

DESCRIPTION

Title of Invention: OUTPUT APPARATUS, OUTPUT METHOD, AND PROGRAM

5 Technical field

[0001] The present invention relates to an output apparatus and the like for acquiring and outputting objective information for specifying a favorable nutrient balance for a user using an analysis result of gut bacteria.

10 Background Art

[0002] Conventionally, there has been a program for proposing a meal pattern recommended for the next meal using time-series blood glucose level data and meal records (see Patent Document 1).

15 Citation List

Patent Document

[0003] Patent Document 1: JP 2023-19885A

Summary of Invention

20 Technical Problem

[0004] It is known that each person's bodily reaction to food varies, and that an optimal nutritional balance exists for each individual.

[0005] However, such conventional techniques cannot present information for specifying a favorable nutrient balance tailored to each individual. In particular,

25 it is difficult to present a personalized nutritional balance that is less likely to

cause a rise in the blood glucose level.

[0006] Furthermore, the conventional techniques cannot present a user's type, using the gut bacteria analysis result of the user.

[0007] Moreover, the conventional techniques cannot present meals that are
5 likely or less likely to cause a rise in the user's blood glucose level, using the gut bacteria analysis result of the user.

Solution to Problem

[0008] A first aspect of the present invention is directed to an output apparatus
10 including: a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance; an acceptance unit that accepts target information containing a gut bacteria analysis result of a user; a prediction unit
15 that acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; and an output unit that outputs the objective information acquired by the prediction unit.

[0009] With this configuration, it is possible to present objective information for
20 specifying a favorable nutrient balance, using an analysis result of gut bacteria.

[0010] Furthermore, a second aspect of the present invention is directed to the output apparatus according to the first aspect, wherein the training data has at least one of health information of the user corresponding to the gut bacteria analysis result and lifestyle information on a lifestyle of the user, and the
25 acceptance unit accepts target information having the gut bacteria analysis result

of the user and at least one of the health information of the user and the lifestyle information of the user.

[0011] With this configuration, it is possible to present objective information for specifying a more favorable nutrient balance, using an analysis result of gut
5 bacteria and at least one of health information and lifestyle information.

[0012] Furthermore, a third aspect of the present invention is directed to the output apparatus according to the first or second aspect, further including: a candidate management unit in which two or more pieces of candidate information each indicating a candidate for information for specifying a favorable nutrient
10 balance are stored, wherein the prediction unit acquires a blood glucose level for each of the two or more pieces of candidate information, using the candidate information, the target information, and the learning information, and acquires candidate information corresponding to a blood glucose level that satisfies a selection condition, and the output unit outputs the candidate information
15 acquired by the prediction unit.

[0013] With this configuration, it is possible to present objective information for specifying a favorable nutrient balance from among two or more candidates, using an analysis result of gut bacteria.

[0014] Furthermore, a fourth aspect of the present invention is directed to the
20 output apparatus according to the first or second aspect, wherein the objective information is a balance identifier for identifying a nutrient balance or balance information indicating a nutrient balance, and the output unit outputs the balance information identified by the balance identifier that is the objective information, or the balance information that is the objective information.

25 [0015] With this configuration, it is possible to present balance information

indicating a favorable nutrient balance, using an analysis result of gut bacteria.

[0016] Furthermore, a fifth aspect of the present invention is directed to the output apparatus according to any one of the first to fourth aspects, further including: a menu acquisition unit that acquires balance information indicating a nutrient balance that is based on the objective information, and acquires menu information for specifying a meal menu corresponding to the balance information, wherein the output unit outputs the menu information instead of the objective information or in addition to the objective information.

[0017] With this configuration, it is possible to specify a favorable nutrient balance using an analysis result of gut bacteria, and propose a meal menu from the nutrient balance.

[0018] Furthermore, a sixth aspect of the present invention is directed to the output apparatus according to any one of the first to fifth aspects, wherein the acceptance unit accepts standard meal information on a meal serving as a standard, the output apparatus further includes a difference acquisition unit that acquires balance information for specifying a nutrient balance corresponding to the standard meal information, and acquires difference information on a difference between the acquired balance information and balance information that is the objective information acquired by the prediction unit, and the output unit outputs the difference information.

[0019] With this configuration, it is possible to present, to a user, difference information for improving a meal consumed by the user.

[0020] Furthermore, a seventh aspect of the present invention is directed to the output apparatus according to any one of the first to sixth aspects, wherein the learning information is a learning model acquired through machine learning

processing using the two or more pieces of training data, and the prediction unit performs machine learning prediction processing using the target information and the learning model, thereby acquiring the objective information.

[0021] With this configuration, it is possible to present objective information for

5 specifying a favorable nutrient balance through machine learning, using an analysis result of gut bacteria.

[0022] Furthermore, the present invention is directed to an output apparatus

including: a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data

10 each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance; a type management unit in which two or more pieces of type information are stored, the type information each having a nutrient balance condition regarding objective information for specifying a nutrient balance and a type identifier for identifying a user's type; an acceptance
15 unit that accepts target information containing a gut bacteria analysis result of a user; a prediction unit that acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; a type determination unit that acquires a type identifier corresponding to the objective information; and an output unit that
20 outputs the type identifier.

[0023] With this configuration, it is possible to present a user's type, using an gut bacteria analysis result of the user.

[0024] Furthermore, an aspect of the present invention is directed to the output apparatus according to the above-described aspect, further including: a type

25 information acquisition unit that acquires type information of the user containing

the type identifier acquired by the type determination unit, and the output unit outputs the type information.

[0025] With this configuration, it is possible to present a user's type, using an gut bacteria analysis result of the user.

5 [0026] Furthermore, an aspect of the present invention is directed to the output apparatus according to the above-described aspect, wherein the acceptance unit accepts standard meal information on a meal serving as a standard, the prediction unit acquires objective information corresponding to the type determined by the type determination unit, the output apparatus further includes a difference
10 acquisition unit that acquires balance information for specifying a nutrient balance corresponding to the standard meal information, and acquires difference information on a difference between the acquired balance information and balance information that is the objective information acquired by the prediction unit, and the output unit outputs the difference information.

15 [0027] With this configuration, it is possible to present difference information based on the user's type. Furthermore, an aspect of the present invention is directed to the output apparatus according to the above-described aspect, wherein second learning information acquired using two or more pieces of training data is stored in the learning information storage unit, the training data each having a
20 gut bacteria analysis result, food item information, and a blood glucose level, the output apparatus further includes: a menu management unit in which two or more pieces of menu management information are stored, the pieces of menu management information each including a food item identifier for identifying a food item and food item information having one or more pieces of nutrient
25 information on the food item; a second prediction unit that acquires a blood

glucose level of the user after consumption of each of the food items respectively specified by the two or more pieces of food item information, using the gut bacteria analysis result of the user, the food item information contained in the two or more pieces of menu management information, and the second learning information;

5 and a recommendation determination unit that acquires recommendation information for recommending a food item, using the blood glucose levels respectively corresponding to the two or more pieces of food item information acquired by the second prediction unit, and the output unit outputs the recommendation information acquired by the recommendation determination
10 unit.

[0028] With this configuration, it is possible to present meals that are likely or less likely to cause a rise in the user's blood glucose level, using the gut bacteria analysis result of the user.

15 Advantageous Effects of Invention

[0029] With the output apparatus according to the present invention, it is possible to present objective information for specifying a favorable nutrient balance, using an analysis result of gut bacteria.

20 Brief Description of Drawings

[0030] FIG. 1 is a conceptual diagram of an information system A in Embodiment 1.

FIG. 2 is a block diagram of the information system A in the embodiment.

FIG. 3 is a flowchart illustrating an operation example of an output
25 apparatus 1 in the embodiment.

FIG. 4 is a flowchart illustrating a first example of learning processing in the embodiment.

FIG. 5 is a flowchart illustrating a second example of learning processing in the embodiment.

5 FIG. 6 is a flowchart illustrating a third example of learning processing in the embodiment.

FIG. 7 is a flowchart illustrating a first example of prediction processing in the embodiment.

10 FIG. 8 is a flowchart illustrating a second example of prediction processing in the embodiment.

FIG. 9 is a flowchart illustrating a third example of prediction processing in the embodiment.

FIG. 10 is a flowchart illustrating a fourth example of prediction processing in the embodiment.

15 FIG. 11 is a flowchart illustrating a fifth example of prediction processing in the embodiment.

FIG. 12 is a flowchart illustrating an example of menu acquisition processing in the embodiment.

20 FIG. 13 is a flowchart illustrating an example of difference acquisition processing in the embodiment.

FIG. 14 is a diagram showing an output example in the embodiment.

FIG. 15 is a block diagram of an information system B in Embodiment 2.

FIG. 16 is a flowchart illustrating an operation example of an output apparatus 3 in the embodiment.

25 FIG. 17 is a flowchart illustrating an example of second learning

processing in the embodiment.

FIG. 18 is a flowchart illustrating an example of type determination processing in the embodiment.

FIG. 19 is a flowchart illustrating a first example of second prediction processing in the embodiment.

FIG. 20 is a flowchart illustrating an example of recommendation determination processing in the embodiment.

FIG. 21 is a diagram showing an example of a type management table in the embodiment.

FIG. 22 is a diagram showing an example of a type related information management table in the embodiment.

FIG. 23 is a diagram showing an example of a menu management table in the embodiment.

FIG. 24 is a diagram showing an example of processing by the output apparatus 3 in the embodiment.

FIG. 25 is a diagram showing an output example in the embodiment.

FIG. 26 is a diagram showing an output example in the embodiment.

FIG. 27 is a diagram showing an output example in the embodiment.

FIG. 28 is a diagram showing an output example in the embodiment.

FIG. 29 is a diagram showing an output example in the embodiment.

FIG. 30 is a schematic view of a computer system in the above-mentioned embodiments.

FIG. 31 is a block diagram of the computer system in the embodiments.

[0031] Hereinafter, embodiments of an output apparatus and the like will be described with reference to the drawings. It should be noted that constituent elements denoted by the same reference numerals in the embodiments perform similar operations, and thus a description thereof may not be repeated.

5 [0032] Embodiment 1

In this embodiment, an output apparatus will be described that acquires and outputs objective information for specifying a favorable nutrient balance for a user, using an gut bacteria analysis result of the user and learning information.

[0033] Furthermore, in this embodiment, the output apparatus will be described
10 that acquires and outputs objective information, using at least one of health information of the user and lifestyle information of the user, in addition to the gut bacteria analysis result of the user.

[0034] Furthermore, in this embodiment, the output apparatus will be described that predicts a blood glucose level using the gut bacteria analysis result of the
15 user and two or more candidates for a nutrient balance, and acquires and outputs a candidate for a nutrient balance corresponding to a blood glucose level that satisfies a selection condition.

[0035] Furthermore, in this embodiment, the output apparatus will be described that proposes a meal menu, using information on the acquired nutrient balance.

20 [0036] Moreover, in this embodiment, the output apparatus will be described that presents a difference between information on the acquired nutrient balance and a nutrient balance obtained from information on a user's meal.

[0037] In this specification, the state in which information X is associated with information Y means that the information Y can be acquired from the information
25 X or the information X can be acquired from the information Y, and there is no

limitation on the method for associating the information. The information X and the information Y may be linked to each other or in the same buffer. The information X may be contained in the information Y, or the information Y may be contained in the information X, for example.

5 [0038] Furthermore, in this specification, the selecting information Z is to obtain the information Z, to obtain a pointer to the information Z, to obtain the ID of the information Z, to flag the information Z, or the like, and they may be any processing that makes the information Z accessible.

[0039] FIG. 1 is a conceptual diagram of an information system A in this
10 embodiment. The information system A includes an output apparatus 1 and one or two or more terminal devices 2.

[0040] The output apparatus 1 is an apparatus that acquires and outputs objective information. The output apparatus 1 is, for example, a cloud server or an ASP server, but there is no limitation on the type thereof. The output
15 apparatus 1 may be stand-alone apparatus. That is to say, the output apparatus 1 may be a terminal. If the output apparatus 1 is a terminal, the output apparatus 1 is, for example, a so-called personal computer, smartphone, or tablet device, but there is no limitation on the type thereof.

[0041] The terminal devices 2 are terminals that are used by users. The
20 terminal devices 2 are, for example, so-called personal computers, smartphones, or tablet devices, but there is no limitation on the type thereof.

[0042] The output apparatus 1 and the two or more terminal devices 2 can typically communicate with each other via a network such as the Internet.

[0043] FIG. 2 is a block diagram of the information system A in this embodiment.
25 The output apparatus 1 constituting the information system A includes a storage

unit 11, an acceptance unit 12, a processing unit 13, and an output unit 14.

[0044] The storage unit 11 includes a learning information storage unit 111, a candidate management unit 112, and a menu management unit 113. The processing unit 13 includes a learning unit 130, a prediction unit 131, a menu acquisition unit 132, and a difference acquisition unit 133.

[0045] Each terminal device 2 includes a terminal storage unit 21, a terminal acceptance unit 22, a terminal processing unit 23, a terminal transmission unit 24, a terminal reception unit 25, and a terminal output unit 26.

[0046] Various types of information are stored in the storage unit 11 constituting the output apparatus 1. The various types of information are, for example, later-described two or more pieces of training data, later-described learning information, later-described candidate information, or later-described menu management information.

[0047] Learning information is stored in the learning information storage unit 111. The learning information is information acquired using two or more pieces of training data.

[0048] The training data is information for acquiring the learning information. The training data is, for example, information for generating a later-described learning model, information for generating a later-described correspondence table, or information for generating a later-described operation expression. The training data may be information for configuring the learning information. The training data has a gut bacteria analysis result and objective information. The training data preferably has at least one of health information and lifestyle information in addition to the gut bacteria analysis result and the objective information. The gut bacteria analysis result and the health information and the

lifestyle information contained in one piece of training data are information on the same person.

[0049] The gut bacteria analysis result (hereinafter, also may be simply referred as an “analysis result”) is information indicating a result of analyzing a person’s

5 gut bacteria. The analysis result is information on each of one or more bacteria that are present in the intestines. The analysis result is, for example,

information on the quantity of bacteria. The analysis result is, for example,

information on the proportion of bacteria. The analysis result is, for example,

information on the quantity of 41 types of bacteria in total consisting of gut

10 bacteria PCA0 to PCA40. The analysis result is, for example, information

indicating the quantity of *Prevotella*, information indicating the quantity of

Bifidobacterium, information indicating the quantity of *Megamonas*, information

indicating the quantity of *Ruminococcus*, information indicating the quantity of

Akkermansia, or information indicating the quantity of *Fusobacterium*. The

15 analysis result is, for example, information indicating the quantity of each type of gut bacteria, obtained through compression by dimensionality reduction.

[0050] The objective information is information for specifying a favorable

nutrient balance for a user. The objective information can be said to be

information that is required to be obtained by the output apparatus 1. The

20 objective information is, for example, balance information or a blood glucose level.

The balance information is information for specifying a nutrient balance. The

balance information is, for example, an identifier (typically an ID) for identifying

information indicating a nutrient balance, or information indicating a nutrient

balance. The objective information may be an identifier for identifying any of

25 two or more types of nutrient balance.

[0051] The information indicating a nutrient balance is, for example, information indicating the amount or proportion of protein, fat, carbohydrates, sugars, or dietary fiber (e.g., in g or %). The information indicating a nutrient balance is, for example, information indicating the amount or proportion of each nutrient
 5 constituting three major nutrients (protein, fat, and carbohydrates) (e.g., in g or %) or information indicating the amount or proportion of each nutrient constituting five major nutrients (protein, fat, carbohydrates, minerals, and vitamins) (e.g., in g or %). The information indicating a nutrient balance is, for example, the amount of energy (e.g., in kcal). The information indicating a
 10 nutrient balance is, for example, a vector (energy amount, carbohydrate amount, fat amount, dietary fiber amount, protein amount, sugar amount).

[0052] The health information is information on an organism. The health information can be said to be information on the health of an organism. There is no limitation on the acquisition route, the acquisition method, or the like of the
 15 health information. The health information typically contains health examination information. The health information contains, for example, data obtainable via a device or data measurable at home (e.g., weight, blood pressure, pulse rate, etc.) as well. The health examination information is information on health examination results. The health information is, for example, information
 20 on blood test results, information on physical measurement results, or user attribute values. The health information is, for example, age, gender, whether or not the user smokes, height, weight, BMI, obesity history, waist circumference, waist-to-hip ratio, hip circumference length, blood pressure, systolic blood pressure, ALT (GPT), basophils, C-peptide, eosinophils, HbA1c, HDL, total
 25 hemoglobin (ctHb), insulin, IL-6, LDL, lymphocytes, MCH, MCV, monocytes,

neutrophils, Non-HDL, nucleated red blood cells, Ht (hematocrit), packed cell volume, platelets, red blood cell count, red blood cell distribution width, thyroid-stimulating hormone, total cholesterol, total cholesterol to HDL ratio, triglycerides, white blood cell count, or baseline blood glucose level.

5 [0053] The lifestyle information is information on a lifestyle of the user. The lifestyle information is, for example, information on sleep, information on meals, or information on activity. The information on sleep is, for example, sleep duration, sleep efficiency, or the time from waking to sleeping. The information on meals is the amount of carbohydrates consumed, the amount of dietary fiber
10 consumed, or the amount of carbohydrates in the previous meal. The information on activity is, for example, time spent exercising or time spent in vigorous activity. The lifestyle information may be information on the lifestyles at two or more points in time. That is to say, the lifestyle information is, for example, a set of sleep information at two or more points in time, information on
15 meals at two or more points in time, or information on activity at two or more points in time. The lifestyle information is, for example, sleep duration for each day over two or more days, total sleep duration over two or more days, the amount of carbohydrates consumed in each meal over two or more meals, the total amount of carbohydrates consumed over two or more meals, time spent exercising for each
20 day over two or more days, or total time spent exercising over two or more days.

[0054] The learning information is information that is used to acquire objective information. The learning information is, for example, a learning model, a correspondence table, or an operation expression.

[0055] The learning model is information acquired through machine learning
25 processing using two or more pieces of training data. The training data in this

case is information in which an analysis result is taken as an explanatory variable and objective information is taken as a response variable. The training data may be information in which at least one of health information and lifestyle information and an analysis result are taken as explanatory variables and objective information is taken as a response variable. The learning model is information that is used for machine learning prediction processing. The learning model may also be said to be a learner, a classifier, a classification model, or the like. Any machine learning algorithm can be used, such as deep learning, random forest, decision tree, SVM, SVR, or the like. For machine learning, various machine learning functions such as the TensorFlow (registered trademark) library, the random forest module of the R language, TinySVM, and various other existing libraries can be used, for example.

[0056] The correspondence table is a table for managing the correspondence between an explanatory variable and objective information. The correspondence table has two or more pieces of correspondence information, and the correspondence information is information indicating the correspondence between an explanatory variable and objective information. The explanatory variable is, for example, an analysis result. The explanatory variable has, for example, at least one of health information and lifestyle information and an analysis result.

[0057] The operation expression is an operation expression for which one or two or more parameters contained in the analysis result is substituted to acquire a predicted blood glucose level. The operation expression is, for example, an operation expression for which one or two or more parameters contained in the analysis result and at least one of health information and lifestyle information are substituted to output a predicted blood glucose level.

[0058] Two or more pieces of candidate information are stored in the candidate management unit 112. The candidate information is a candidate for information for specifying a favorable nutrient balance. The candidate information is typically balance information. The balance information in this case is typically information indicating a nutrient balance or an identifier for identifying information indicating a nutrient balance. The candidate information is, for example, information indicating the energy amount and the amount or proportion of each nutrient constituting three major nutrients (protein, fat, and carbohydrates), information indicating the energy amount and the amount or proportion of each nutrient constituting five major nutrients (protein, fat, carbohydrates, minerals, and vitamins), information indicating the amount of energy that is to be obtained in a unit period (e.g., per day or per meal) and the amount or proportion of each nutrient constituting the three major nutrients, or information indicating the amount of energy that is to be obtained in a unit period (e.g., per day) and the amount or proportion of each nutrient constituting the five major nutrients. The amount or proportion of carbohydrates may contain the amount or proportion of sugars contained in the carbohydrates and the amount or proportion of dietary fiber contained in the carbohydrates.

[0059] Two or more pieces of menu management information are stored in the menu management unit 113. The menu management information is information for managing menu information corresponding to the balance information. The menu information is information for specifying a meal menu. The menu may be one or more dishes, one or more food items, or one or more dishes and one or more food items. That is to say, the menu information may be information for specifying items before cooking, items after cooking, and items before cooking and

items after cooking.

[0060] The menu management information is, for example, food item information.

The food item information is information for specifying a food item. The food item information has, for example, two or more pieces of nutrient information.

5 The nutrient information is information on the energy and nutrients contained in a food item. The nutrient information is, for example, the amount of energy contained in a food item or the amount of each of one or two or more nutrients. The food item information has, for example, a food item name or a food item image.

10 [0061] The acceptance unit 12 accepts various types of information and instructions. For example, the acceptance unit 12 receives various types of information and instructions from the terminal device 2. For example, the acceptance unit 12 accepts various types of information and instructions from the user. The various types of information and instructions are, for example, target
15 information, meal information, or learning instructions. The meal information in this case is, for example, standard meal information.

[0062] In this case, the accepting is typically reception of information transmitted via a wired or wireless communication line, but it may be a concept that encompasses acceptance of information input from an input device such as a
20 keyboard, a mouse, or a touch panel, acceptance of information read from a recording medium such as an optical disk, a magnetic disk, or a semiconductor memory, and the like.

[0063] The target information is information on a user to whom the objective information is presented. The target information contains an analysis result of a
25 user. The target information may have at least one of the health information of

the user and the lifestyle information of the user in addition to the analysis result.

[0064] The meal information is information on a meal. The meal information is, for example, information for specifying a meal, balance information of a meal, or an image of a meal (dish). The balance information of a meal contains, for
 5 example, the amount or proportion of each of two or more nutrients consumed in a meal. Each of two or more nutrients is, for example, carbohydrates, fat, dietary fiber, sugars, or protein. Such balance information contains, for example, the energy amount.

[0065] The standard meal information is information on a meal serving as a
 10 standard. The standard meal information is typically information that serves as a base when acquiring difference information. The standard meal information is, for example, information on a meal consumed by a user, information on a meal desired by a user, or information on a meal that is consumed by an average user.

[0066] The processing unit 13 performs various types of processing. The various
 15 types of processing are, for example, processing that is performed by the learning unit 130, the prediction unit 131, the menu acquisition unit 132, or the difference acquisition unit 133.

[0067] The learning unit 130 acquires learning information using the two or more pieces of training data in the storage unit 11. Such two or more pieces of training
 20 data may be information that is stored in an external device (not shown) and is temporarily stored in the storage unit 11.

[0068] The learning information that is acquired by the learning unit 130 is, for example, a learning model, a correspondence table, or an operation expression. Hereinafter, each of these types of information will be described.

(1) Case in which learning information is learning model

[0069] For example, the learning unit 130 gives the two or more pieces of training data in the storage unit 11 to a learning module of machine learning and executes the module, thereby acquiring a learning model. This learning model is given

5 together with the accepted target information to a prediction module of machine learning, and is used to acquire objective information.

(1-1) Case in which objective information is blood glucose level, and balance information is used

10 [0070] For example, the learning unit 130 performs machine learning processing using two or more pieces of training data in which balance information and target information are taken as explanatory variables and a blood glucose level is taken as a response variable, thereby acquiring a learning model.

15 (1-2) Case in which objective information is blood glucose level, and balance information is not used

[0071] For example, the learning unit 130 performs machine learning processing using two or more pieces of training data in which target information is taken as an explanatory variable and a blood glucose level is taken as a response variable,
20 thereby acquiring a learning model.

(1-3) Case in which objective information is balance identifier for identifying nutrient balance

[0072] For example, the learning unit 130 performs machine learning processing
25 using two or more pieces of training data in which target information is taken as

an explanatory variable and a balance identifier is taken as a response variable, thereby acquiring a learning model.

(1-4) Case in which objective information is information indicating nutrient

5 balance

[0073] For example, the learning unit 130 performs machine learning processing using two or more pieces of training data in which target information is taken as an explanatory variable and a vector that is information indicating a nutrient balance is taken as a response variable, thereby acquiring a learning model. The
10 vector is, for example, (energy amount, carbohydrate amount, fat amount, dietary fiber amount, protein amount).

(2) Case in which learning information is correspondence table

(2-1) Case in which one piece of training data is one piece of correspondence

15 information

[0074] For example, the learning unit 130 vectorizes the explanatory variable contained in the training data, for each of the two or more pieces of training data in the storage unit 11. Next, for example, the learning unit 130 acquires
20 correspondence information having the vector and the objective information contained in the training data, for each of the two or more pieces of training data. Next, for example, the learning unit 130 configures a correspondence table having the acquired two or more pieces of correspondence information. The vector is, for example, (quantity of gut bacteria PCA0, quantity of gut bacteria PCA1, ..., quantity of PCA40, height, weight, ..., blood pressure, ..., red blood cell count, ...).

25 The objective information is, for example, information indicating a blood glucose

level, a balance identifier, or a nutrient balance.

(2-2) Case in which one or two or more explanatory variables paired with same objective information is used to generate one piece of correspondence information

5 [0075] For example, the learning unit 130 vectorizes the explanatory variables contained in the training data, for each of the two or more pieces of training data in the storage unit 11. Next, for example, the learning unit 130 acquires a representative vector of the vectors of the one or two or more explanatory variables paired with the same objective information, for each of the two or more
10 different pieces of objective information. Next, for example, the learning unit 130 acquires correspondence information having the representative vector and the objective information, for each of the two or more different pieces of objective information. Next, for example, the learning unit 130 configures a
15 correspondence table having the acquired two or more pieces of correspondence information.

(3) Case in which learning information is operation expression

[0076] For example, the learning unit 130 vectorizes the explanatory variables contained in the training data, for each of the two or more pieces of training data
20 in the storage unit 11. Next, the learning unit 130 acquires an operation expression in which two or more elements contained in the vector acquired from the explanatory variables are taken as input and a blood glucose level that is the objective information is taken as output, for each of the two or more pieces of training data. For example, the learning unit 130 acquires, using the least
25 squares method, an operation expression in which two or more elements

contained in the vector acquired from the explanatory variables are taken as input and a blood glucose level that is the objective information is taken as output, for each of the two or more pieces of training data. There is no limitation on the method for acquiring an operation expression.

5 [0077] The prediction unit 131 acquires objective information using the accepted target information of the user and the learning information. For example, the prediction unit 131 acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information of the user and the learning information. Various methods are possible for the prediction
10 unit 131 to acquire objective information using the target information and the learning information. Hereinafter, the various methods will be described.

(1) Case in which candidate information is not used

(1-1) Case in which learning information is learning model

15 [0078] The prediction unit 131 performs machine learning prediction processing using the target information of the user and the learning model in the learning information storage unit 111, thereby acquiring objective information. More specifically, the prediction unit 131 gives the target information of the user and the learning model to a prediction module of machine learning and executes the
20 prediction module, thereby acquiring objective information.

(1-2) Case in which learning information is correspondence table

(1-2-1) Case in which one piece of correspondence information with greatest similarity is selected

25 [0079] The prediction unit 131 acquires a vector in which the two or more pieces

of information contained in the target information of the user are taken as elements. Next, the prediction unit 131 calculates a similarity between this vector and each of the vectors contained in the two or more pieces of correspondence information contained in the correspondence table. Next, the prediction unit 131 acquires objective information contained in the correspondence information corresponding to the vector with the greatest similarity.

(1-2-2) Case in which correspondence information that satisfies selection condition is selected

[0080] The prediction unit 131 acquires a vector in which the two or more pieces of information contained in the target information of the user are taken as elements. Next, the prediction unit 131 calculates a similarity between this vector and each of the vectors contained in the two or more pieces of correspondence information contained in the correspondence table. Next, the prediction unit 131 selects one or more pieces of correspondence information with a similarity that satisfies a selection condition. Next, the prediction unit 131 acquires objective information contained in the one or more pieces of correspondence information. Next, the prediction unit 131 acquires a representative value of the acquired one or more pieces of objective information. The representative value of the objective information is, for example, objective information with the highest count, an average value of the objective information, or a median value of the objective information.

(1-3) Case in which learning information is operation expression

[0081] The prediction unit 131 gives two or more pieces of information contained in the target information of the user to an operation expression and executes the operation expression, thereby acquiring a blood glucose level that is the objective information.

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(2) Case in which candidate information is used

[0082] If the prediction unit 131 uses candidate information, the prediction unit 131 acquires a blood glucose level using the candidate information, the target information, and the learning information, for each of the two or more pieces of
 10 candidate information. Next, the prediction unit 131 acquires candidate information corresponding to a blood glucose level that satisfies a selection condition. The selection condition is typically that the blood glucose level has the lowest value, but, for example, it may be that the blood glucose level is at or below a threshold value or is below the threshold value. If the selection condition is
 15 that the blood glucose level is at or below a threshold value or is below the threshold value, the prediction unit 131 may acquire two or more pieces of candidate information.

[0083] Hereinafter, the processing that acquires a blood glucose level differs depending on the type of learning information, but the processing that acquires
 20 candidate information corresponding to a blood glucose level that satisfies a selection condition is the same. Therefore, the processing up to acquiring a blood glucose level will be described below for each of the three types of learning information.

25 (2-1) Case in which learning information is learning model

[0084] The prediction unit 131 gives the candidate information, the target information, and the learning model to a prediction module of machine learning and executes the prediction module, thereby acquiring a blood glucose level, for each of the two or more pieces of candidate information. Any machine learning
 5 algorithm can be used in this case, such as deep learning, random forest, decision tree, SVR, or the like.

[0085] Furthermore, the learning model in this case is information acquired by the learning unit 130 using two or more pieces of training data in which balance information and target information are taken as explanatory variables and a
 10 blood glucose level is taken as a response variable.

(2-2) Case in which learning information is correspondence table

(2-2-1) Case in which correspondence information with greatest similarity is used

[0086] The prediction unit 131 configures a vector in which candidate
 15 information and two or more pieces of information contained in the target information are taken as elements, for each of the two or more pieces of candidate information. The prediction unit 131 calculates, for each of the two or more pieces of candidate information, a similarity between this vector and each of the vectors contained in the two or more pieces of correspondence information of the
 20 correspondence table, and acquires a blood glucose level contained in the correspondence information with the greatest similarity.

(2-2-2) Case in which correspondence information that satisfies selection condition is used

25 [0087] The prediction unit 131 configures a vector in which candidate

information and two or more pieces of information contained in the target information are taken as elements, for each of the two or more pieces of candidate information. The prediction unit 131 calculates, for each of the two or more pieces of candidate information, a similarity between this vector and each of the vectors contained in the two or more pieces of correspondence information of the correspondence table, and acquires blood glucose levels respectively contained in one or more pieces of correspondence information with a similarity that satisfies a selection condition. Next, the prediction unit 131 acquires a representative value (e.g., an average value or a median value) of the acquired one or two or more blood glucose levels. The selection condition in this case is, for example, that the similarity is at or above a threshold value or is above the threshold value.

(2-3) Case in which learning information is operation expression

[0088] The prediction unit 131 gives the candidate information and each of the two or more pieces of information contained in the target information to an operation expression and executes the operation expression, thereby acquiring a blood glucose level, for each of the two or more pieces of candidate information.

[0089] The menu acquisition unit 132 acquires balance information indicating a nutrient balance that is based on the objective information, and acquires menu information for specifying a meal menu corresponding to the balance information, from the menu management unit 113.

[0090] The difference acquisition unit 133 acquires balance information for specifying a nutrient balance corresponding to the accepted standard meal information. Next, the difference acquisition unit 133 acquires difference information on a difference between the acquired balance information and

balance information that is acquired by the prediction unit 131. The difference information is, for example, information indicating a difference between the amounts or proportions of two or more nutrients. The difference information is, for example, information indicating a difference between the energy amounts.

5 The difference information is, for example, food item information for specifying a food item to make up the difference between the amounts or proportions of two or more nutrients, or menu information for specifying a meal menu to make up the difference between the amounts or proportions of two or more nutrients. The difference information is, for example, food item information for specifying a food
10 item to make up the difference between the energy amounts, or menu information for specifying a meal menu to make up the difference between the energy amounts.

[0091] The difference acquisition unit 133 acquires, for example, the energy amounts respectively corresponding to the one or more dish names contained in
15 the standard meal information, or the amounts of two or more nutrients respectively corresponding to the one or more dish names, from the storage unit 11 or the recipe database in an external device (not shown). The recipe database is a database in which the energy amount and the amount of each of two or more nutrients are stored in pairs with a dish name, for each of the one or more dish
20 names.

[0092] Furthermore, for example, the difference acquisition unit 133 gives a dish image that is the standard meal information and the learning model to a prediction module of machine learning, thereby acquiring the energy amount and the amount of each of two or more nutrients corresponding to the dish image.
25 This learning model is information acquired by performing machine learning

processing using two or more pieces of training data each having a dish image, the energy amount, and the amount of each of two or more nutrients. The prediction module is a module that outputs the energy amount and the amount of each of two or more nutrients of the dish, using the dish image and the learning model.

5 [0093] The accepted standard meal information may be the amount of each of two or more nutrients, or a menu name. If the standard meal information is one or more menu names, the difference acquisition unit 133 acquires the amounts of nutrients respectively corresponding to the one or more menu names, and acquires balance information using the amounts of nutrients. Next, the
10 difference acquisition unit 133 acquires difference information on a difference between the acquired balance information and balance information that is acquired by the prediction unit 131.

[0094] The output unit 14 outputs the objective information acquired by the prediction unit 131. The objective information is, for example, balance
15 information or a blood glucose level. If the prediction unit 131 acquires a balance identifier, for example, the output unit 14 may acquire information indicating a nutrient balance identified by the balance identifier from the storage unit 11 or an unshown device, and output the information indicating the nutrient balance.

[0095] The output unit 14 outputs, for example, the candidate information
20 acquired by the prediction unit 131. The candidate information is balance information. This candidate information can be said to be objective information.

[0096] The output unit 14 outputs, for example, balance information identified by a balance identifier that is the objective information, or balance information that is the objective information.

25 [0097] The output unit 14 outputs, for example, the menu information acquired

by the menu acquisition unit 132, instead of the objective information or in addition to the objective information.

[0098] The output unit 14 outputs, for example, the difference information acquired by the difference acquisition unit 133, instead of the objective

5 information or in addition to the objective information.

[0099] Various types of information are stored in the terminal storage unit 21 constituting the terminal device 2. The various types of information are, for example, a user identifier.

[0100] The terminal acceptance unit 22 accepts various types of information,
10 instructions, and the like. The various types of information, instructions, and the like are, for example, target information, meal information, or learning instructions.

[0101] In this case, the accepting is a concept that encompasses acceptance of information input from an input device such as a keyboard, a mouse, or a touch
15 panel, reception of information transmitted via a wired or wireless communication line, acceptance of information read from a recording medium such as an optical disk, a magnetic disk, or a semiconductor memory, and the like.

[0102] The various types of information, instructions, and the like may be input by any input part such as a touch screen, a keyboard, a mouse, or a menu screen.

20 [0103] The terminal processing unit 23 performs various types of processing. The various types of processing are, for example, processing that changes the accepted information, instructions, and the like into information, instructions, and the like with a structure for transmission. The various types of processing are, for example, processing that changes the received information into

25 information with a structure for output.

[0104] The terminal transmission unit 24 transmits the various types of information, instructions, and the like to the output apparatus 1. The various types of information, instructions, and the like are, for example, target information, meal information, or learning instructions.

5 [0105] The terminal reception unit 25 receives the various types of information. The various types of information are, for example, objective information, menu information, or difference information.

[0106] The terminal output unit 26 outputs various types of information. The various types of information are, for example, objective information, menu
10 information, or difference information.

[0107] In this case, the output is a concept that encompasses display on a display screen, projection using a projector, printing by a printer, output of a sound, transmission to an external apparatus, accumulation in a recording medium, and delivery of a processing result to another processing apparatus or another
15 program.

[0108] The storage unit 11, the learning information storage unit 111, the candidate management unit 112, the menu management unit 113, and the terminal storage unit 21 are preferably non-volatile recording media, but they may be realized by volatile recording media.

20 [0109] There is no limitation on the procedure in which information is stored in the storage unit 11 and the like. For example, information may be stored the storage unit 11 and the like via a recording medium, information transmitted via a communication line or the like may be stored in the storage unit 11 and the like, or information input via an input device may be stored in the storage unit 11 and
25 the like.

[0110] The acceptance unit 12 is preferably realized by a wireless or wired communication part, but it may be realized by a broadcast receiving part, a device driver for an input part such as a touch screen or a keyboard, control software for a menu screen, or the like.

5 [0111] The processing unit 13, the prediction unit 131, the menu acquisition unit 132, and the terminal processing unit 23 may be typically realized by processors, memories, or the like. Typically, the processing procedure of the processing unit 13 and the like is realized by software, and the software is stored in a recording medium such as a ROM. However, the processing procedure may be realized by
10 hardware (dedicated circuits). The processors are, for example, CPUs, MPUs, GPUs, or the like, but there is no limitation on the type thereof.

[0112] The output unit 14 is typically realized by a wireless or wired communication part. However, the output unit 14 may be realized by driver software for an output device such as a display screen or a speaker, a combination
15 of driver software for an output device and the output device, or the like.

[0113] The terminal acceptance unit 22 may be realized by a device driver for an input part such as a touch screen or a keyboard, control software for a menu screen, or the like.

[0114] The terminal transmission unit 24 is typically realized by a wireless or
20 wired communication part, but it may be realized by a broadcasting part.

[0115] The terminal reception unit 25 is typically realized by a wireless or wired communication part, but it may be realized by a broadcast receiving part.

[0116] The terminal output unit 26 may be considered to include or to not include an output device such as a display screen or a speaker. The terminal output unit
25 26 may be realized by driver software for an output device, a combination of driver

software for an output device and the output device, or the like.

[0117] Next, an operation example of the output apparatus 1 will be described with reference to the flowchart in FIG. 3.

[0118] (Step S301) The acceptance unit 12 determines whether or not it has
5 accepted a learning instruction. If it has accepted a learning instruction, the procedure advances to step S302, or otherwise the procedure advances to step S303.

[0119] (Step S302) The learning unit 130 performs learning processing. The procedure returns to step S301. An example of the learning processing will be
10 described later with reference to the flowcharts in FIGS. 4, 5, and 6.

[0120] (Step S303) The acceptance unit 12 determines whether or not it has accepted target information and the like. If it has accepted target information and the like, the procedure advances to step S304, or otherwise the procedure returns to step S301. The target information and the like are target information,
15 or target information and meal information.

[0121] (Step S304) The prediction unit 131 performs prediction processing, thereby acquiring objective information. An example of the prediction processing will be described later with reference to the flowcharts in FIGS. 7, 8, 9, 10, and 11.

[0122] (Step S305) The output unit 14 outputs the objective information acquired
20 in step S304. The information that is output in this case is preferably balance information indicating a nutrient balance, or a blood glucose level. It is preferable that if a balance identifier is acquired in step S304, the prediction unit 131 acquires balance information indicating a nutrient balance identified by the balance identifier, and the output unit 14 outputs the balance information
25 indicating the nutrient balance.

[0123] (Step S306) The processing unit 13 determines whether or not to output menu information. If it is to output menu information, the procedure advances to step S307, or otherwise the procedure returns to step S301.

[0124] (Step S307) The menu acquisition unit 132 acquires balance information
5 indicating the nutrient balance that has been acquired.

[0125] (Step S308) The menu acquisition unit 132 performs processing that acquires menu information corresponding to the balance information acquired in step S307. An example of the menu acquisition processing will be described later with reference to the flowchart in FIG. 12. The menu acquisition unit 132 may
10 acquire menu information paired with the balance information acquired in step S307, from the menu management unit 113.

[0126] (Step S309) The output unit 14 outputs the menu information acquired in step S308. For example, the output unit 14 transmits the menu information to the terminal device 2.

[0127] (Step S310) The difference acquisition unit 133 determines whether or not
15 the acceptance unit 12 has accepted meal information as well in step S303. If it has accepted meal information as well, the procedure advances to step S311, or otherwise the procedure returns to step S301.

[0128] (Step S311) The difference acquisition unit 133 acquires difference
20 information. An example of the difference acquisition processing will be described later with reference to the flowchart in FIG. 13.

[0129] (Step S312) The output unit 14 outputs the difference information acquired in step S311. The procedure returns to step S301. For example, the output unit 14 transmits the difference information to the terminal device 2.

[0130] In the flowchart in FIG. 3, the output unit 14 may output two or more
25

types of information that are to be output, together.

[0131] In the flowchart in FIG. 3, the processing ends at power off or at an interruption of termination processing.

[0132] Next, a first example of the learning processing in step S302 will be

5 described with reference to the flowchart in FIG. 4. The first example of the learning processing corresponds to the case of acquiring a learning model.

[0133] (Step S401) The learning unit 130 substitutes 1 for a counter i .

[0134] (Step S402) The learning unit 130 determines whether or not an i^{th} piece of training data is present in the storage unit 11. If an i^{th} piece of training data is
10 present, the procedure advances to step S403, or otherwise the procedure advances to step S405.

[0135] (Step S403) The learning unit 130 acquires the i^{th} piece of training data from the storage unit 11. Next, for example, the learning unit 130 changes the i^{th} piece of training data into a vector with a structure with which the data can be
15 given to a learning module, and adds the vector to a buffer (not shown).

[0136] (Step S404) The learning unit 130 increments the counter i by 1. The procedure returns to step S402.

[0137] (Step S405) The learning unit 130 gives a set of two or more vectors (e.g., a file) in the buffer (not shown) to the learning module in the storage unit 11.

20 [0138] (Step S406) The learning unit 130 executes the learning module.

[0139] (Step S407) The learning unit 130 acquires a learning model obtained as a result of executing the learning module in step S406, and accumulates the learning model in the learning information storage unit 111. The procedure returns to the upper-level processing.

25 [0140] Next, a second example of the learning processing in step S302 will be

described with reference to the flowchart in FIG. 5. The second example of the learning processing corresponds to the case of acquiring a correspondence table having one piece of correspondence information corresponding to one piece of training data.

5 [0141] (Step S501) The learning unit 130 substitutes 1 for a counter i .

[0142] (Step S502) The learning unit 130 determines whether or not an i^{th} piece of training data is present in the storage unit 11. If an i^{th} piece of training data is present, the procedure advances to step S503, or otherwise the procedure returns to the upper-level processing.

10 [0143] (Step S503) The learning unit 130 configures correspondence information using the i^{th} piece of training data, and adds the information to the correspondence table. The correspondence information has, for example, correspondence information contained in the training data and objective information contained in the training data.

15 [0144] (Step S504) The learning unit 130 increments the counter i by 1. The procedure returns to step S402.

[0145] Next, a third example of the learning processing in step S302 will be described with reference to the flowchart in FIG. 6. The third example of the learning processing corresponds to the case of configuring one piece of

20 correspondence information using one or more pieces of training data corresponding to the same objective information, and acquiring a correspondence table. In the flowchart in FIG. 6, it is preferable to sort two or more pieces of training data using objective information as a key, as initial processing.

[0146] (Step S601) The learning unit 130 substitutes 1 for a counter i .

25 [0147] (Step S602) The learning unit 130 determines whether or not an i^{th} piece

of objective information of different information is present. If an i^{th} piece of objective information of different information is present, the procedure advances to step S603, or otherwise the procedure returns to the upper-level processing.

[0148] (Step S603) The learning unit 130 substitutes 1 for a counter j .

5 [0149] (Step S604) The learning unit 130 determines whether or not a j^{th} element is present, which is information in the training data excluding the objective information. If a j^{th} element is present, the procedure advances to step S605, or otherwise the procedure advances to step S609. The j^{th} element is, for example, the energy amount, or the amount of each of two or more nutrients.

10 [0150] (Step S605) The learning unit 130 acquires information on the j^{th} element from all training data containing the i^{th} piece of objective information. The j^{th} element is.

[0151] (Step S606) The learning unit 130 acquires a representative value of the two or more pieces of information acquired in step S605. The representative
15 value of the two or more pieces of information is, for example, information with the highest count or an average value.

[0152] (Step S607) The learning unit 130 substitutes the representative value acquired in step S606, as information on the j^{th} element paired with the i^{th} piece of objective information.

20 [0153] (Step S608) The learning unit 130 increments the counter j by 1. The procedure returns to step S604.

[0154] (Step S609) The learning unit 130 acquires correspondence information indicating the correspondence between the i^{th} piece of objective information and the representative vector, and accumulates the information in the correspondence
25 table. The information on the element constituting a representative vector is the

information acquired in step S607.

[0155] (Step S610) The learning unit 130 increments the counter *i* by 1. The procedure returns to step S602.

[0156] As described above, the learning unit 130 may acquire, using the least
 5 squares method or the like, an operation expression in which two or more elements contained in the vector acquired from information in the training data excluding a blood glucose level that is the objective information are taken as input and a blood glucose level that is the objective information is taken as output.

[0157] Next, a first example of the prediction processing in step S304 will be
 10 described with reference to the flowchart in FIG. 7. The first example of the prediction processing corresponds to the case of acquiring objective information through machine learning prediction processing.

[0158] (Step S701) The prediction unit 131 acquires the accepted target information.

15 [0159] (Step S702) The prediction unit 131 acquires a learning model in the learning information storage unit 111.

[0160] (Step S703) The prediction unit 131 gives the correspondence information acquired in step S701 and the learning model acquired in step S702, to the prediction module in the storage unit 11.

20 [0161] (Step S704) The prediction unit 131 executes the prediction module.

[0162] (Step S705) The prediction unit 131 acquires objective information obtained as a result of executing the prediction module in step S704. The procedure returns to the upper-level processing.

[0163] Next, a second example of the prediction processing in step S304 will be
 25 described with reference to the flowchart in FIG. 8. The second example of the

prediction processing corresponds to the case of acquiring objective information using a correspondence table.

[0164] (Step S801) The prediction unit 131 acquires the accepted target information.

5 [0165] (Step S802) The prediction unit 131 configures a vector in which two or more pieces of information contained in the correspondence information acquired in step S801 are taken as elements.

[0166] (Step S803) The prediction unit 131 substitutes 1 for a counter i .

[0167] (Step S804) The prediction unit 131 determines whether or not an i^{th} piece
10 of correspondence information is present in the correspondence table in the learning information storage unit 111. If an i^{th} piece of correspondence information is present, the procedure advances to step S805, or otherwise the procedure advances to step S808.

[0168] (Step S805) The prediction unit 131 acquires the vector contained in the i^{th}
15 piece of correspondence information.

[0169] (Step S806) The prediction unit 131 calculates a similarity between the vector acquired in step S802 and the vector acquired in step S805, and associates the similarity with the i^{th} piece of correspondence information.

[0170] (Step S807) The prediction unit 131 increments the counter i by 1. The
20 procedure returns to step S804.

[0171] (Step S808) The prediction unit 131 acquires objective information contained in correspondence information corresponding to a similarity that satisfies a selection condition. The selection condition is, for example, that the similarity is in the top N (N is a natural number of 1 or more), that the similarity
25 is at or above a threshold value, or that the similarity is above a threshold value.

[0172] (Step S809) The prediction unit 131 determines whether or not the number of pieces of objective information acquired in step S808 is two or more. If the number is two or more, the procedure advances to step S810, or otherwise the procedure returns to the upper-level processing.

5 [0173] (Step S810) The prediction unit 131 acquires a representative of the two or more pieces of objective information acquired in step S808. The procedure returns to the upper-level processing. The representative of the two or more pieces of objective information is, for example, objective information with the highest count, an average value, or a median value.

10 [0174] Next, a third example of the prediction processing in step S304 will be described with reference to the flowchart in FIG. 9. The third example of the prediction processing corresponds to the case of acquiring objective information through machine learning prediction processing, using candidate information.

[0175] (Step S901) The prediction unit 131 acquires the accepted target
15 information.

[0176] (Step S902) The prediction unit 131 substitutes 1 for a counter i .

[0177] (Step S903) The prediction unit 131 determines whether or not an i^{th} piece of candidate information is present in the candidate management unit 112. If an i^{th} piece of candidate information is present, the procedure advances to step S904,
20 or otherwise the procedure advances to step S909.

[0178] (Step S904) The prediction unit 131 acquires the i^{th} piece of candidate information from the candidate management unit 112.

[0179] (Step S905) The prediction unit 131 acquires a learning model from the learning information storage unit 111. The prediction unit 131 acquires
25 information that is to be given to the prediction module, using the learning model,

the correspondence information acquired in step S901, and the candidate information acquired in step S904.

[0180] (Step S906) The prediction unit 131 gives the information acquired in step S905 to the prediction module, and executes the prediction module.

5 [0181] (Step S907) The prediction unit 131 acquires a blood glucose level obtained as a result of executing the prediction module in step S906, and associates the blood glucose level with the i^{th} piece of candidate information.

[0182] (Step S908) The prediction unit 131 increments the counter i by 1. The procedure returns to step S903.

10 [0183] (Step S909) The prediction unit 131 acquires one or more pieces of candidate information paired with a blood glucose level that matches a selection condition. The selection condition is, for example, that the blood glucose level is the lowest, that the blood glucose level is in the bottom N (N is a natural number of 2 or more), that the blood glucose level is at or below a threshold value, or that
15 the blood glucose level is below a threshold value.

[0184] (Step S910) The prediction unit 131 determines whether the number of pieces of candidate information selected in step S909 is two or more or is one. If the number is two or more, the procedure advances to step S911, or otherwise the procedure returns to the upper-level processing.

20 [0185] (Step S911) The prediction unit 131 acquires a representative of the two or more pieces of candidate information selected in step S909. The procedure returns to the upper-level processing. The representative of the two or more pieces of candidate information is, for example, candidate information with the highest count.

25 [0186] Next, a fourth example of the prediction processing in step S304 will be

described with reference to the flowchart in FIG. 10. The fourth example of the prediction processing corresponds to the case of acquiring objective information through a correspondence table, using candidate information.

[0187] (Step S1001) The prediction unit 131 acquires the accepted target
5 information.

[0188] (Step S1002) The prediction unit 131 substitutes 1 for a counter i.

[0189] (Step S1003) The prediction unit 131 determines whether or not an i^{th} piece of candidate information is present in the candidate management unit 112.

If an i^{th} piece of candidate information is present, the procedure advances to step
10 S1004, or otherwise the procedure advances to step S1013.

[0190] (Step S1004) The prediction unit 131 acquires the i^{th} piece of candidate information from the candidate management unit 112.

[0191] (Step S1005) The prediction unit 131 configures a vector in which two or more pieces of information contained in the target information acquired in step
15 S1001 and one or more pieces of information contained in the i^{th} piece of candidate information acquired in step S1004 are taken as elements.

[0192] (Step S1006) The prediction unit 131 substitutes 1 for a counter j.

[0193] (Step S1007) The prediction unit 131 determines whether or not a j^{th} piece of correspondence information is present in the correspondence table in the
20 learning information storage unit 111. If a j^{th} piece of correspondence information is present, the procedure advances to step S1008, or otherwise the procedure advances to step S1011.

[0194] (Step S1008) The prediction unit 131 acquires a vector contained in the j^{th} piece of correspondence information in the correspondence table.

25 [0195] (Step S1009) The prediction unit 131 acquires a similarity between the

vector acquired in step S1005 and the vector acquired in step S1008, and associates the similarity with the j^{th} piece of correspondence information.

[0196] (Step S1010) The prediction unit 131 increments the counter j by 1. The procedure returns to step S1007.

5 [0197] (Step S1011) The prediction unit 131 acquires a blood glucose level contained in correspondence information associated with a similarity that matches a selection condition. The blood glucose level acquired in this case is associated with candidate information. The selection condition in this case is, for example, that the similarity is in the top N (N is a natural number of 1 or more),
 10 that the similarity is at or above a threshold value, or that the similarity is above a threshold value.

[0198] (Step S1012) The prediction unit 131 increments the counter i by 1. The procedure returns to step S1003.

[0199] (Step S1013) The prediction unit 131 acquires one or more pieces of
 15 candidate information corresponding to a blood glucose level that matches the selection condition.

[0200] (Step S1014) The prediction unit 131 determines whether the number of pieces of candidate information selected in step S1013 is two or more or is one. If the number is two or more, the procedure advances to step S1015, or otherwise
 20 the procedure returns to the upper-level processing.

[0201] (Step S1015) The prediction unit 131 acquires a representative of the two or more pieces of candidate information selected in step S1014. The procedure returns to the upper-level processing. The representative of the two or more pieces of candidate information is, for example, candidate information with the
 25 largest proportion.

[0202] Next, a fifth example of the prediction processing in step S304 will be described with reference to the flowchart in FIG. 11. The fifth example of the prediction processing corresponds to the case of acquiring objective information through an operation expression, using candidate information.

5 [0203] (Step S1101) The prediction unit 131 acquires the accepted target information.

[0204] (Step S1102) The prediction unit 131 substitutes 1 for a counter i .

[0205] (Step S1103) The prediction unit 131 determines whether or not an i^{th} piece of candidate information is present in the candidate management unit 112.

10 If an i^{th} piece of candidate information is present, the procedure advances to step S1104, or otherwise the procedure advances to step S1109.

[0206] (Step S1104) The prediction unit 131 acquires the i^{th} piece of candidate information from the candidate management unit 112.

[0207] (Step S1105) The prediction unit 131 acquires an operation expression
15 from the learning information storage unit 111. The prediction unit 131 gives the correspondence information acquired in step S1101 and the candidate information acquired in step S1104 to the operation expression.

[0208] (Step S1106) The prediction unit 131 executes the operation expression configured in step S1105, thereby acquiring a blood glucose level, and associates
20 the blood glucose level with the i^{th} piece of candidate information.

[0209] (Step S1107) The prediction unit 131 increments the counter i by 1. The procedure returns to step S1103.

[0210] (Step S1108) The prediction unit 131 acquires one or more pieces of candidate information paired with a blood glucose level that matches a selection
25 condition. The selection condition is, for example, that the blood glucose level is

the lowest, that the blood glucose level is in the bottom N (N is a natural number of 2 or more), that the blood glucose level is at or below a threshold value, or that the blood glucose level is below a threshold value.

[0211] (Step S1109) The prediction unit 131 determines whether the number of
 5 pieces of candidate information selected in step S1108 is two or more or is one. If the number is two or more, the procedure advances to step S1110, or otherwise the procedure returns to the upper-level processing.

[0212] (Step S1110) The prediction unit 131 acquires a representative of the two
 10 or more pieces of candidate information selected in step S1108. The procedure returns to the upper-level processing. The representative of the two or more pieces of candidate information is, for example, candidate information with the highest count.

[0213] Next, an example of the menu acquisition processing in step S308 will be described later with reference to the flowchart in FIG. 12.

15 [0214] (Step S1201) The menu acquisition unit 132 substitutes 1 for a counter i.

[0215] (Step S1202) The menu acquisition unit 132 determines whether or not an i^{th} piece of food item information serving as a candidate for selection is present in the menu management unit 113. If an i^{th} piece of food item information is present, the procedure advances to step S1203, or otherwise the procedure
 20 advances to step S1207. The i^{th} piece of food item information serving as a candidate for selection is food item information that has not been at least selected.

[0216] (Step S1203) The menu acquisition unit 132 acquires one or more pieces of nutrient information contained in the i^{th} piece of food item information.

[0217] (Step S1204) The menu acquisition unit 132 determines whether or not
 25 the nutrient information acquired in step S1203 matches a use condition, using

the acquired balance information (two or more pieces of nutrient information) and the nutrient information acquired in step S1203. If it matches a use condition, the procedure advances to step S1205, or otherwise the procedure advances to step S1206. The use condition is, for example, that the one or more pieces of

5 nutrient information acquired in step S1203 do not exceed the respective pieces of nutrient information (e.g., the energy amount and the amounts of respective nutrients) contained in the acquired balance information.

[0218] (Step S1205) The menu acquisition unit 132 acquires an i^{th} piece of food item information, and temporarily stores it in a buffer (not shown).

10 [0219] (Step S1206) The menu acquisition unit 132 increments the counter i by 1. The procedure returns to step S1202.

[0220] (Step S1207) The menu acquisition unit 132 determines whether or not two or more pieces of food item information are present in the buffer (not shown).

If two or more pieces of food item information are present, the procedure advances

15 to step S1208, or otherwise the procedure advances to step S1211.

[0221] (Step S1208) The menu acquisition unit 132 configures a selection screen, which is a screen for the user to select a food item, using two or more pieces of food item information in the buffer (not shown).

[0222] (Step S1209) The menu acquisition unit 132 outputs the selection screen

20 configured in step S1208.

[0223] (Step S1210) The menu acquisition unit 132 determines whether or not it has accepted the user's selection of food item information from the selection screen presented to the user. If it has accepted the selection of food item information, the procedure advances to step S1211, or otherwise the procedure

25 returns to step S1210. The menu acquisition unit 132 temporarily stores the

selected food item information in the buffer (not shown).

[0224] (Step S1211) The menu acquisition unit 132 acquires one piece of food item information selected by the user, and temporarily stores the information in the buffer (not shown).

5 [0225] (Step S1212) The menu acquisition unit 132 determines whether or not to acquire a next piece of food item information. If it is to acquire a next piece of food item information, the procedure advances to step S1213, or otherwise the procedure advances to step S1216.

[0226] Whether or not to acquire a next piece of food item information is, for
10 example, determined in advance. For example, it is determined in advance that food item information on two types of food items consisting of a food item for a main dish and that for a side dish is selected.

[0227] (Step S1213) The menu acquisition unit 132 acquires nutrient information contained in the food item information temporarily stored in step S1210.

15 [0228] (Step S1214) The menu acquisition unit 132 acquires nutrient information on a difference between the nutrient information acquired in step S121 and the balance information acquired in step S303.

[0229] (Step S1215) The menu acquisition unit 132 performs menu acquisition processing using the nutrient information on a difference acquired in step S1214.

20 [0230] (Step S1216) The menu acquisition unit 132 configures menu information that is to be output, using the one or more pieces of food item information temporarily stored in the buffer (not shown). The procedure returns to the upper-level processing.

[0231] Next, an example of the difference acquisition processing in step S311 will
25 be described later with reference to the flowchart in FIG. 13.

[0232] (Step S1301) The difference acquisition unit 133 acquires balance information corresponding to the accepted meal information. The balance information in this case is the energy amount and the amount of each of two or more nutrients.

5 [0233] (Step S1302) The difference acquisition unit 133 substitutes 1 for a counter i .

[0234] (Step S1303) The difference acquisition unit 133 determines whether or not an i^{th} item constituting the difference information is present. If an i^{th} item is present, the procedure advances to step S1304, or otherwise the procedure
10 advances to step S1308. The item is, for example, the energy, or each of two or more nutrients.

[0235] (Step S1304) The difference acquisition unit 133 acquires an i^{th} piece of item information contained in the acquired objective information. The i^{th} piece of item information is, for example, the energy amount, or the amount of each of two
15 or more nutrients.

[0236] (Step S1305) The difference acquisition unit 133 acquires an i^{th} piece of item information, which is information acquired in step S1301 and corresponding to the meal information.

[0237] (Step S1306) The difference acquisition unit 133 acquires a difference
20 between the two pieces of item information, and temporarily stores it in the buffer (not shown) in association with the i^{th} item.

[0238] (Step S1307) The difference acquisition unit 133 increments the counter i by 1. The procedure returns to step S1303.

[0239] (Step S1308) The difference acquisition unit 133 configures difference
25 information having information on the difference corresponding to the two or

more items stored in the buffer (not shown).

[0240] Hereinafter, a specific operation example of the information system A in this embodiment will be described.

[0241] A learning model is stored in the learning information storage unit 111.

5 The learning model is information acquired by the learning unit 130 through machine learning processing using the two or more pieces of training data. The training data in this case is data in which gut bacteria analysis results (quantity of gut bacteria PCA0, quantity of gut bacteria PCA1, ..., quantity of PCA40) and balance information (energy amount, carbohydrate amount, fat amount, dietary
10 fiber amount, sugar amount, protein amount) are taken as explanatory variables and a blood glucose level is taken as a response variable.

[0242] Furthermore, it is assumed that two or more pieces of candidate information are stored in the candidate management unit 112. The two or more pieces of candidate information in this case have a structure (energy amount,
15 carbohydrate amount, fat amount, dietary fiber amount, sugar amount, protein amount).

[0243] It is assumed that in this situation, a user X inputs his or her gut bacteria analysis result (quantity of PCA0, quantity of PCA1, ..., quantity of PCA40) and meal information to the terminal device 2 on June 23. It is assumed that the
20 meal information in this case has text strings “grilled lean beef, potato, macaroni with cod roe, boiled broccoli, grilled king oyster mushrooms, tofu, miso soup (with onion and wakame seaweed), and steamed white rice with pickled plum and sesame salt”, and meal images of the respective dishes constituting the meal.

The terminal device 2 accepts the analysis result and the meal information, and
25 transmits them in association with a user identifier “X” to the output apparatus 1.

[0244] Next, the acceptance unit 12 of the output apparatus 1 receives the analysis result and the meal information associated with the user identifier “X” from the terminal device 2.

[0245] Next, the prediction unit 131 of the output apparatus 1 acquires a
 5 predicted blood glucose level through machine learning prediction processing, using candidate information, the analysis result, and the learning model, for each of the two or more pieces of candidate information. Next, the prediction unit 131 acquires a blood glucose level that matches the selection condition “the blood glucose level has the lowest value”, and acquires candidate information
 10 corresponding to the blood glucose level. It is assumed that the candidate information (energy amount, carbohydrate amount, fat amount, dietary fiber amount, sugar amount, protein amount) is (612, C1, L1, D1, S1, P1). Furthermore, it can be said that the selected candidate information is ideal balance information for the user X.

15 [0246] Furthermore, it is assumed that the difference acquisition unit 133 acquires balance information (560, C2, L2, D2, S2, P2) corresponding to the meal information, using the received meal information.

[0247] Next, it is assumed that the difference acquisition unit 133 acquires difference information (−52, −30.5, +3.4, −2.2, −26.1, +3.4), which is a set of
 20 differences between the item information contained in the balance information corresponding to the meal information and the item information contained in the ideal balance information.

[0248] Next, the processing unit 13 configures objective information that is to be output. It is assumed that the objective information in this case is a radar chart
 25 acquired from the energy amount “612 kcal” contained in the ideal balance

information and information on the five nutrients contained in the ideal balance information.

[0249] Furthermore, the processing unit 13 configures difference information that is to be output. The difference information that is to be output is (−52, −30.5,
5 +3.4, −2.2, −26.1, +3.4).

[0250] Moreover, the processing unit 13 configures screen information that is to be transmitted to the terminal device 2, using the various types of acquired information. Next, the output unit 14 transmits the screen information to the terminal device 2 of the user X.

10 [0251] Next, the terminal device 2 of the user X receives the screen information, configures a screen from the screen information, and outputs the screen. FIG. 14 shows such an output example. FIG. 14 contains meal information 1401, balance information 1402 acquired from the meal information 1401, difference information 1403, and ideal balance information 1404. A radar chart contained
15 in the ideal balance information 1404 contains a graph showing the nutrient balance of the current meal as well. It will be appreciated that the output format for the information on the five nutrients contained in the ideal balance information is not limited to a radar chart, and it may also be a graph representing the amount of each nutrient, a table representing the amount of each
20 nutrient, or the like.

[0252] As described above, according to this embodiment, it is possible to present objective information for specifying a favorable nutrient balance, using an analysis result of gut bacteria.

[0253] Furthermore, according to this embodiment, it is possible to present
25 objective information for specifying a more favorable nutrient balance, using an

analysis result of gut bacteria and at least one of health information and lifestyle information.

[0254] Furthermore, according to this embodiment, it is possible to present objective information for specifying a favorable nutrient balance from among two or more pieces of candidate information, using an analysis result of gut bacteria.

[0255] Furthermore, according to this embodiment, it is possible to specify a favorable nutrient balance using an analysis result of gut bacteria, and propose a meal menu from the nutrient balance.

[0256] Moreover, according to this embodiment, it is possible to present objective information for specifying a favorable nutrient balance through machine learning, using an analysis result of gut bacteria.

[0257] The processing in this embodiment may be realized by software. The software may be distributed by software downloads or the like. Furthermore, the software may be distributed in a form where the software is stored in a recording medium such as a CD-ROM. The same applies to other embodiments in this specification. The software that realizes the output apparatus 1 in this embodiment is the following sort of program. Specifically, this program is a program for causing a computer capable of accessing a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance, to function as: an acceptance unit that accepts target information containing a gut bacteria analysis result of a user; a prediction unit that acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; and an output unit

that outputs the objective information acquired by the prediction unit.

[0258] Embodiment 2

In this embodiment, an output apparatus will be described that can present a user's type, using an gut bacteria analysis result of the user.

5 [0259] In this embodiment, an output apparatus will be described that can present meals that are likely or less likely to cause a rise in the user's blood glucose level, using an gut bacteria analysis result of the user.

[0260] A conceptual diagram of an information system B in this embodiment is identical to FIG. 1, except for the reference numerals for the output apparatus.

10 [0261] FIG. 15 is a block diagram of the information system B in this embodiment. The information system B includes an output apparatus 3, and one or two or more terminal devices 2.

[0262] The output apparatus 3 includes a storage unit 31, an acceptance unit 32, a processing unit 33, and an output unit 34. The storage unit 31 includes a
15 learning information storage unit 311, a type management unit 312, the candidate management unit 112, and a menu management unit 313. The processing unit 33 include a learning unit 330, a prediction unit 331, a type determination unit 332, a type information acquisition unit 333, a second prediction unit 334, a recommendation determination unit 335, and a difference acquisition unit 336.

20 [0263] Various types of information are stored in the storage unit 31 constituting the output apparatus 3. The various types of information are, for example, two or more pieces of training data, learning information, later-described second learning information, later-described type information, menu management information, two or more pieces of type detail information, or two or more pieces of
25 advice information.

[0264] The type detail information is information that explains a later-described type in detail. The type detail information is information associated with a later-described type identifier. The advice information is information for advising the user based on the user's type. The advice information is, for example, information on a food item that is to be recommended to the user. The advice information is information associated with a later-described type identifier. There is no limitation on the content of the advice. The advice is, for example, advice regarding meals, but it may be advice regarding exercising or sleep, for example. The type detail information and the advice information may be stored in the type management unit 312.

[0265] Learning information is stored in the learning information storage unit 311. Second learning information is stored in the learning information storage unit 311. The learning information is the same as the learning information described in Embodiment 1.

[0266] The second learning information is information acquired using two or more pieces of training data each having a gut bacteria analysis result, food item information, and a blood glucose level. The second learning information is preferably information acquired by a learning unit 330, which will be described later. The second learning information is, for example, a learning model, a correspondence table, or an operation expression.

[0267] Two or more pieces of type management information are stored in the type management unit 312. For example, 18 pieces of type management information are stored in the type management unit 312.

[0268] The type management information is information on a user's type. The type management information is information for acquiring a type identifier

corresponding to objective information for specifying a nutrient balance. The type management information is, for example, a type correspondence table, a type condition table, or a type learning model.

[0269] A type is typically a type regarding a user's meal. The type is preferably the type of a meal that is preferred for the user. The type is preferably the type of a meal that is less likely to cause a rise in the user's blood glucose level. The type may also be said to be a class, a category, a classification, or the like.

[0270] The type correspondence table has two or more pieces of type correspondence information each having objective information for specifying a nutrient balance and a type identifier.

[0271] The type condition table has a nutrient balance condition for each of the two or more type identifiers. The nutrient balance condition is a condition regarding objective information for specifying a nutrient balance. The nutrient balance condition is, for example, a condition having information indicating the range of the amount of each of two or more nutrients, or a condition having information indicating the range of the proportion of each of two or more nutrients.

[0272] The type learning model is a learning model acquired by performing machine learning processing using two or more pieces of training data each having objective information for specifying a nutrient balance and a type identifier. The learning model is given together with information for specifying a nutrient balance to a module for performing machine learning prediction processing. The type identifier is acquired by executing the module.

[0273] The type identifier is information for specifying a user's type. The type identifier is, for example, a type ID or a type name. The type identifier is, for

example, “A”, “B”, “C”

[0274] Two or more pieces of menu management information are stored in the menu management unit 313. The menu management information in this case is information for specifying a nutrient contained in the food item. The menu
 5 management information in this case has food item information. The menu management information in this case has a food item identifier and food item information. The food item identifier is information for specifying a food item. The food item identifier is, for example, a food item ID or a food item name. The food item information has one or more pieces of nutrient information of the food
 10 item.

[0275] The acceptance unit 32 accepts various types of information and instructions. For example, the acceptance unit 12 receives various types of information and instructions from the terminal device 2. For example, the acceptance unit 12 accepts various types of information and instructions from the
 15 user. The various types of information and instructions are, for example, standard meal information, a learning instruction, a second learning instruction, a type output instruction, or a food item proposal instruction.

[0276] The learning instruction is an instruction to acquire learning information. The second learning instruction is an instruction to acquire second learning
 20 information. The type output instruction is an instruction to output type information. The food item proposal instruction is an instruction to output propose information.

[0277] The processing unit 33 performs various types of processing. The various types of processing are, for example, processing that is performed by the learning
 25 unit 330, the prediction unit 131, the type determination unit 332, the type

information acquisition unit 333, the second prediction unit 334, or the recommendation determination unit 335. The various types of processing are performed on digital signals.

[0278] The learning unit 330 acquires learning information using two or more pieces of training data. The processing by the learning unit 330 is the same as the processing by the learning unit 130.

[0279] The learning unit 330 acquires second learning information using two or more pieces of training data. The training data in this case has a gut bacteria analysis result, food item information, and a blood glucose level. The gut bacteria analysis result and the food item information are taken as explanatory variables, and the blood glucose level is taken as a response variable. The training data in this case preferably has one or both of the health information and the lifestyle information in addition to the gut bacteria analysis result and the objective information. The health information and the lifestyle information are taken as explanatory variables.

[0280] The above-described training data is typically stored in the storage unit 31. Furthermore, the above-described training data may be information that is stored in an external device (not shown) and is temporarily stored in the storage unit 31.

(1) Case in which second learning information is learning model

[0281] The learning unit 330 acquires two or more pieces of training data from the storage unit 31. The learning unit 130 gives the two or more pieces of training data to a learning module of machine learning and executes the module, thereby acquiring a second learning model, which is second learning information.

This second learning model is given together with the accepted target information

to a prediction module of machine learning, and is used to acquire a blood glucose level.

(2) Case in which second learning information is correspondence table

5 [0282] The learning unit 330 vectorizes the explanatory variables contained in the training data, for each of the two or more pieces of training data in the storage unit 31. Next, for example, the learning unit 130 acquires correspondence information having the vector and a blood glucose level that is the objective information contained in the training data, for each of the two or more pieces of

10 training data. Next, for example, the learning unit 130 configures a second correspondence table having the acquired two or more pieces of correspondence information. The vector is, for example, (quantity of gut bacteria PCA0, quantity of gut bacteria PCA1, ..., quantity of PCA40, height, weight, ..., blood pressure, ..., red blood cell count, ...).

15

(3) Case in which second learning information is operation expression

[0283] For example, the learning unit 330 vectorizes the explanatory variables contained in the training data, for each of the two or more pieces of training data in the storage unit 31. Next, the learning unit 330 acquires a second operation

20 expression in which two or more elements contained in the vector acquired from the explanatory variables are taken as input and a blood glucose level is taken as output, for each of the two or more pieces of training data. For example, the learning unit 330 acquires, using the least squares method, a second operation expression in which two or more elements contained in the vector acquired from

25 the explanatory variables are taken as input and a blood glucose level is taken as

output, for each of the two or more pieces of training data. There is no limitation on the method for acquiring a second operation expression.

[0284] The prediction unit 331 acquires objective information corresponding to the type determined by a type determination unit 332, which will be described
5 later.

[0285] For example, the prediction unit 331 acquires objective information paired with the type determined by the type determination unit 332 from a type correspondence table having two or more pieces of type correspondence information, each of which is a pair of a type and objective information.

10 [0286] For example, the prediction unit 331 acquires objective information using the accepted target information of the user, the type, and the learning information. The processing in which the prediction unit 331 acquires objective information using the learning information is the same as the processing by the prediction unit 131, except that the type determined by the type determination unit 332 is
15 used as well. For example, the prediction unit 331 acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information of the user, the type, and the learning information. Various methods are possible for the prediction unit 331 to acquire objective information using the target information, the type, and the learning information. The
20 method for acquiring objective information is the same as the processing by the prediction unit 131 described in Embodiment 1, except that the type is used as well, and thus a description thereof has been omitted. The processing by the prediction unit 331 involves (1) Case in which candidate information is not used, (1-1) Case in which learning information is learning model, (1-2) Case in which
25 learning information is correspondence table, (1-3) Case in which learning

information is operation expression, (2) Case in which candidate information is used, (2-1) Case in which learning information is learning model, (2-2) Case in which learning information is correspondence table, (2-3) Case in which learning information is operation expression, and the like, as with the processing by the prediction unit 131.

[0287] Furthermore, the prediction unit 331 may perform all the processing that is performed by the prediction unit 131, without using the type determined by the type determination unit 332.

[0288] The type determination unit 332 acquires a type identifier corresponding to objective information for specifying a nutrient balance. The type determination unit 332 acquires a type identifier corresponding to objective information for specifying a nutrient balance, using the type management information in the type management unit 312.

(1) Case in which type management information is type correspondence table

[0289] The type determination unit 332 acquires a type identifier paired with the objective information with the greatest similarity to the objective information acquired by the prediction unit 131 for specifying a nutrient balance, from the type correspondence table.

(2) Case in which type management information is type condition table

[0290] The type determination unit 332 acquires a type identifier paired with a nutrient balance condition that is satisfied by the objective information acquired by the prediction unit 131 for specifying a nutrient balance, from the type condition table.

(3) Case in which type management information is type learning model

[0291] The type determination unit 332 gives the objective information acquired by the prediction unit 131 for specifying a nutrient balance and the type learning
 5 model to a prediction module for performing machine learning prediction processing and executes the prediction module, thereby acquiring a type identifier.

[0292] The type information acquisition unit 333 acquires type information of the user containing the type identifier acquired by the type determination unit 332.

10 For example, the type information acquisition unit 333 acquires type detail information paired with the type identifier acquired by the type determination unit 332, from the storage unit 31, and acquires type information having the type detail information and the type identifier. For example, the type information acquisition unit 333 acquires advice information paired with the type identifier
 15 acquired by the type determination unit 332, from the storage unit 31, and acquires type information having the advice information and the type identifier. The type information may have a type identifier, one or more pieces of type detail information, and one or more pieces of advice information.

[0293] The second prediction unit 334 acquires a blood glucose level of the user
 20 after consumption of a food item specified by the food item information contained in the menu management information, using the gut bacteria analysis result of the user, the food item information contained in the two or more pieces of menu management information, and the second learning information, for each of the two or more pieces of menu management information. “For each of the two or
 25 more pieces of menu management information” means that the processing is

performed for each piece of the food item information contained in the two or more pieces of menu management information.

[0294] For example, the second prediction unit 334 acquires a blood glucose level of a user through (1), (2), or (3) below. The second prediction unit 334 associates
 5 the acquired blood glucose level with the food item information contained in the menu management information, for each piece of the menu management information.

(1) Case in which second learning information is learning model

10 [0295] The second prediction unit 334 gives the gut bacteria analysis result of the user accepted by the acceptance unit 32, the food item information contained in the menu management information, and the second learning model to a prediction module of machine learning and executes the prediction module, thereby acquiring a blood glucose level, for each of the two or more pieces of menu
 15 management information in the menu management unit 113.

(2) Case in which second learning information is correspondence table

[0296] The second prediction unit 334 vectorizes the gut bacteria analysis result of the user accepted by the acceptance unit 32 and the food item information
 20 contained in the menu management information, for each of the two or more pieces of menu management information in the menu management unit 113. The second prediction unit 334 calculates a similarity between this vector and each vector contained in the correspondence information in the second correspondence table, for each piece of the menu management information. The
 25 second prediction unit 334 acquires a blood glucose level paired with the vector

with the greatest similarity, from the second correspondence table, for each piece of the menu management information.

(3) Case in which second learning information is operation expression

5 [0297] The second prediction unit 334 substitutes the gut bacteria analysis result of the user accepted by the acceptance unit 32 and the food item information contained in the menu management information for a second operation expression and executes the second operation expression, thereby acquiring a blood glucose level, for each of the two or more pieces of menu management information in the
10 menu management unit 113.

[0298] The recommendation determination unit 335 acquires recommendation information, using the blood glucose levels respectively corresponding to the two or more pieces of food item information acquired by the second prediction unit 334.

15 [0299] The recommendation information is information for recommending a food item. The recommendation information is, for example, information proposing meals that are less likely to cause a rise in the user's blood glucose level. The recommendation information is, for example, information informing the user about meals that are likely to cause a rise in the user's blood glucose level.

20 [0300] The recommendation determination unit 335 acquires recommendation information containing food item names contained in the menu management information respectively paired with one or two or more blood glucose levels that satisfy a selection condition, using the blood glucose levels acquired by the second prediction unit 334, for each of the two or more pieces of menu management
25 information.

[0301] The selection condition is, for example, that the blood glucose level is at or above a threshold value or is above the threshold value, or that the blood glucose level is in the top N (N is a natural number of 1 or more). In this case, the recommendation determination unit 335 acquires recommendation information containing a food item name that is not recommended for the user.

[0302] The selection condition is, for example, that the blood glucose level is at or below a threshold value or is below the threshold value, or that the blood glucose level is in the bottom N (N is a natural number of 1 or more). In this case, the recommendation determination unit 335 acquires recommendation information containing a food item name that is recommended for the user.

[0303] The difference acquisition unit 336 acquires balance information for specifying a nutrient balance corresponding to the accepted standard meal information. Next, the difference acquisition unit 336 acquires difference information on a difference between the acquired balance information and balance information that is acquired by the prediction unit 331.

[0304] The output unit 34 outputs various types of information. In this case, the output is typically transmission to the terminal device 2, but it may be a concept that encompasses display on a display screen, projection using a projector, printing by a printer, output of a sound, transmission to an external apparatus, accumulation in a recording medium, and delivery of a processing result to another processing apparatus or another program.

[0305] The output unit 34 outputs, for example, the type identifier acquired by the type determination unit 332. The output unit 34 outputs, for example, the type information acquired by the type information acquisition unit 333. The output unit 34 outputs, for example, the recommendation information acquired by

the recommendation determination unit 335. The output unit 34 outputs, for example, the information for specifying the nutrient balance acquired by the prediction unit 331. The output unit 34 outputs, for example, the difference information acquired by the difference acquisition unit 336.

5 [0306] The storage unit 31, the learning information storage unit 311, the type management unit 312, and the menu management unit 313 are preferably non-volatile recording media, but they may be realized by volatile recording media.

[0307] There is no limitation on the procedure in which information is stored in
10 the storage unit 31 and the like. For example, information may be stored the storage unit 31 and the like via a recording medium, information transmitted via a communication line or the like may be stored in the storage unit 31 and the like, or information input via an input device may be stored in the storage unit 31 and the like.

15 [0308] The processing unit 33, the learning unit 330, the prediction unit 331, the type determination unit 332, the type information acquisition unit 333, the second prediction unit 334, the recommendation determination unit 335, and the difference acquisition unit 336 may be typically realized by processors, memories, or the like. Typically, the processing procedure of the processing unit 33 and the
20 like is realized by software, and the software is stored in a recording medium such as a ROM. However, the processing procedure may be realized by hardware (dedicated circuits). The processors are, for example, CPUs, MPUs, GPUs, or the like, but there is no limitation on the type thereof.

[0309] The output unit 34 is typically realized by a wireless or wired
25 communication part. However, the output unit 34 may be realized by driver

software for an output device such as a display screen or a speaker, a combination of driver software for an output device and the output device, or the like.

[0310] Next, an operation example of the output apparatus 3 will be described with reference to the flowchart in FIG. 16.

5 [0311] (Step S1601) The acceptance unit 32 determines whether or not it has accepted a second learning instruction. If it has accepted a learning instruction, the procedure advances to step S1602, or otherwise the procedure advances to step S1603.

[0312] (Step S1602) The learning unit 330 performs second learning processing.
10 The procedure returns to step S1601. An example of the second learning processing will be described later with reference to the flowchart in FIG. 17.

[0313] (Step S1603) The acceptance unit 32 determines whether or not it has accepted a type output instruction. If it has accepted a type output instruction, the procedure advances to step S1604, or otherwise the procedure advances to
15 step S1609.

[0314] (Step S1604) The prediction unit 131 acquires target information contained in the type output instruction. The target information contains an analysis result of a user. The target information may have at least one of the health information of the user and the lifestyle information of the user in addition
20 to the analysis result.

[0315] (Step S1605) The prediction unit 131 performs prediction processing, using the target information. An example of the prediction processing has been described above with reference to the flowcharts in FIGS. 7, 8, 9, 10, and 11. The objective information acquired in the prediction processing in this case is
25 information indicating a nutrient balance.

[0316] (Step S1606) The type determination unit 332 determines a user's type, using information indicating a nutrient balance. An example of the type determination processing will be described later with reference to the flowchart in FIG. 18.

5 [0317] (Step S1607) The type information acquisition unit 333 acquires the type identifier acquired in step S1606. The type information acquisition unit 333 acquires type detail information and advice information paired with the type identifier, from the storage unit 31. The type information acquisition unit 333 configures type information having the type identifier, the type detail information,
10 and the advice information.

[0318] (Step S1608) The output unit 34 outputs the type information. The procedure returns to step S1601.

[0319] (Step S1609) The acceptance unit 32 determines whether or not it has accepted a food item proposal instruction. If it has accepted a food item proposal
15 instruction, the procedure advances to step S16104, or otherwise the procedure returns to step S1601.

[0320] (Step S1610) The second prediction unit 334 acquires target information having the food item proposal instruction.

[0321] (Step S1611) The second prediction unit 334 performs second prediction
20 processing using the target information. A first example of second prediction processing will be described with reference to the flowchart in FIG. 19.

[0322] (Step S1612) The recommendation determination unit 335 performs recommendation determination processing. An example of the recommendation determination processing will be described later with reference to the flowchart in
25 FIG. 20.

[0323] (Step S1613) The output unit 34 outputs the recommendation information.
The procedure returns to step S1601.

[0324] In the flowchart in FIG. 16, the output apparatus 3 may accept a learning instruction, and the learning unit 330 may acquire learning information. This

5 processing is the same as the processing by the learning unit 130.

[0325] Furthermore, in the flowchart in FIG. 16, the output unit 34 may acquire type information and recommendation information together, and output both the type information and the recommendation information.

[0326] Moreover, in the flowchart in FIG. 16, the processing ends at power off or
10 at an interruption of termination processing.

[0327] Next, a first example of the second learning processing in step S1602 will be described with reference to the flowchart in FIG. 17. The first example of the second learning processing corresponds to the case of acquiring a learning model.

[0328] (Step S1701) The learning unit 330 substitutes 1 for a counter i .

15 [0329] (Step S1702) The learning unit 330 determines whether or not an i^{th} piece of training data is present in the storage unit 31. If an i^{th} piece of training data is present, the procedure advances to step S1703, or otherwise the procedure advances to step S1705.

[0330] (Step S1703) The learning unit 330 acquires the i^{th} piece of training data
20 from the storage unit 31. Next, the learning unit 330 changes the i^{th} piece of training data, for example, into a vector with a structure with which the data can be given to a learning module, and adds the vector to a buffer (not shown).

[0331] (Step S1704) The learning unit 330 increments the counter i by 1. The procedure returns to step S1702.

25 [0332] (Step S1705) The learning unit 330 gives a set of two or more vectors (e.g.,

a file) in the buffer (not shown) to the learning module in the storage unit 11.

[0333] (Step S1706) The learning unit 330 executes the learning module.

[0334] (Step S1707) The learning unit 330 acquires a second learning model obtained as a result of executing the learning module in step S1706, and

5 accumulates the second learning model in the learning information storage unit 311. The procedure returns to the upper-level processing.

[0335] In the flowchart in FIG. 17, the learning unit 330 may configure second learning information that is a correspondence table, using two or more pieces of training data. Furthermore, the learning unit 330 may configure second

10 learning information that is an operation expression, using two or more pieces of training data.

[0336] Next, a first example of the type determination processing in step S1606 will be described with reference to the flowchart in FIG. 18.

[0337] (Step S1801) The type determination unit 332 acquires the balance
15 information acquired in S1605.

[0338] (Step S1802) The type determination unit 332 substitutes 1 for a counter i .

[0339] (Step S1803) The type determination unit 332 determines whether or not an i^{th} piece of type correspondence information is present in the type correspondence table. If an i^{th} piece of type correspondence information is
20 present, the procedure advances to step S1804, or otherwise the procedure advances to step S1807.

[0340] (Step S1804) The type determination unit 332 acquires balance information contained in the i^{th} piece of type correspondence information.

[0341] (Step S1805) The type determination unit 332 calculates a similarity
25 between the balance information acquired in step S1801 and the balance

information acquired in step S184, and associates the similarity with the i^{th} piece of type correspondence information. The balance information is typically a vector.

[0342] (Step S1806) The type determination unit 332 increments the counter i by

5 1. The procedure returns to step S1803.

[0343] (Step S1807) The type determination unit 332 acquires a type identifier contained in the type correspondence information associated with the greatest similarity. The procedure returns to the upper-level processing.

[0344] Next, a first example of the second prediction processing in step S1611 will
10 be described with reference to the flowchart in FIG. 19.

[0345] (Step S1901) The second prediction unit 334 acquires a second learning model from the learning information storage unit 311.

[0346] (Step S1902) The second prediction unit 334 substitutes 1 for a counter i .

[0347] (Step S1903) The second prediction unit 334 determines whether or not an
15 i^{th} piece of menu management information is present in the menu management unit 313. If an i^{th} piece of menu management information is present, the procedure advances to step S1904, or otherwise the procedure returns to the upper-level processing.

[0348] (Step S1904) The second prediction unit 334 acquires food item
20 information contained in the i^{th} piece of menu management information.

[0349] (Step S1905) The second prediction unit 334 acquires a gut bacteria analysis result and the like of the user contained in the food item proposal instruction. The second prediction unit 334 acquires food item information and a second learning model. The second prediction unit 334 gives the gut bacteria
25 analysis result, the food item information, and the second learning model to a

prediction module for performing machine learning prediction processing and executes the prediction module, thereby acquiring a blood glucose level. The second prediction unit 334 associates the blood glucose level with the food item information contained in the i^{th} piece of menu management information. The gut bacteria analysis result and the like of the user may be only the gut bacteria analysis result of the user, or may have at least one of health information and lifestyle information, in addition to the gut bacteria analysis result of the user.

[0350] (Step S1906) The second prediction unit 334 increments the counter i by 1. The procedure returns to step S1903.

10 [0351] Next, an example of the recommendation determination processing in step S1612 will be described later with reference to the flowchart in FIG. 20.

[0352] (Step S2001) The recommendation determination unit 335 sorts food item information using a blood glucose level as a key.

[0353] (Step S2002) The recommendation determination unit 335 acquires one or
15 more pieces of food item information that satisfy a first selection condition. The first selection condition is, for example, that the blood glucose level is in the top N (N is a natural number of 1 or more), or that the blood glucose level is at or above a threshold value or is above the threshold value.

[0354] (Step S2003) The recommendation determination unit 335 acquires one or
20 more pieces of food item information that satisfy a second selection condition. The second selection condition is, for example, that the blood glucose level is in the bottom N (N is a natural number of 1 or more), or that the blood glucose level is at or below a threshold value or is below the threshold value.

[0355] (Step S2004) The recommendation determination unit 335 configures
25 recommendation information having the one or more pieces of food item

information acquired in step S2002 and the one or more pieces of food item information acquired in step S2003. The procedure returns to the upper-level processing.

[0356] Hereinafter, a specific operation example of the information system B in this embodiment will be described.

[0357] A type management table shown in FIG. 21 is stored in the type management unit 312 of the output apparatus 3. The type management table in this case is a table for managing type management information. The type management table in this case is a type correspondence table. The type management table manages records each having “ID”, “energy (kcal)”, “protein (g)”, “fat (g)”, “carbohydrates (g)”, “sugars (g)”, “dietary fiber (g)”, “fat/carbohydrates”, and “dietary pattern”. “ID” is information for specifying a record. “Energy (kcal)”, “protein (g)”, “fat (g)”, “carbohydrates (g)”, “sugars (g)”, “dietary fiber (g)”, and “fat/carbohydrates” are balance information corresponding to a type. “Dietary pattern” is a type identifier. The type identifier in this case is a numerical value from “1” to “18”. The type identifiers from “1” to “18” may be considered as types “A” to “R”, respectively.

[0358] Furthermore, a type related information management table shown in FIG. 22 is stored in the type management unit 312. The type related information management table is a table for managing records each having “type identifier”, “type detail information”, and “advice information”.

[0359] A menu management table shown in FIG. 23 is stored in the menu management unit 313. The menu management table manages records each having “ID”, “food item name”, “energy (kcal)”, “protein (g)”, “fat (g)”,

“carbohydrates (g)”, “sugars (g)”, “dietary fiber (g)”, and “fat/carbohydrates”. “ID”

is information for specifying a record. “Food item name” is a food item identifier. “Energy (kcal)” is the calories of a food item, and “protein (g)”, “fat (g)”, “carbohydrates (g)”, “sugars (g)”, “dietary fiber (g)”, and “fat/carbohydrates” are the amounts of respective nutrients contained in the food item.

[0360] Furthermore, it is assumed that the above-described learning model and the second learning model are stored in the learning information storage unit 311.

[0361] Moreover, it is assumed that two or more pieces of candidate information are stored in the candidate management unit 112. The two or more pieces of candidate information in this case have a structure (energy amount, carbohydrate amount, fat amount, dietary fiber amount, sugar amount, protein amount).

[0362] In the above-described situation, two specific examples of an operation example of the output apparatus 3 will be described using the processing conceptual diagram in FIG. 24. Specific Example 1 is an example in which the output apparatus 3 outputs type information. Specific Example 2 is an example in which the output apparatus 3 outputs recommendation information.

[0363] Specific Example 1

It is assumed that the acceptance unit 32 of the output apparatus 3 receives a type output instruction containing target information of a user Y, from the terminal device 2. It is assumed that the target information (2401) in this case has, for example, an analysis result of the user Y, health information of the user Y, and lifestyle information of the user Y. The state in which the type output instruction has target information may be, for example, that target information can be acquired based on a user identifier contained in the type output instruction.

[0364] Next, the prediction unit 131 acquires target information contained in the

type output instruction. Next, the prediction unit 131 gives candidate information (2402), the target information (2401), and a learning model to a prediction module for performing machine learning prediction processing and executes the prediction module, thereby acquiring a predicted blood glucose level, for each of the two or more pieces of candidate information. The blood glucose level is a post-meal blood glucose level after consumption of a food item corresponding to the candidate information. The blood glucose level is associated with the candidate information.

[0365] Next, the prediction unit 131 acquires a blood glucose level that matches the selection condition “the blood glucose level has the lowest value”, and acquires candidate information corresponding to the blood glucose level. It can be said that selected candidate information (2403) is ideal balance information for the user Y. The ideal balance information is information on a nutritional balance that is less likely to cause a rise in the user’s blood glucose level.

[0366] Next, the type determination unit 332 acquires a vector (energy (kcal), protein (g), fat (g), carbohydrates (g), sugars (g), dietary fiber (g), fat/carbohydrates) of the ideal balance information. Next, the type determination unit 332 calculates a similarity between the vector (energy (kcal), protein (g), fat (g), carbohydrates (g), sugars (g), dietary fiber (g), fat/carbohydrates) configured from the records in FIG. 21 and the vector of the ideal balance information of the user Y. Next, the type determination unit 332 acquires a type identifier paired with the vector configured from the record with the greatest similarity, from FIG. 21. In this case, it is assumed that the type determination unit 332 acquires a type identifier “7”. In this case, it is assumed that the type identifiers “1”, “2” ... “7” ..., and “18” are rephrased as type

identifiers “A”, “B” ..., and “G” ... “R”, respectively.

[0367] The type information acquisition unit 333 acquires type detail information and advice information paired with the type identifier “G”, from FIG. 22. Next, the type information acquisition unit 333 configures type information (2404)

5 having the type identifier, the type detail information, and the advice information.

[0368] Next, the output unit 34 transmits the type information to the terminal device 2. The output unit 34 may transmit the ideal balance information for the user Y as well, which was acquired by the output apparatus 3.

[0369] Next, the terminal device 2 receives and outputs the type information.

10 FIGS. 25, 26, and 27 show such an output example.

[0370] FIG. 25 has a type identifier (type “G”) (2501) and type detail information (2502). FIG. 26 is advice information paired with the type identifier “G”. FIG. 27 graphically illustrates the nutritional compositions respectively corresponding to the 18 type identifiers. In FIG. 27, the type identifier “G” of the user Y (2701)

15 is displayed in a prominent manner compared with the other type identifiers.

The information constituting FIG. 27 is stored in the storage unit 31.

[0371] The terminal device 2 may receive and output the ideal balance information for the user Y as well, which was acquired by the output apparatus 3.

20 FIG. 28 shows such an output example. In FIG. 28, the gray area indicates the recommended range in general nutritional science.

[0372] Specific Example 2

It is assumed that the acceptance unit 32 of the output apparatus 3 receives a food item proposal instruction containing target information of a user Y, from the terminal device 2.

25 [0373] Next, the second prediction unit 334 acquires target information contained

in the food item proposal instruction. The second prediction unit 334 performs second prediction processing as follows, using the target information. It is assumed that the target information (2401) in this case has, for example, an analysis result of the user Y, health information of the user Y, and lifestyle information of the user Y.

[0374] The second prediction unit 334 acquires a second learning model from the learning information storage unit 311. Next, the second prediction unit 334 gives the food item information contained in the menu management information (2402), the target information (2401), and the second learning model to a prediction module for performing machine learning prediction processing and executes the prediction module, thereby acquiring a blood glucose level, for each piece of the menu management information in the menu management unit 313, and associates the blood glucose level with the menu management information.

[0375] Next, the recommendation determination unit 335 sorts food item information contained in the menu management information, using a blood glucose level as a key.

Next, the recommendation determination unit 335 acquires 15 pieces of food item information that satisfy a first selection condition (e.g., “the blood glucose level is in the top 15” in this case). Furthermore, the recommendation determination unit 335 acquires 10 pieces of food item information that satisfy a second selection condition (e.g., “the blood glucose level is in the bottom 10” in this case). Next, the recommendation determination unit 335 configures first recommendation information (2404) containing food item information of food items that the user Y is advised to avoid, using the 15 pieces of food item information that satisfy the first selection condition. Furthermore, the

recommendation determination unit 335 configures second recommendation information (2404) containing food item information of food items that are recommended for the user Y, using the 15 pieces of food item information that satisfy the second selection condition. Next, the output unit 34 transmits the first recommendation information and the second recommendation information to the terminal device 2.

[0376] The terminal device 2 receives and outputs the first recommendation information and the second recommendation information. An example of the first recommendation information is indicated as 2901 in FIG. 29, and an example of the second recommendation information is indicated as 2902 in FIG. 29.

[0377] As described above, according to this embodiment, it is possible to present a user's type, using an gut bacteria analysis result of the user.

[0378] Furthermore, according to this embodiment, it is possible to present meals that are likely or less likely to cause a rise in the user's blood glucose level, using the gut bacteria analysis result of the user.

[0379] The software that realizes the output apparatus 3 in this embodiment is the following sort of program. Specifically, this program is a program for causing a computer capable of accessing a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance, to function as: a type management unit in which two or more pieces of type management information are stored, the type management information each having a type identifier for identifying a user's type corresponding to objective information for specifying a nutrient balance; an acceptance unit that accepts target information

containing a gut bacteria analysis result of a user; a prediction unit that acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; a type determination unit that acquires a type identifier corresponding to the objective information; and an output unit that outputs the type identifier.

[0380] Furthermore, the software that realizes the output apparatus 3 is the following sort of program. Specifically, this program is a program for causing a computer capable of accessing a learning information storage unit in which second learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result, food item information, and a blood glucose level, and a menu management unit in which two or more pieces of menu management information are stored, the pieces of menu management information each including a food item identifier for identifying a food item and food item information having one or more pieces of nutrient information on the food item, to function as: a second prediction unit that acquires a blood glucose level of the user after consumption of each of the food items respectively specified by the two or more pieces of food item information, using the gut bacteria analysis result of the user, the food item information contained in the two or more pieces of menu management information, and the second learning information; a recommendation determination unit that acquires recommendation information for recommending a food item, using the blood glucose levels respectively corresponding to the two or more pieces of food item information acquired by the second prediction unit; and an output unit that outputs the recommendation information acquired by the recommendation determination unit.

[0381] Furthermore, FIG. 30 shows the external appearance of a computer that executes the program described in this specification to realize the output apparatus 1, the output apparatus 3, and the like in various embodiments described above. The foregoing embodiments may be realized using computer

5 hardware and a computer program executed thereon. FIG. 30 is a schematic view of a computer system 300. FIG. 31 is a block diagram of the system 300.

[0382] In FIG. 30, the computer system 300 includes a computer 301 including a CD-ROM drive, a keyboard 302, a mouse 303, and a monitor 304.

[0383] In FIG. 31, the computer 301 includes, in addition to the CD-ROM drive

10 3012, an MPU 3013, a bus 3014 connected to the CD-ROM drive 3012 and the like, a ROM 3015 in which a program such as a boot up program is stored, a RAM 3016 that is connected to the MPU 3013 and is a memory in which a command of an application program is temporarily stored and a temporary storage area is provided, and a hard disk 3017 in which programs such as an application program
15 and a system program and data are stored. Although not shown, the computer 301 may further include a network card that provides connection to a LAN.

[0384] The program for causing the computer system 300 to execute the functions of the output apparatus 1 and the like in the foregoing embodiments may be stored in a CD-ROM 3101 that is inserted into the CD-ROM drive 3012, and be
20 transmitted to the hard disk 3017. Alternatively, the program may be transmitted via a network (not shown) to the computer 301 and stored in the hard disk 3017. At the time of execution, the program is loaded into the RAM 3016. The program may be loaded from the CD-ROM 3101, or loaded directly from a network.

25 [0385] The program does not necessarily have to include, for example, an

operating system (OS) or a third party program to cause the computer 301 to execute the functions of the output apparatus 1 and the like in the foregoing embodiments. The program may only include a command portion to call an appropriate function (module) in a controlled mode and obtain desired results.

5 The manner in which the computer system 300 operates is well known, and thus a detailed description thereof has been omitted.

[0386] It should be noted that, in the program, in a step of transmitting information, a step of receiving information, or the like, processing that is performed by hardware, for example, processing performed by a modem or an
10 interface card in the transmitting step (processing that can be performed only by hardware) is not included.

[0387] Furthermore, the computer that executes the program may be constituted by a single computer, or constituted by multiple computers. That is to say, centralized processing may be performed, or distributed processing may be
15 performed.

[0388] Furthermore, in the foregoing embodiments, it will be appreciated that at least two communication parts in one apparatus may be physically realized by one medium.

[0389] In the foregoing embodiments, each process may be realized as centralized
20 processing using a single apparatus, or may be realized as distributed processing using multiple apparatuses.

[0390] The present invention is not limited to the embodiments set forth herein. Various modifications are possible within the scope of the present invention.

25 Industrial Applicability

[0391] As described above, the output apparatus according to the present invention has an effect of making it possible to present objective information for specifying a favorable nutrient balance, using an analysis result of gut bacteria, thus rendering this apparatus useful as an output apparatus and the like.

CLAIMS

[Claim 1] An output apparatus comprising:

a learning information storage unit in which learning information

5 acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance;

an acceptance unit that accepts target information containing a gut bacteria analysis result of a user;

10 a prediction unit that acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; and

an output unit that outputs the objective information acquired by the prediction unit.

15

[Claim 2] The output apparatus according to claim 1,

wherein the training data has at least one of health information of the user corresponding to the gut bacteria analysis result and lifestyle information on a lifestyle of the user, and

20 the acceptance unit accepts target information having the gut bacteria analysis result of the user and at least one of the health information of the user and the lifestyle information of the user.

[Claim 3] The output apparatus according to claim 1 or 2, further

25 comprising:

a candidate management unit in which two or more pieces of candidate information each indicating a candidate for information for specifying a favorable nutrient balance are stored,

wherein the prediction unit acquires a blood glucose level for each of the
5 two or more pieces of candidate information, using the candidate information, the target information, and the learning information, and acquires candidate information corresponding to a blood glucose level that satisfies a selection condition, and

the output unit outputs the candidate information acquired by the
10 prediction unit.

[Claim 4] The output apparatus according to claim 1 or 2,

wherein the objective information is a balance identifier for identifying a nutrient balance or balance information indicating a nutrient balance, and

15 the output unit outputs the balance information identified by the balance identifier that is the objective information, or the balance information that is the objective information.

[Claim 5] The output apparatus according to claim 1 or 2, further

20 comprising:

a menu acquisition unit that acquires balance information indicating a nutrient balance that is based on the objective information, and acquires menu information for specifying a meal menu corresponding to the balance information,

wherein the output unit outputs the menu information instead of the
25 objective information or in addition to the objective information.

[Claim 6] The output apparatus according to claim 1 or 2,

 wherein the acceptance unit accepts standard meal information on a meal serving as a standard,

5 the output apparatus further comprises a difference acquisition unit that acquires balance information for specifying a nutrient balance corresponding to the standard meal information, and acquires difference information on a difference between the acquired balance information and balance information that is the objective information acquired by the prediction unit, and

10 the output unit outputs the difference information.

[Claim 7] The output apparatus according to claim 1 or 2,

 wherein the learning information is a learning model acquired through machine learning processing using the two or more pieces of training data, and

15 the prediction unit performs machine learning prediction processing using the target information and the learning model, thereby acquiring the objective information.

[Claim 8] The output apparatus according to claim 1 or 2, further

20 comprising:

 a type management unit in which two or more pieces of type management information are stored, the type management information each having a type identifier for identifying a user's type corresponding to objective information for specifying a nutrient balance;

25 a type determination unit that references the type management unit, and

acquires a type identifier corresponding to the objective information acquired by the prediction unit; and

an output unit that outputs the type identifier.

5 [Claim 9] The output apparatus according to claim 8, further comprising:
a type information acquisition unit that acquires type information of the user containing the type identifier acquired by the type determination unit, and
the output unit outputs the type information.

10 [Claim 10] The output apparatus according to claim 8,
wherein the acceptance unit accepts standard meal information on a meal serving as a standard,
the prediction unit acquires objective information corresponding to the type determined by the type determination unit,
15 the output apparatus further comprises a difference acquisition unit that acquires balance information for specifying a nutrient balance corresponding to the standard meal information, and acquires difference information on a difference between the acquired balance information and balance information that is the objective information acquired by the prediction unit, and
20 the output unit outputs the difference information.

[Claim 11] The output apparatus according to claim 1 or 2,
wherein second learning information acquired using two or more pieces of training data is stored in the learning information storage unit, the training data
25 each having a gut bacteria analysis result, food item information, and a blood

glucose level,

the output apparatus further comprises:

a menu management unit in which two or more pieces of menu management information are stored, the pieces of menu management information each including a food item identifier for identifying a food item and food item information having one or more pieces of nutrient information on the food item;

a second prediction unit that acquires a blood glucose level of the user after consumption of each of the food items respectively specified by the two or more pieces of food item information, using the gut bacteria analysis result of the user, the food item information contained in the two or more pieces of menu management information, and the second learning information; and

a recommendation determination unit that acquires recommendation information for recommending a food item, using the blood glucose levels respectively corresponding to the two or more pieces of food item information acquired by the second prediction unit, and

the output unit outputs the recommendation information acquired by the recommendation determination unit.

[Claim 12] An output method realized using a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria analysis result and objective information that is for specifying a favorable nutrient balance, an acceptance unit, a prediction unit, and an output unit, comprising:

an acceptance step in which the acceptance unit accepts target information containing a gut bacteria analysis result of a user;

a prediction step in which the prediction unit acquires objective information for specifying a nutrient balance that is recommended for the user, using the target information and the learning information; and

an output step in which the output unit outputs the objective information
5 acquired in the prediction step.

[Claim 13] A program for causing a computer capable of accessing a learning information storage unit in which learning information acquired using two or more pieces of training data is stored, the training data each having a gut bacteria
10 analysis result and objective information that is for specifying a favorable nutrient balance, to function as:

an acceptance unit that accepts target information containing a gut bacteria analysis result of a user;

a prediction unit that acquires objective information for specifying a
15 nutrient balance that is recommended for the user, using the target information and the learning information; and

an output unit that outputs the objective information acquired by the prediction unit.