieces of utterance data having the start timings "0:00:00", "0:00:05", "0:00:11", and "0:00:18" in the speech data. Moreover, in the example illustrated in FIG. **9**, a case is illustrated in which the utterance data having the start timing "0:00:20" is specified by the user as the utterance data to which a speaker name is to be given. Herein, it is assumed that the utterance data having the start timing "0:00:20" is same as the utterance data having the utterance ID "5" in the first data illustrated in FIG. **2**.

[0096] Assume that the operation history information is in the state illustrated in FIG. **3**. In this case, as described above, the generating unit **30** generates the candidate list illustrated in FIG. **8**. Hence, as illustrated in FIG. **9**, the first control unit **32** displays a candidate list **58**B in an entry field **58**A, which is used to enter the speaker name of the utterance data that is specified by the user by operating the input unit **20** as the utterance data to which a speaker name is to be given (i.e., the utterance data having the start timing "0:00:20"), in the setting screen **54**A. Meanwhile, the first control unit **32** can display the candidate list **58**B when a pointer T displayed on the display unit **22** is positioned on the entry field **58**A as a result of a user operation of the input unit **20**.

[0097] Returning to the explanation with reference to FIG. **1**, the third receiving unit **31** receives, from the input unit **20**, the speaker name given by the user to the utterance data to which a speaker name is to be given. Herein, the user operates the input unit **20** and selects a speaker name from the candidate list (in FIG. **9**, from the candidate list **58**B). In the case when the speaker name "<new>" is selected, the input unit **20** receives the input of the speaker name. Then, the input unit **20** sends the speaker name that is either input or selected by the user to the third receiving unit **31**. Thus, by receiving the speaker name input by the user from the input unit **20**, the third receiving unit **31** receives from the user the speaker name corresponding to the utterance data to which a speaker name is to be given.

[0098] FIG. **10** is a schematic diagram illustrating an example of a setting screen **54**B. Herein, it is assumed that, in the setting screen **54**A illustrated in FIG. **9**, the speaker name "journalist" is selected from the candidate list **58**B as a result of a user operation of the input unit **20**. In this case, as illustrated in FIG. **10**, the first control unit **32** displays "journalist" as the speaker name corresponding to the utterance data having the start timing "0:00:20".

[0099] Once the third receiving unit **31** receives "journalist" as the speaker name corresponding to the utterance data having the start timing "0:00:20", it stores the speaker name "journalist" in the storage unit **18** as the speaker name corresponding to the utterance ID of the utterance data having the start timing "0:00:20". As a result, the operation history information gets updated. FIG. **11** is a schematic diagram of an exemplary data structure of the updated operation history information. For example, the third receiving unit **31** updates the operation history information that was in the state illustrated in FIG. **3** to the operation history information illustrated in FIG. **11**.

[0100] With reference to the example illustrated in FIG. **9**, the explanation is given for a case in which, in the entry field **58**A for entering speaker names, an entry field for text input is placed as the topmost field and the candidate list **58**B having the speaker names arranged according to the priority is displayed below the entry field for text input. Moreover, in the example illustrated in FIG. **9**, the speaker name "<new>" is not included in the candidate list **58**B. As a result, it becomes possible for the user to give the speaker name either by operating the input unit **20** and directly inputting the speaker name in the entry field for text input or by selecting one of the speaker names displayed in the candidate list **58**B.

[0101] FIG. **12** is a schematic diagram illustrating an example of the candidate list. FIG. **13** is a schematic diagram illustrating a display form of the candidate list. Herein, assume that the generating unit **30** generates the candidate list illustrated in FIG. **12**. In that case, if the display form is such that the speaker name "<new>" is not to be included in a candidate list **58**C, then the first control unit **32** can display the candidate list **58**C as illustrated in FIG. **13**.

[0102] However, the display form of the candidate list **58**B is not limited to the display form illustrated in FIG. **9**. Alternatively, for example, in the case when "<new>" is the speaker name corresponding to the priority "1", the first control unit **32** can place the entry field for text input as the topmost field.

[0103] FIG. **14** is a schematic diagram illustrating a display form of the candidate list. For example, assume that the generating unit **30** generates the candidate list illustrated in FIG. **12**. In that case, the first control unit **32** can display a

candidate list **58**D in which the speaker name "<new>" is also included in the order of priority specified in the candidate list (see FIG. **14**).

[0104] Given below is the explanation about a sequence of operations performed during the information processing in the information processing apparatus **12**.

[0105] FIG. **15** is a flowchart illustrating a sequence of operations performed during the information processing in the information processing apparatus **12**.

[0106] Firstly, the first receiving unit **24** receives speech data from the obtaining unit **14** (Step S**100**). Then, the dividing unit **25** divides the speech data, which is received by the first receiving unit **24** at Step S**100**, into a plurality of pieces of utterance data (Step S**102**).

[0107] Subsequently, the assigning data **26** generates the first data (Step S**104**). That is, at Step S**104**, the assigning unit **26** assigns, to each piece of utterance ID that is obtained by the dividing unit **25** by dividing the speech data at Step S**102**, an utterance ID which represents unique identification information of that piece of utterance data and which indicates the chronological sequence of that piece of utterance data in the speech data. Moreover, the assigning unit **26** assigns a speaker ID to each piece of utterance data. In this way, the assigning generates the first data and stores it in the storage unit **18**.

[0108] Then, the first control unit **32** performs control to display an input screen on the display unit **22** to enable selection of a piece of utterance data to which a speaker name is to be given from among a plurality of pieces of utterance data that are included in the speech data received at Step S**100** (Step S**106**).

[0109] FIG. **16** is a schematic diagram illustrating an example of the input screen. For example, the first control unit **32** performs control to display on the display unit **22** an input screen that includes a setting screen **54**C illustrated in FIG. **16**. More specifically, the first control unit **32** reads the first data generated at Step S**104** and reads the operation history information stored in the storage unit **18**. Then, the first control unit **32** displays the setting screen **54**C that includes a list of information for enabling identification of the pieces of utterance data included in the speech data received at Step S**100**, that includes an entry field for entering speaker names, and that includes an entry field for entering uttered contents. In the example illustrated in FIG. **16**, the start timings "0:00:00", "0:00:05", "0:00:11", "0:00:18", and "0:00:20" of the pieces of utterance data in the speech data are displayed as the list of information that enables identification of the pieces of utterance data. Herein, the pieces of utterance data having the start timings "0:00:00", "0:00:05", "0:00:11", and "0:00:18" have speaker names already given thereto. Moreover, the pieces of utterance data having the start timings "0:00:00", "0:00:05", "0:00:11", "0:00:18", and "0:00:20" have the uttered contents already set therein.

[0110] Returning to the explanation with reference to FIG. **15**, subsequently, the second receiving unit **28** determines whether or not instruction information indicating the utterance data to which a speaker name is to be given is received from the user (Step S**108**). Until it is determined that the utterance data to which a speaker name is to be given is received from the user (Yes at Step S**108**), the second receiving unit **28** repeatedly determines that the utterance data to which a speaker name is to be given is not received from the user (No at Step S**108**). Once it is determined that the utterance data to which a speaker name is to be given is received from the user (Yes at Step S**108**), the system control proceeds to Step S**110**.

[0111] Then, the generating unit **30** obtains the speaker ID corresponding to the utterance ID that is specified in the instruction information received by the second receiving unit **28** at Step S**108** (Step S**110**); as well as reads the operation history information that is stored in the storage unit **18** (Step S**112**).

[0112] Subsequently, the generating unit **30** performs a candidate list generating operation (Step S**114**) (described later in detail). As a result of the candidate list generating operation performed at Step S**114**, a candidate list is generated.

[0113] Then, the first control unit **32** performs control to display the candidate list, which is generated as a result of the candidate list generating operation performed at Step S**114**, in the entry field for entering the speaker name that corresponds to the utterance data which is received from the user at Step S**108** as the utterance data to which a speaker name is to be given (Step S**116**). As a result of the operation performed at Step S**116**; for example, the candidate list **58**B illustrated in FIG. **9** is displayed.

[0114] Subsequently, the third receiving unit **31** determines whether or not the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20** (Step S**118**). Until it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20** (Yes at Step S**118**), the third receiving unit **31** repeatedly determines that the speaker name given by the user to the utterance data to which a speaker name is to be given has not been received from the input unit **20** (No at Step S**118**). Once it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20** (Yes at Step S**118**), the system control proceeds to Step S**120**.

[0115] Then, the first control unit **32** performs control to display the speaker name received at Step S**118** in a speaker name display field for the utterance data that is received at Step S**108** as the utterance data to which a speaker name is to be given (Step S**120**).

[0116] Moreover, the third receiving unit **31** stores the speaker name received at Step S**118** in the storage unit **18** in a corresponding manner to the utterance ID of the utterance data that is received at Step S**108** as the utterance data to which a speaker name is to be given as well as in a corresponding manner to the speaker ID obtained at Step S**110** (Step S**122**). As a result of the operation performed at Step S**122**, the operation history information stored in the storage unit **18** gets updated every time the user gives a speaker name to a piece of utterance data.

[0117] Then, the information processing apparatus **12** determines whether or not to end the information processing (Step S**124**). The information processing apparatus **12** performs the determination at Step S**124** by, for example, determining whether or not a signal indicating the end of information processing is received as a result of an operation of the input unit **20** by the user.

[0118] If it is determined not to end the information processing (No at Step S**124**), then the system control returns to Step S**106**. On the other hand, if it is determined to end the information processing (Yes at Step S**124**); then that marks the end of the present routine.

[0119] Given below is the explanation of the candidate list generating operation performed at Step S**114**.

[0120] FIG. **17** is a flowchart for explaining a sequence of operations performed by the generating unit **30** during the candidate list generating operation.

[0121] Firstly, the first calculating unit **34** calculates the first probabilities based on the operation history information (Step S**200**). Then, the second calculating unit **36** calculates the second probabilities (Step S**202**).

[0122] Subsequently, the third calculating unit **38** calculates the scores (Step S**204**). Then, the generating unit **30** selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**, and generates a candidate list in which the selected speaker names are listed as candidate speaker names (Step S**206**). That marks the end of the present routine.

[0123] As described above, in the information processing apparatus **12** according to the first embodiment, based on the operation history information, a candidate list is generated that indicates the candidate speaker names which can be given by the user to the utterance data to which a speaker name is to be given. For that reason, in the information processing apparatus **12** according to the first embodiment, it becomes possible to provide information that easily enables giving a speaker name to the utterance data of each of one or more speakers that is included in the speech data.

[0124] Moreover, in the information processing apparatus **12** according to the first embodiment, for each speaker name specified in the operation history information, a score is calculated that indicates the likelihood at which that speaker name is given to the utterance data to which a speaker name is to be given. Then, in the information processing apparatus **12**, a candidate list is generated in which the speaker names are arranged in descending order of scores.

[0125] For that reason, it becomes possible to provide information that easily enables giving a speaker name to the utterance data of each of one or more speakers that is included in the speech data.

[0126] Furthermore, in the information processing apparatus **12** according to the first embodiment, the score mentioned above is calculated on the basis of the chronologically previous piece of utterance data to the utterance data to which a speaker name is to be given.

[0127] Thus, in the information processing apparatus **12** according to the first embodiment, the candidate list is generated by taking into account the relay of speakers found in the speech data. As a result, the information processing apparatus **12** can be implemented in a particularly suitable manner in the case of assigning speaker names to each piece of utterance data included in the speech data having a straightforward relay of speakers such as in a lecture, an interview, a press conference, or the like.

[0128] Moreover, in the information processing apparatus **12** according to the first embodiment, even when the granularity desired by the user is not at an individual level, that is, even when a role or an organization is to be uniformly assigned to a plurality of speakers as the speaker name; a candidate list can be generated according to the granularity. That enables achieving reduction in the user load of altering the speaker names.

Second Embodiment

[0129] According to a second embodiment, a candidate list is generated by further referring to the utterance data that is selected by the user.

[0130] FIG. **18** is a block diagram illustrating a functional configuration of an information processing system **10**A according to the second embodiment. The information processing system **10**A includes the obtaining unit **14**, the input unit **20**, the display unit **22**, an information processing apparatus **12**A, and the storage unit **18**. Herein, the obtaining unit **14**, the input unit **20**, the display unit **22**, and the storage unit **18** are identical to the description in the first embodiment.

[0131] The information processing apparatus **12**A includes the first receiving unit **24**, the dividing unit **25**, the assigning unit **26**, the second receiving unit **28**, the third receiving unit **31**, a generating unit **30**A, and the first control unit **32**. Herein, the first receiving unit **24**, the dividing unit **25**, the assigning unit **26**, the second receiving unit **28**, the third receiving unit **31**, and the first control unit **32** are identical to the description in the first embodiment.

[0132] The generating unit **30**A includes the first calculating unit **34**, the second calculating unit **36**, a third calculating unit **38**A, a fourth calculating unit **40**, an extracting unit **42**, and a first obtaining unit **41**. Herein, the first calculating unit **34** and the second calculating unit **36** are identical to the description in the first embodiment.

[0133] The first obtaining unit **41** obtains text data corresponding to each piece of utterance data that is included in the speech data received by the first receiving unit **24**. Herein, the first obtaining unit **41** implements a known technology for generating text data from the speech data, and obtains text data corresponding to each piece of utterance data that is obtained by the dividing unit **25** by dividing the speech data.

[0134] Alternatively, as the text data corresponding to each piece of utterance data, the first obtaining unit **41** can obtain text data that indicates the uttered contents set by the user for each piece of utterance data which is obtained by the dividing unit **25** by dividing the speech data. Rather, as the text data corresponding to each piece of utterance data, it is desirable that the first obtaining unit **41** obtains text data that indicates the uttered contents set by the user for each piece of utterance data which is obtained by the dividing unit **25** by dividing the speech data.

[0135] From among the pieces of text data obtained corresponding to the pieces of utterance data by the first obtaining unit **41**, the extracting unit **42** at least reads the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given and reads the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given.

[0136] Alternatively, the extracting unit **42** can read at least either the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given or the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given. However, from the perspective of enhancing the accuracy of speaker names specified in the candidate list; it is desirable that, from among the pieces of text data obtained corresponding to the pieces of utterance data by the first obtaining unit **41**, the extracting unit **42** reads the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker

name is to be given as well as reads the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given.

[0137] Then, the extracting unit **42** analyzes the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given as well as analyzes the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given; and extracts predetermined speaker identification information included in each piece of text data.

[0138] Alternatively, the extracting unit **42** can analyze the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given as well as analyze the previous piece of utterance data to the utterance data to which a speaker name is to be given; and can extract speaker identification information included in each piece of utterance data.

[0139] The speaker identification information enables identification of the speakers. In the second embodiment, the speaker identification information points to one or more pieces of information that belong to speaker names set by the user and that enable identification of the speakers. In the second embodiment, in the storage unit **18** are further stored the speaker names given by the user in a corresponding manner to one or more pieces of speaker identification information belonging to each speaker name. Herein, the speaker names and the speaker identification information belonging to each speaker name can be set in advance by the user by operating the input unit **20**, and can be stored in advance in the storage unit **18**. Moreover, the speaker names and the speaker identification information belonging to each speaker name can be modified by operating the input unit **20**.

[0140] For example, in the storage unit **18**, "journalist" is stored in advance as a speaker name. Moreover, for example, as the speaker identification information corresponding to the speaker name "journalist"; "newspaper P", "Q", "newspaper R", and "S" are stored in the storage unit **18**. Herein, "Q" indicates the name of an employee of newspaper P; while "S" indicates the name of an employee of newspaper R. In this way, in the second embodiment, in the storage unit **18**, the speaker identification information belonging to each speaker name is stored in advance.

[0141] Moreover, the speaker identification information belonging to each speaker name can be set in a dynamically associated manner to proper nouns such as person names/organization names that are extracted from the text data corresponding to each piece of utterance data based on the operation history information. For example, in the storage unit **18**, "journalist" is stored as the speaker name and "newspaper P" and "Q" are stored as the speaker identification information.

[0142] The extracting unit **42** analyzes the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given as well as analyzes the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given; and extracts predetermined speaker identification information included in each piece of text data.

[0143] The fourth calculating unit **40** calculates third probabilities based on the operation history information and based on the speaker identification information that has been extracted. The third probabilities indicate the probabilities at which the speaker identification information belonging to all speaker names specified in the operation history information is included in at least the utterance data to which a speaker name is to be given.

[0144] Herein, although the third probabilities indicate the probabilities at which the speaker identification information belonging to all speaker names specified in the operation history information is included in at least the utterance data to which a speaker name is to be given, it is desirable that the third probabilities indicate the probabilities at which the speaker identification information belonging to all speaker names specified in the operation history information is not only included in the utterance data to which a speaker name is to be given but also included in the previous piece of utterance data to the utterance data to which a speaker name is to be given.

[0145] FIG. **19** is an explanatory diagram for explaining the third probabilities. For example, it is assumed that the utterance data that is received by the second receiving unit **28** as the utterance data to which a speaker name is to be given is same as the utterance data having the start timing "0:00:20" as illustrated in FIG. **16**. Moreover, it is assumed that the user has operated the input unit **20** and has set the text data "I am S working for newspaper R. Director U is known to be strict regarding acting. How was the experience to work under director U?" as the uttered contents for the utterance data to which a speaker name is to be given. Furthermore, it is assumed that "Who's next? Pleas raise your hand. Yes, that journalist over there, go ahead with your question." is the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given.

[0146] In this case, the extracting unit **42** extracts "newspaper R" and "S" as the preregistered speaker identification information from the pieces of text data. Then, regarding each speaker name specified in the operation history information, the fourth calculating unit **40** calculates the third probability that indicates the probability at which the speaker identification information belonging to that speaker name is extracted by the extracting unit **42**. In this case, as the third probability corresponding to the speaker name "journalist", the fourth calculating unit **40** calculates "1.0" as the third probability for "newspaper R" and "S" that are extracted by the extracting unit **42** as the speaker identification information belonging to the speaker name "journalist". In contrast, if the speaker identification information belonging to the speaker names "presenter" and "leading performer" is not extracted from the text data read by the extracting unit **42**, then the fourth calculating unit **40** calculates "0" as the third probability corresponding to each of the speaker names "presenter" and "leading performer".

[0147] Returning to the explanation with reference to FIG. **18**, the third calculating unit **38**A calculates scores. In the second embodiment, the third calculating unit **38**A calculates the scores based on the first probabilities calculated by the first calculating unit **34**, the second probabilities calculated by the second calculating unit **36**, and the third probabilities calculated by the fourth calculating unit **40**.

[0148] FIG. **20** is an explanatory diagram for explaining the score calculation performed by the third calculating unit **38**A. Herein, in an identical manner to the third calculating unit **38** according to the first embodiment, the third calculating unit **38**A reads the first probability and the second probability corresponding to each speaker name specified in the operation history information. Moreover, the third calculating unit **38**A reads the third probability calculated by the fourth cal-

culating unit **40** regarding each speaker name specified in the operation history information. Then, as the score corresponding to each speaker name, the third calculating unit **38**A calculates the added value of the first probability, the second probability, and the third probability corresponding to that speaker name (see FIG. **20**). Alternatively, in an identical manner to the first embodiment, as the score corresponding to each speaker name, the third calculating unit **38**A can calculate a value obtained by firstly multiplying the first probability, the second portability, and the third probability with a predetermined weight coefficient; and then adding the first probability, the second probability, and the third probability.

[0149] Returning to the explanation with reference to FIG. **18**, the generating unit **30**A selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**A, and generates a candidate list in which the selected speaker names are listed as candidate speaker names.

[0150] Given below is the explanation about a sequence of operations performed during the information processing in the information processing apparatus **12**A.

[0151] FIG. **21** is a flowchart illustrating a sequence of operations performed during the information processing in the information processing apparatus **12**A.

[0152] In the information processing apparatus **12**A, the operations performed from Step S**100** to Step S**112** are identical to the operations performed according to the first embodiment (see FIG. **15**). Then, the first obtaining unit **41** obtains the text data corresponding to each piece of utterance data (Step S**1130**).

[0153] Subsequently, the generating unit **30**A performs a candidate list generating operation (Step S**1140**) (described later in detail). Then, in the information processing apparatus **12**A, the operations from Step S**116** to Step S**124** are performed in an identical manner to the operations performed according to the first embodiment. That marks the end of the present routine.

[0154] Given below is the explanation of the candidate list generating operation performed by the generating unit **30**A at Step S**1140**.

[0155] FIG. **22** is a flowchart for explaining a sequence of operations performed by the generating unit **30**A during the candidate list generating operation.

[0156] Firstly, in an identical manner to the operation at Step S**200** (see FIG. **17**) in the first embodiment, the first calculating unit **34** calculates the first probabilities (Step S**2000**). Then, in an identical manner to the operation at Step S**202** (see FIG. **17**) in the first embodiment, the second calculating unit **36** calculates the second probabilities (Step S**2020**).

[0157] Subsequently, from among the text data obtained by the first obtaining unit **41** corresponding to each piece of utterance data, the extracting unit **42** at least analyzes the text data of the utterance data that is obtained by the second receiving unit **28** as the utterance data to which a speaker name is to be given and analyzes the text data of the previous piece of utterance data to the utterance data to which a speaker name is to be given; and extracts predetermined speaker identification information specified in those pieces of text data (Step S**2030**).

[0158] Then, the fourth calculating unit **40** calculates the third probabilities based on the operation history information and based on the speaker identification information that has been extracted (Step S**2040**). Subsequently, the third calculating unit **38**A calculates the scores based on the first probabilities calculated by the first calculating unit **34**, the second probabilities calculated by the second calculating unit **36**, and the third probabilities calculated by the fourth calculating unit **40** (Step S**2060**).

[0159] Then, the generating unit **30**A selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**A, and generates a candidate list in which the selected speaker names are listed as candidate speaker names (Step S**2080**). That marks the end of the present routine.

[0160] As described above, in the information processing system **10**A according to the second embodiment, a candidate list is generated by further referring either to the utterance data to which a speaker name is to be given or to the text data corresponding to that utterance data.

[0161] For that reason, in the information processing system **10**A, in the case when the utterance data to which a speaker name is to be given either contains the speaker identification information that enables identification of the speaker corresponding to that utterance data or contains the speaker identification information in which the speaker of the next piece of utterance data is associated to the previous piece of utterance data, the scores can be calculated by taking into account such speaker identification information.

[0162] Moreover, in addition to the effect achieved in the first embodiment, it becomes possible to further enhance the accuracy of the speaker names listed in the candidate list. Furthermore, in addition to the effect achieved in the first embodiment, it becomes possible to provide information that enables the user to easily give the speaker names.

[0163] Besides, in the information processing apparatus **12**A according to the second embodiment, a candidate list is generated by further referring either to the utterance data to which a speaker name is to be given or to the text data corresponding to that utterance data. Hence, even in the case when there is irregularity in the speaker relay and when speaker names are to be given to pieces of the utterance data that are included in the speech data of a debate session in which the presenter controls the order of utterances, it is possible to provide information that easily enables setting of the speaker names.

Third Embodiment

[0164] According to a third embodiment, a candidate list is generated by further referring to reproduction history information of the speech data.

[0165] FIG. **23** is a block diagram illustrating a functional configuration of an information processing system **10**B according to the third embodiment. The information processing system **10**B includes the obtaining unit **14**, the input unit **20**, the display unit **22**, an information processing apparatus **12**B, a storage unit **18**B, and a reproducing unit **46**. Herein, the obtaining unit **14**, the input unit **20**, and the display unit **22** are identical to the description in the first embodiment.

[0166] The reproducing unit **46** is a known reproducing device that is capable of reproducing speech data. In the information processing apparatus **12**B, while the reproducing unit **46** is reproducing the speech data, the information indicating the current reproducing position in the speech data is displayed on the display unit **22**. Moreover, in the information processing apparatus **12**B, the reproducing unit **46** selectively reproduces the utterance data that is specified by the user by operating the input unit **20**.

[0167] The information processing apparatus **12**B includes the first receiving unit **24**, the dividing unit **25**, the assigning unit **26**, the second receiving unit **28**, the third receiving unit **31**, a generating unit **30**B, the first control unit **32**, and a second control unit **49**. Herein, the first receiving unit **24**, the dividing unit **25**, the assigning unit **26**, the second receiving unit **28**, the third receiving unit **31**, and the first control unit **32** are identical to the description in the first embodiment. The second control unit **49** controls the reproduction of the speech data performed by the reproducing unit **46**. Moreover, when the user operates the input unit **20** and selectively specifies a piece of utterance data from the speech data as the reproduction target, the second control unit **49** performs control so that the specified utterance data is reproduced by the reproducing unit **46**. At that time, in the storage unit **18**B, the second control unit **49** stores, as reproduction history information, the number of times of reproducing the piece of utterance data that has been reproduced.

[0168] The storage unit **18**B is used not only to store the first data and the operation history information described in the first embodiment but also to store the reproduction history information that indicates the number of times of reproducing each piece of utterance data that was reproduced during a predetermined number of prior reproduction operations. Every time a piece of utterance data is reproduced, the second control unit **49** updates the reproduction history information that is stored in the storage unit **18**B.

[0169] The generating unit **30**B includes the first calculating unit **34**, the second calculating unit **36**, a third calculating unit **38**B, a fifth calculating unit **60**, and a second obtaining unit **62**. Herein, the first calculating unit **34** and the second calculating unit **36** are identical to the description in the first embodiment.

[0170] The second obtaining unit **62** obtains the reproduction history information that indicates the number of times of reproducing each piece of utterance data included in the speech data which is obtained by the first receiving unit **24**.

[0171] With respect to each speaker name specified in the operation history information; the fifth calculating unit **60** calculates a fourth probability, which indicates the probability at which the utterance data corresponding to that speaker name is reproduced, on the basis of the number of times of reproducing the utterance data corresponding to that speaker name.

[0172] FIG. **24** is an explanatory diagram for explaining the fourth probability calculated by the fifth calculating unit **60** with respect to each speaker name. As illustrated in FIG. **24**, with respect to each speaker name specified in the operation history information; larger the number of times of reproduction, the greater is the fourth probability calculated by the fifth calculating unit **60**.

[0173] Returning to the explanation with reference to FIG. **23**, the third calculating unit **38**B calculates scores based on the first probabilities, the second probabilities, and the fourth probabilities. Herein, a score indicates the probability at which a speaker name specified in the operation history information is given by the user.

[0174] FIG. **25** is an explanatory diagram for explaining the score calculation performed by the third calculating unit **38**B. In an identical manner to the third calculating unit **38** according to the first embodiment, the third calculating unit **38**B reads the first probability and the second probability regarding each speaker name specified in the operation history information. In addition, the third calculating unit **38**B reads the fourth probability calculated by the fifth calculating unit **60** regarding each speaker name specified in the operation history information. Then, as the score corresponding to each speaker name specified in the operation history information, the third calculating unit **38**B calculates the added value of the first probability, the second probability, and the fourth probability corresponding to that speaker name (see FIG. **25**).

[0175] Returning to the explanation with reference to FIG. **23**, the generating unit **30**B selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**B, and generates a candidate list in which the selected speaker names are listed as candidate speaker names.

[0176] Given below is the explanation about a sequence of operations performed during the information processing in the information processing apparatus **12**B.

[0177] FIG. **26** is a flowchart illustrating a sequence of operations performed during the information processing in the information processing apparatus **12**B.

[0178] In the information processing apparatus **12**B, the operations performed from Step S**100** to Step S**112** are identical to the operations performed according to the first embodiment (see FIG. **15**). Then, the second obtaining unit **62** obtains the reproduction history information that indicates the number of times of reproducing each piece of utterance data included in the speech data which is obtained by the first receiving unit **24** (Step S**3000**).

[0179] Subsequently, the generating unit **30**B performs a candidate list generating operation (Step S**3020**) (described later in detail). Then, in the information processing apparatus **12**B, the operations from Step S**116** to Step S**124** are performed in an identical manner to the operations performed according to the first embodiment. That marks the end of the present routine.

[0180] Given below is the explanation of the candidate list generating operation performed by the generating unit **30**B at Step S**3020**.

[0181] FIG. **27** is a flowchart for explaining a sequence of operations performed by the generating unit **30**B during the candidate list generating operation.

[0182] Firstly, in an identical manner to the operation at Step S**200** (see FIG. **17**) in the first embodiment, the first calculating unit **34** calculates the first probabilities (Step S**4000**). Then, in an identical manner to the operation at Step S**202** (see FIG. **17**) in the first embodiment, the second calculating unit **36** calculates the second probabilities (Step S**4020**).

[0183] Subsequently, the second obtaining unit **62** obtains the reproduction history information regarding each piece of utterance data that is included in the speech data (Step S**4040**). Then, the fifth calculating unit **60** calculates the fourth probabilities (Step S**4060**).

[0184] Subsequently, the third calculating unit **38**B calculates the scores based on the first probabilities calculated by the first calculating unit **34**, the second probabilities calculated by the second calculating unit **36**, and the fourth probabilities calculated by the fifth calculating unit **60** (Step S**4080**).

[0185] Then, the generating unit **30**B selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit **38**B, and generates a candidate list in which the selected speaker names are listed as candidate speaker names (Step S**4090**). That marks the end of the present routine.

[0186] As described above, in the information processing system **10**B according to the third embodiment, larger the recent number of times of reproduction with respect to a piece of utterance data included in the speech data, the greater is the calculated score. For that reason, in the information processing system **10**B according to the third embodiment, in the candidate list, it becomes possible to list such speaker names on priority which correspond to the pieces of utterance data that are the target for the user to manually confirm similarity in the voice quality.

[0187] Hence, in addition to the effect achieved in the first embodiment, it becomes possible to provide information that easily enables setting of speaker names to the utterance data of speakers.

Fourth Embodiment

[0188] In each of the first to third embodiments described above, the explanation is given for the case in which the information processing apparatus **12** (or the information processing apparatus **12**A or the information processing apparatus **12**B) generates as well as displays a candidate list. However, that is not the only possible case.

[0189] Alternatively, some of the operations performed the information processing apparatus **12** (or the information processing apparatus **12**A or the information processing apparatus **12**B) can be performed in another device that is connected via a network.

[0190] As an example of that case, in an information processing system **11** according to a fourth embodiment, some of the functions of the information processing apparatus **12** (or the information processing apparatus **12**A or the information processing apparatus **12**B) are implemented in a server device that is present on a network.

[0191] FIG. **28** is a schematic diagram of the information processing system **11** according to the fourth embodiment.

[0192] In the information processing system **11**; a host device **74** and a server device **70** are connected to each other via a network **72** such as the Internet.

[0193] The host device **74** has the hardware configuration of a commonly-used computer in which a CPU, a ROM, a RAM, and an HDD are connected to each other via a bus. Moreover, the host device **74** includes an obtaining unit **14**C, an input unit **20**C, a display unit **22**C, a communicating unit **78**C, and a control unit **79**C. Herein, the obtaining unit **14**C, the input unit **20**C, and the display unit **22**C are respectively identical to the obtaining unit **14**, the input unit **20**, and the display unit **22** according to the first embodiment.

[0194] The communicating unit **78**C is a communication interface for communicating a variety of data with the server device **70** via the network **72**. In the fourth embodiment, to the server device **70**, the communicating unit **78**C sends a variety of information such as speech data that is obtained by the obtaining unit **14**C; instruction information that is input by the user by operating the input unit **20**C and that indicates the piece of utterance data to which a speaker name is to be given; and speaker names or uttered contents that are input by the user by operating the input unit **20**C. On the other hand, from the server device **70**, the communicating unit **78**C receives various input screens that are to be displayed on the display unit **22**C. The control unit **79**C controls the operations of the constituent elements of the host device **74**. Moreover, the control unit **79**C performs control to display the input screens that are received from the server device **70**. Furthermore, the control unit **79**C performs control to send a variety of information, which has been input from the input unit **20**C, to the server device **70** via the network **72**.

[0195] The server device **70** has the hardware configuration of a commonly-used computer in which a CPU, a ROM, a RAM, and an HDD are connected to each other via a bus. Moreover, the server device **70** includes an information processing unit **12**C, a communicating unit **76**C, and a storage unit **18**C. Herein, the information processing unit **12**C has an identical configuration to the configuration of the information processing apparatus **12** according to the first embodiment. More specifically, the information processing unit **12**C includes a first receiving unit **24**C, a dividing unit **25**C, an assigning unit **26**C, a second receiving unit **28**C, a third receiving unit **31**C, and a generating unit **30**C. Herein, the first receiving unit **24**C, the dividing unit **25**C, the assigning unit **26**C, the second receiving unit **28**C, the third receiving unit **31**C, and the generating unit **30**C are respectively identical to the first receiving unit **24**, the dividing unit **25**, the assigning unit **26**, the second receiving unit **28**, the third receiving unit **31**, and the generating unit **30** according to the first embodiment.

[0196] The storage unit **18**C has an identical configuration to the configuration of the storage unit **18** according to the first embodiment. The communicating unit **76**C is an interface for communicating a variety of information with the host device **74** via the network **72**. In the fourth embodiment, to the host device **74**, the communicating unit **76**C sends various input screens that are generated in the information processing unit **12**C such as an input screen including a candidate list generated by the generating unit **30**C or an input screen that enables selection of the utterance data to which a speaker name is to be given. On the other hand, from the host device **74**, the communicating unit **76**C receives a variety of information such as instruction information that indicates the utterance data to which a speaker name is to be given or the speaker names or the uttered contents that have been input.

[0197] Herein, the operations performed in the information processing system **11** according to the fourth embodiment are identical to the operations performed in the information processing apparatus **12** according to the first embodiment except for the following points: the server device **70** receives a variety of information, which in the first embodiment is received by the information processing apparatus **12** (see FIG. **1**) from the input unit **20** (see FIG. **1**) or from the obtaining unit **14** (see FIG. **1**), from the host device **74**; and the server device **70** sends a variety of information, such as the input screens or the candidate list generated in the information processing unit **12**C, not to the display unit **22** (see FIG. **1**) but to the host device **74**.

[0198] The host device **74** gets various operations, which in the first embodiment are performed in the information processing apparatus **12**, performed in the server device **70**. The host device **74** itself only obtains and displays a variety of information. Apart from those points, the operations are identical to the operations performed in the information processing apparatus **12** according to the first embodiment.

[0199] Given below is explanation of operations performed in the server device **70**.

[0200] FIG. **29** is a flowchart for explaining a sequence of operations performed during the information processing in the server device **70**.

[0201] Firstly, the first receiving unit **24**C receives speech data from the communicating unit **76**C of the host device **74** via the network **72** (Step S**500**). Then, the dividing unit **25**C

divides the speech data, which is received by the first receiving unit **24**C at Step S**500**, into a plurality of pieces of utterance data (Step S**502**).

[0202] Subsequently, the assigning unit **26**C generates the first data (Step S**504**) in an identical manner to that described in the first embodiment. Then, the assigning unit **26**C stores the first data in the storage unit **18**C.

[0203] Subsequently, to the host device **74**, the communicating unit **76**C sends an input screen that enables selection of a piece of utterance data to which a speaker name is to be given from among a plurality of pieces of utterance data that are included in the speech data received at Step S**500**, as well as sends the first data (Step S**506**).

[0204] The second receiving unit **28**C determines whether or not instruction information indicating the utterance data to which a speaker name is to be given is received from the host device **74** (Step S**508**). Until it is determined that the utterance data to which a speaker name is to be given is received from the host device **74** (Yes at Step S**508**), the second receiving unit **28**C repeatedly determines that the utterance data to which a speaker name is to be given is not received from the host device **74** (No at Step S**508**). Once it is determined that the utterance data to which a speaker name is to be given is received from the host device **74** (Yes at Step S**508**), the system control proceeds to Step S**510**.

[0205] Then, the generating unit **30**C obtains, from the storage unit **18**C, the speaker ID corresponding to the utterance ID that is specified in the instruction information received at Step S**508** (Step S**510**); as well as reads the operation history information that is stored in the storage unit **18**C (Step S**512**).

[0206] Subsequently, the generating unit **30**C performs a candidate list generating operation (Step S**514**) in an identical manner to the candidate list generating operation (see Step S**114** in FIG. **15**) according to the first embodiment.

[0207] Then, to the host device **74**, the communicating unit **76**C sends an input screen in which the candidate list, which is generated by the generating unit **30**C at Step S**514**, is displayed in an entry field for entering the speaker name corresponding to the utterance data to which a speaker name is to be given (Step S**516**).

[0208] Subsequently, the third receiving unit **31**C determines whether or not the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the host device **74** (Step S**518**). Until it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the host device **74** (Yes at Step S**518**), the third receiving unit **31**C repeatedly determines that the speaker name given by the user to the utterance data to which a speaker name is to be given has not been received from the host device **74** (No at Step S**518**). Once it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the host device **74** (Yes at Step S**518**), the system control proceeds to Step S**520**.

[0209] Then, the communicating unit **76**C sends the speaker name received at Step S**518** to the host device **74** (Step S**520**).

[0210] Subsequently, in the operation history information, the third receiving unit **31**C stores the speaker name, which is received at Step S**518**, in a corresponding manner to the utterance ID of the utterance data that is received at Step S**508** as the utterance data to which a speaker name is to be given (Step S**522**). As a result of the operation performed at Step S**522**, every time the user gives a speaker name to a piece of utterance data, the operation history information stored in the storage unit **18**C gets updated.

[0211] Then, the information processing unit **12**C determines whether or not to end the information processing (Step S**524**). The information processing unit **12**C performs the determination at Step S**524** by, for example, determining whether or not a signal indicating the end of information processing is received from the host device **74**.

[0212] If it is determined not to end the information processing (No at Step S**524**), then the system control returns to Step S**506**. On the other hand, if it is determined to end the information processing (Yes at Step S**524**); then that marks the end of the present routine.

[0213] Given below is the explanation of information processing performed in the host device **74**.

[0214] FIG. **30** is a flowchart for explaining a sequence of operations performed during the information processing in the host device **74**.

[0215] Firstly, the obtaining unit **14**C receives speech data (Step S**600**). Then, the communicating unit **78**C sends the speech data, which is received at Step S**600**, to the server device **70** (Step S**602**).

[0216] Subsequently, until it is determined that an input screen and the first data is received from the server device (Yes at Step S**604**), the communicating unit **78**C repeatedly determines that the input screen and the first data is not received from the server device **70** (No at Step S**604**). Once it is determined that an input screen and the first data is received from the server device **70** (Yes at Step S**604**), the system control proceeds to Step S**606**.

[0217] Then, the control unit **79**C performs control to display the input screen, which is received at Step S**604**, on the display unit **22**C (Step S**606**).

[0218] Subsequently, the control unit **79**C determines whether or not instruction information indicating the utterance data to which a speaker name is to be given is received from the user (Step S**608**). Herein, the control unit **79**C performs the determination at Step S**608** by determining whether or not the instruction information is received from the input unit **20**C as a result of an operation of the input unit **20**C by the user.

[0219] Until it is determined that the utterance data to which a speaker name is to be given is received from the user (Yes at Step S**608**), the control unit **79**C repeatedly determines that the utterance data to which a speaker name is to be given is not received from the user (No at Step S**608**). Once it is determined that the utterance data to which a speaker name is to be given is received from the user (Yes at Step S**608**), the system control proceeds to Step S**610**.

[0220] Then, the communicating unit **78**C sends the instruction information, which is received at Step S**608**, to the server device **70** (Step S**610**).

[0221] Subsequently, until an input screen, in which a candidate list is displayed in an entry field for entering the speaker name corresponding to the utterance data to which a speaker name is to be given, is received from the server device **70** (Yes at Step S**612**), the communicating unit **78**C repeatedly determines that the input screen is not received from the server device **70** (No at Step S**612**). Once the input screen is received from the server device **70** (Yes at Step S**612**), the system control proceeds to Step S**614**. Then, the control unit **79**C displays the input screen, which is received at Step S**612**,

on the display unit **22**C (Step S**614**). As a result, on the display unit **22**C, the candidate list gets displayed in the entry field for entering the speaker name corresponding to the utterance data that is received at Step S**608** as the utterance data to which a speaker name is to be given.

[0222] Subsequently, the control unit **79**C determines whether or not the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20**C (Step S**616**). Until it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20**C (Yes at Step S**616**), the control unit **79**C repeatedly determines that the speaker name given by the user to the utterance data to which a speaker name is to be given has not been received from the input unit **20**C (No at Step S**616**). Once it is determined that the speaker name given by the user to the utterance data to which a speaker name is to be given has been received from the input unit **20**C (Yes at Step S**616**), the system control proceeds to Step S**618**.

[0223] Then, the communicating unit **78**C sends the speaker name, which is received at Step S**616**, to the server device **70** (Step S**618**). Moreover, the control unit **79**C displays the speaker name, which is received at Step S**616**, in a display field for displaying the speaker name of the utterance data that is received at Step S**608** as the utterance data to which a speaker name is to be given (Step S**620**).

[0224] Then, the control unit **79**C determines whether or not to end the information processing (Step S**622**). The control unit **79**C performs the determination at Step S**622** by, for example, determining whether or not a signal indicating the end of information processing is received as a result of an operation of the input unit **20**C by the user.

[0225] If it is determined not to end the information processing (No at Step S**622**), then the system control returns to Step S**604**. On the other hand, if it is determined to end the information processing (Yes at Step S**622**); then that marks the end of the present routine.

[0226] As described above, in the fourth embodiment, some of the functions of the information processing apparatus **12** (or the information processing apparatus **12**A or the information processing apparatus **12**B) are implemented in the server device **70** that is present on the network **72**; and the candidate list is generated in the server device **70**. For that reason, in addition to the effect achieved in the first embodiment, even in the case when a plurality of host devices **74** is present, the operation history information can be updated in a collective manner.

Fifth Embodiment

[0227] Each of the information processing apparatus **12** according to the first embodiment, the information processing apparatus **12**A according to the second embodiment, the information processing apparatus **12**B according to the third embodiment, the server device **70** according to the fourth embodiment, and the host device **74** according to the fourth embodiment has the hardware configuration of a commonly-used computer in which a CPU, a ROM, a RAM, and a HDD are connected to each other via a bus.

[0228] The computer programs that are executed for performing the abovementioned information processing in the information processing apparatus **12** according to the first embodiment, the information processing apparatus **12**A according to the second embodiment, the information processing apparatus **12**B according to the third embodiment, the server device **70** according to the fourth embodiment, and the host device **74** according to the fourth embodiment are stored in advance in the ROM and provided as a computer program product.

[0229] Alternatively, the computer programs that are executed for performing the abovementioned information processing in the information processing apparatus **12** according to the first embodiment, the information processing apparatus **12**A according to the second embodiment, the information processing apparatus **12**B according to the third embodiment, the server device **70** according to the fourth embodiment, and the host device **74** according to the fourth embodiment can be recorded in the form of installable or executable files in a computer-readable recording medium such as a compact disk read only memory (CD-ROM), a flexible disk (FD), a compact disk readable (CD-R), or a digital versatile disk (DVD), and provided as a computer program product.

[0230] Still alternatively, the computer programs that are executed for performing the abovementioned information processing in the information processing apparatus **12** according to the first embodiment, the information processing apparatus **12**A according to the second embodiment, the information processing apparatus **12**B according to the third embodiment, the server device **70** according to the fourth embodiment, and the host device **74** according to the fourth embodiment can be saved as downloadable files on a computer connected to the Internet or can be made available for distribution through a network such as the Internet.

[0231] As a result of executing the computer programs for performing the abovementioned information processing in the information processing apparatus **12** according to the first embodiment, the information processing apparatus **12**A according to the second embodiment, the information processing apparatus **12**B according to the third embodiment, the server device **70** according to the fourth embodiment, and the host device **74** according to the fourth embodiment; each of the abovementioned constituent elements is generated in a main memory device.

[0232] Meanwhile, the variety of information stored in the HDD, that is, the variety of information stored in the storage unit **18**, the storage unit **18**A, and the storage unit **18**B can also be stored in an external device (such as a server). In this case, the configuration can be such that the external device is connected via a network to the information processing apparatus **12**, or the information processing apparatus **12**A, or the information processing apparatus **12**B, or the server device **70** and the host device **74**.

[0233] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

What is claimed is:

1. An information processing apparatus comprising:

a first receiving unit configured to receive speech data containing pieces of utterance data of speakers;

a dividing unit configured to divide the speech data into the pieces of utterance data;

an assigning unit configured to assign speaker identification information to each piece of utterance data based on an acoustic feature of the each piece of utterance data;

a second receiving unit configured to receive, from a user, instruction information that indicates a piece of utterance data to which a speaker name is to be given from among the pieces of utterance data included in the speech data; and

a generating unit configured to generate a candidate list that indicates candidate speaker names so as to enable the user to determine a speaker name to be given to the piece of utterance data identified by the instruction information, based on operation history information in which at least pieces of utterance identification information for identifying the respective pieces of utterance data, pieces of the speaker identification information that has been assigned to the respective pieces of utterance data, and speaker names given by the user to the respective pieces of utterance data identified by the pieces of speaker identification information are associated with one another.

2. The apparatus according to claim **1**, wherein the generating unit generates the candidate list that indicates the correspondence between the candidate speaker names and probabilities at which the candidate speaker names are given to the piece of utterance data identified by the instruction information based on the operation history information.

3. The apparatus according to claim **1**, wherein

each piece of utterance identification information enables unique identification of a piece of utterance data as well as indicates the chronological sequence of the piece of utterance data in the speech data,

the generating unit includes

a first calculating unit configured to calculate, from a correspondence relationship between the pieces of speaker identification information and the speaker names specified in the operation history information, first probabilities that indicate probabilities at which the speaker names are associated with the respective pieces of speaker identification information;

a second calculating unit configured to calculate second probabilities each of which indicates a probability at which each speaker name specified in the operation history information is given subsequent to the speaker name corresponding to a chronologically previous piece of utterance data; and

a third calculating unit configured to calculate a score that indicates a likelihood at which the speaker name is given to the piece of utterance data to which a speaker name is to be given based on the piece of speaker identification information corresponding to the piece of utterance data identified by the instruction information, based on the corresponding first probability, and based on the corresponding second probability, for each speaker name specified in the operation history information, and

the generating unit selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit, and generates the candidate list that indicates the selected speaker names as the candidate speaker names.

4. The apparatus according to claim **3**, wherein the generating unit selects a predetermined number of speaker names in descending order of the scores calculated by the third calculating unit, and generates the candidate list in which the speaker names are arranged in descending order of the scores.

5. The apparatus according to claim **3**, wherein

the operation history information further contains text data set by the user with respect to the piece of utterance data identified by the piece of utterance identification information,

the generating unit further includes

an extracting unit configured to extract, from at least the piece of utterance data to which a speaker name is to be given, the piece of speaker identification information belonging to each speaker name specified in the operation history information; and

a fourth calculating unit configured to calculate third probabilities each of which indicates a probability at which the text data of at least the utterance data to which a speaker name is to be given contains the piece of speaker identification information belonging to each speaker name specified in the operation history information, and

the third calculating unit calculates the score based on the piece of speaker identification information corresponding to the piece of utterance data identified by the instruction information, based on the corresponding first probability, based on the corresponding second probability, and based on the corresponding third probability, for each speaker name specified in the operation history information.

6. The apparatus according to claim **3**, wherein

the operation history information further contains the number of times of reproducing each piece of utterance data, which is identified by the utterance identification information, during a predetermined number of prior reproduction operations,

the generating unit further includes

a second obtaining unit configured to obtain the recent number of times of reproducing each piece of utterance data included in the speech data, respectively; and

a fifth calculating unit configured to calculate a fourth probability that indicates a probability of reproducing the piece of utterance data corresponding to the speaker name based on the number of times of reproducing the piece of utterance data corresponding to the speaker name, for each speaker name specified in the operation history information, and

the third calculating unit calculates a score that indicates a likelihood at which the speaker name is given to the piece of utterance data to which a speaker name is to be given, based on the piece of speaker identification information corresponding to the piece of utterance data identified by the instruction information, based on the corresponding first probability, based on the corresponding second probability, and based on the corresponding fourth probability, for each speaker name specified in the operation history information.

7. A computer program product comprising a computer-readable medium containing a program executed by a computer, the program causing the computer to execute:

receiving speech data containing pieces of utterance data of speakers;

dividing the speech data into the pieces of utterance data;

assigning speaker identification information to each piece of utterance data based on an acoustic feature of the each piece of utterance data;

receiving, from a user, instruction information that indicates a piece of utterance data to which a speaker name is to be given from among the pieces of utterance data included in the speech data; and

generating a candidate list that indicates candidate speaker names so as to enable the user to determine a speaker name to be given to the piece of utterance data identified by the instruction information, based on operation history information in which at least pieces of utterance identification information for identifying the respective pieces of utterance data, pieces of the speaker identification information that has been assigned to the respective pieces of utterance data, and speaker names given by the user to the respective pieces of utterance data identified by the pieces of speaker identification information are associated with one another.

8. An information processing method comprising:

receiving speech data containing pieces of utterance data of speakers;

dividing the speech data into the pieces of utterance data;

assigning speaker identification information to each piece of utterance data based on an acoustic feature of the each piece of utterance data;

receiving, from a user, instruction information that indicates a piece of utterance data to which a speaker name is to be given from among the pieces of utterance data included in the speech data; and

generating a candidate list that indicates candidate speaker names so as to enable the user to determine a speaker name to be given to the piece of utterance data identified by the instruction information, based on operation history information in which at least pieces of utterance identification information for identifying the respective pieces of utterance data, pieces of the speaker identification information that has been assigned to the respective pieces of utterance data, and speaker names given by the user to the respective pieces of utterance data identified by the pieces of speaker identification information are associated with one another.

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