METHOD AND APPARATUS, ELECTRONIC DEVICE AND STORAGE MEDIUM FOR RECOMMENDING TARGET INFORMATION

The present disclosure claims priority to Chinese application No. 202110807187.6, filed on July 16, 2021, all the content of the Chinese application involved by the priority are incorporated into the present disclosure.

Technical Field

The present disclosure relates to, but is not limited to, the field of information processing, and particularly to a method and apparatus, electronic device and storage medium for recommending target information.

Background Art

With a development of science and technology, there exist a plurality of emerging application technologies and application scenarios, and these application technologies may be suitable for being configured in related application scenarios. Information corresponding to the application scenarios may be generated in different application scenarios, and the information may be better applied in the related application scenarios by being processed, so that a better application effect is obtained.

For example, during information recommendation, more matching information can be recommended to a user after the related information is processed using an information processing technology.

Summary

Embodiments of the present disclosure provide a method and an apparatus an electronic device and a storage medium for recommending target information.

A first aspect of the embodiments of the present disclosure provides a method for recommending target information, including: acquiring a reference parameter set of at least one dimension information in candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set includes: a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set includes: candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the candidate weight subsets;

determining a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets; the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value subsets has a proportionality coefficient, and the proportionality coefficient is configured to represent a degree of an influence of the dimension information on determination of recommended target information from the candidate information;

determining a target weight subset according to the target mapping value subset, wherein the target weight subset includes a target weight of the at least one dimension information influencing the candidate information; and

selecting the recommended target information from the candidate information according to the target weight subset.

A second aspect of the embodiments of the present disclosure provides an apparatus for recommending target information, including:

an acquiring module configured to acquire a reference parameter set of at least one dimension information of candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set includes a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set includes candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the candidate weight subsets;

a target mapping value subset determining module configured to determine a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets; the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value subsets has a proportionality coefficient, and the proportionality coefficient is

configured to represent a degree of an influence of the dimension information on determination of recommended target information from the candidate information;

a target weight subset determining module configured to determine a target weight subset according to the target mapping value subset, wherein the target weight subset includes a target weight of the at least one dimension information influencing the candidate information; and

a recommending module configured to select the recommended target information from the candidate information according to the target weight.

A third aspect of the embodiments of the present disclosure provides an electronic device, including:

a memory configured to store processor-executable instructions; and

a processor connected with the memory;

wherein the processor is configured to execute the method for recommending target information according to any technical solution of the foregoing first aspect.

A fourth aspect of the embodiments of the present disclosure provides a non-transitory computer-readable storage medium, wherein the computer-readable storage medium stores computer-executable instructions, and the computer-executable instructions, when executed by a processor, implement the method for recommending target information according to any technical solution of the foregoing first aspect.

In the embodiments of the present disclosure, when the first sum value is determined, the proportionality coefficient is added before each element in the candidate mapping value subsets, i.e., each candidate mapping value, so that the method according to the embodiment may improves recommendation accuracy of the target information, reduces mutual influences and restriction between the weights corresponding to the plural dimension information, reduces influences of the weights corresponding to one part of the dimension information on the weights corresponding to the other part of the dimension information, reduces a sacrifice degree of the weights corresponding to the other part of the dimension information on determination accuracy of the target information, and thus improves an effect of the weights corresponding to the other part of the dimension information on the determination accuracy of the target information, thereby improving balance of the weights corresponding to the plural dimension information during the determination of the target information, and facilitates an improvement of the determination accuracy of the target information.

It should be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not intended to limit the present disclosure.

Brief Description of Drawings

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 shows a schematic flow diagram of a method for recommending target information according to an exemplary embodiment;

FIG. 2 shows a schematic flow diagram of determination of a target mapping value subset according to an exemplary embodiment;

FIG. 3 shows a schematic flow diagram of acquisition of a candidate parameter set according to an exemplary embodiment;

FIG. 4 shows a schematic flow diagram of update of a proportionality coefficient according to an exemplary embodiment;

FIG. 5 shows a schematic diagram of a trend of a change in a candidate mapping value in an application scenario according to an exemplary embodiment;

FIG. 6 shows a schematic diagram of a trend of a change in a candidate mapping value in an application scenario according to an exemplary embodiment;

FIG. 7 shows a schematic flow diagram of another method for recommending target information according to an exemplary embodiment; and

FIG. 8 shows a block diagram of a terminal device according to an exemplary embodiment.

Detailed Description

Exemplary embodiments will be described in detail here, and examples thereof are illustrated in the accompanying drawings. The following description

refers to the accompanying drawings in which the same numbers in different drawings represent the same or similar elements unless otherwise represented. The implementations described in the following exemplary embodiments do not represent all implementations consistent with the invention. Instead, they are merely examples of apparatuses and methods consistent with some aspects related to the invention as recited in the appended claims.

In general, during information recommendation, since there are many reference factors, i.e., factors affecting result of information recommendation, final information is recommended in conjunction with a plurality of reference factors. However, generally, the plurality of reference factors may be mutually restricted and influenced, and information recommendation may be influenced by one or several reference factors, such that the final recommended information may be greatly influenced by one or several of the reference factors, and may be prone to get into a local optimum state.

In this case, if there are reference factors playing a critical role in the final recommended information among the other reference factors, a degree of determination of the final recommended information by the reference factors playing the critical role is reduced, such that a degree of determination of the final recommended information by other reference information is far less than the degree of determination by the one or several reference factors, and thus, a relationship among the plural reference factors cannot be balanced according to the reference factors, and an overall optimal effect cannot be achieved. Therefore, accuracy of the final recommended information is reduced, and the

most suitable or matched recommended information cannot be recommended, thereby reducing a recommendation effect and use experiences of a user.

Reference is made to FIG. 1 which is a schematic flow diagram of a method for recommending target information according to an embodiment of the present disclosure, including:

step S100: acquiring a reference parameter set of at least one dimension information of candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set includes a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set includes candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the respective candidate weight subsets;

step S200: determining a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets; the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value subsets has a proportionality coefficient, and the proportionality coefficient is used for representing a degree of an influence of the dimension information on determination of recommended target information from the candidate information;

step S300: determining a target weight subset according to the target mapping value subset, wherein the target weight subset includes a target weight of the at least one dimension information influencing the candidate information; and

step S400: selecting the recommended target information from the candidate information according to the target weight subset.

The method may be executed at least in a mobile terminal; that is, an entity for executing the method may at least include a mobile terminal. The mobile terminal may include a mobile phone, a tablet computer, a vehicle-mounted central control device, a wearable device, an intelligent device, or the like, and the intelligent device may include an intelligent office device, an intelligent home device, or the like.

The method according to the embodiment may be executed by an execution terminal in various recommendation scenarios, for example, a recommendation scenario in which a recommendation result is determined by one dimension information, or a recommendation scenario in which the recommendation result is determined by a plurality of dimension information. In these recommendation scenarios, the candidate information to be recommended has a plurality of dimension information for reference, and final recommended information may be determined according to the dimension information. The proportion of different dimension information in determining whether a certain candidate information is the final recommended information is different, such that different dimension information has different reference values for determination of the final recommended information.

Certainly, the method may also be executed by the execution terminal in various recommendation scenarios; for example, some candidate targets have a plurality of dimension information, and the scenarios in which whether the candidate target is a final target is determined according to the different dimension information are all within the protection scope of the present embodiment.

Using the method, the optimal target weight corresponding to each of dimension information may be determined, and therefore, the recommended target information is determined according to the optimal target weight.

In the present embodiment, the candidate information to be recommended includes at least one of: a video, an official account, an article, and/or a product description information, or the like. Products herein include, but are not limited to: physical commodities and/or services. Certainly, other types of content may also be included and are not listed one by one here, and any content which includes plural dimension information may be used as the candidate information to be recommended, and is within the protection scope of the present embodiment.

In one embodiment, the dimension information of the candidate information to be recommended includes at least one of: downloads, favorites, likes, number of following users of an author of the candidate information, average browsing duration, number of comments, number of forwarding, or the like. Certainly, there may be at least one dimension information matched for different candidate information. In the present embodiment, the dimension information of the

candidate information to be recommended may be generated according to a historical operation of a user receiving the information for the candidate information.

In another embodiment, the dimension information of the candidate information to be recommended includes at least one of: a difference between an amount of the information to be recommended and an amount of information preferred by the recommended user, similarity between content of information to be recommended and content of preferred by recommended user, and recommendation strength of the information to be recommended, or the like.

In a specific application scenario, for example, when a video, or an official account, or an article, or the like, is viewed or browsed, it may be downloaded, favorited, given a like, commented, and/or forwarded; and the author of the target message of the video, or the official account, or the article, or the like, may be followed. The different dimension information, such as downloads, favorites, likes, number of following users of the author of the candidate information, the average browsing duration, number of comments, number of forwarding, or the like, may reflect a user’s preference degree for the viewed or browsed content, such as the video, the official account, the article, or the like.

Different dimension information has different weights in the candidate information to be recommended, and whether the candidate information is the target information may be determined according to the weights of the dimension information in the candidate information; that is, the target information may be determined from the candidate information according to the weights of the

dimension information in the candidate information. When a subsequent video, or official account, or article is recommended to the user, the target information required to be recommended may be determined from candidate information to be recommended according to information, such as downloads, favorites, likes, comments and/or forwarding, or the like, of the video, official account, article or content in other forms to be recommended.

Therefore, the weights of the different dimension information of the candidate information to be recommended play a key role in determination of the target information, and the present embodiment provides a description of the determination of the target information from the candidate information according to the weights of the different dimension information of the candidate information.

For step S100, the reference parameter set of the at least one dimension information of the candidate information to be recommended is obtained, the reference parameter set is used as a basic parameter set for determining the target information, and the target information is determined in conjunction with information in the candidate parameter set and information in the reference parameter set.

The reference parameter set includes the reference weight subset of the at least one dimension information and the reference mapping value subset corresponding to the reference weight subset. The reference weight subset is a set of reference weights of the at least one dimension information; that is, the reference weight subset includes the reference weights of the at least one

dimension information. The reference mapping value subset is a set of mapping values corresponding to the reference weights of the at least one dimension information; that is, the reference mapping value subset includes the mapping values of the reference weights of the at least one dimension information. The reference parameter set may be a predetermined set.

The reference weight subset may be denoted as Xbase={xbase1, xbase2, xbase3,…, xbasen}; that is, the candidate information to be recommended has n dimension informations, each dimension information has a corresponding reference weight, and n may be determined according to the candidate information to be recommended. In the present embodiment, each weight in the reference weight subset is referred to as an element of the reference weight subset.

For example, the candidate information to be recommended is a video, the video includes seven dimension informations which are downloads, favorites number of likes, number of following users of an author of the candidate information, average browsing duration, number of comments and number of forwards, and each dimension information has a reference weight. For example, the reference weight subset is Xbase={xbase1, xbase2, xbase3, xbase4, xbase5, xbase6, xbase7}. A weight value in the reference weight subset corresponding to each dimension information, i.e., a numerical value of each element, may be predetermined, that is, it may be a reference numerical value matched with the candidate information to be recommended, or a randomly initialized numerical value, or the like.

The reference mapping value subset may be denoted as Ybase={ybase1, ybase2, ybase3,…, ybasen}, i.e., mapping values corresponding to the weights of n dimension information. Each mapping value in the reference mapping value subset is referred to as an element of the reference mapping value subset, and a number of the elements in the subset is equal to a number of the elements in the reference weight subset. The reference mapping values and the reference weights have a corresponding mapping relationship, and the mapping relationship may be determined according to actual service requirements, and it may also be a preset mapping relationship, or the like.

For example, the corresponding mapping values may be determined according to the reference weights using a preset model or a functional relationship, or the like; for example, the mapping value ybase1 of xbase1, the mapping value ybase2 of xbase2, or the like, may be determined according to the preset model or functional relationship, and each reference weight corresponds to one reference mapping value, such that the mapping value of each element in the reference weight subset may be determined, thereby determining the reference mapping value subset. For example, Ybase={ybase1, ybase2, ybase3, ybase4, ybase5, ybase6, ybase7}.

Step S100 further includes: acquiring the plurality of candidate parameter sets of the at least one dimension information, that is, acquiring a plurality of candidate parameter sets, each candidate parameter set including the candidate weight subset of the at least one dimension information and the candidate mapping value subsets corresponding to the candidate weight subsets.

A number of candidate weights included in each candidate weight subset is the same as a number of the reference weights of the dimension information included in the reference weight subset. Here, each candidate weight in the candidate weight subset is also taken as each element of the candidate weight subset. That is, the number of the elements included in each candidate weight subset is the same as the number of the elements in the reference weight subset.

In the present embodiment, a number of the candidate weight subsets may be determined according to actual requirements, for example, it may be 3 or 5, or the like. The candidate weight subsets may be denoted as X1, X2, X3,…, Xt; that is, t candidate weight subsets are included. Each candidate weight subset includes the same number of elements as that in the reference mapping value subset, for example, 7.

For example, 5 candidate weight subsets, X1, X2, X3, X4, and X5 are obtained, wherein X1={x11, x12, x13, x14, x15, x16, x17}, X2={x21, x22, x23, x24, x25, x26, x27}, X3={x31, x32, x33, x34, x35, x36, x37}, X4={x41, x42, x43, x44, x45, x46, x47}, and X5={x51, x52, x53, x54, x55, x56, x57}.

For any two candidate weight subsets, if at least one dimension information in the candidate weight subsets corresponds to different candidate weight values, the two candidate weight subsets are different. For the same dimension information, the weights included in any two different candidate weight subsets may be same or different. In the present embodiment, it will be taken as an example that the weights included in any two different candidate weight subsets are different for the same dimension information. When different candidate

weight subsets are used as the target weight subset, the determined target information is different, and the optimal target weight subset may be determined by determining the target weight subset from the different candidate weight subsets, such that the target information with highest recommendation accuracy is determined, and the recommendation accuracy is improved.

Each candidate weight in the candidate weight subset may be predetermined, or may be a candidate weight matched with the candidate information to be recommended from a database, or may be determined using another method, which is not limited herein.

The candidate mapping value subsets corresponding to the candidate weight subsets may be denoted as Y1, Y2, Y3,…, Yt, and a number of the candidate mapping value subsets is the same as the number of the candidate weight subsets. If there exist 5 candidate weight subsets, there will be 5 candidate mapping value subsets, Y1 and X1 have a mapping relationship, Y2 and X2 have a mapping relationship, ..., and Y5 and X5 have a mapping relationship. A number of mapping values included in each candidate mapping value subset is the same as the number of the weights in the candidate weight subset; that is, the number of the elements in the candidate mapping value subset is the same as the number of the elements in the candidate weight subset.

For example, Y1={y11, y12, y13, y14, y15, y16, y17}, Y2={y21, y22, y23, y24, y25, y26, y27}, Y3={y31, y32, y33, y34, y35, y36, y37}, and Y4 and Y5 have similar fashions. Y11 and x11 have a mapping relationship, y12 and x12 have a mapping relationship, y13 and x13 have a mapping relationship, ..., and

y17 and x17 have a mapping relationship. Y21 and x21 have a mapping relationship, y22 and x22 have a mapping relationship, y23 and x23 have a mapping relationship, ..., y27 and x27 have a mapping relationship, and the rest subsets have a similar fashion.

In the present embodiment, the candidate mapping value subset may be determined according to the candidate weight subset, and similarly, it may be determined using a preset model or a functional relationship. The preset model or functional relationship here may be the same as the preset model or functional relationship used to determine the reference mapping value subset according to the reference weight subset.

The candidate weight subset and the candidate mapping value subset may be used to determine the target weight subset, and thus the target information.

The target mapping value subset may be determined using step S200.

The first sum value is the sum of the elements in any one of the candidate mapping value subsets, and when the first sum value is determined, each element in each candidate mapping value subset has a proportionality coefficient, and the proportionality coefficient is used for representing the degree of the influence of the dimension information corresponding to the element on the determination of the recommended target information from the candidate information. The first sum value is determined according to the elements in the candidate mapping value subset and the proportionality coefficients of the elements.

For example, the candidate mapping value subset Y1={y11, y12, y13, y14, y15, y16, y17}, and when the first sum value is determined, each element in the candidate mapping value subset Y1 has a proportionality coefficient; for example, for Y1={a*y11, b*y12, c*y13, d*y14, e*y15, f*y16, g*y17}, a, b, c, d, e, f, and g are the proportionality coefficients. The first sum value corresponding to Y1 may be denoted as sum(a*y11, b*y12, c*y13, d*y14, e*y15, f*y16, g*y17). Similarly, each element in other candidate mapping value subsets also has a proportionality coefficient; for example, for Y2={a*y21, b*y22, c*y23, d*y24, e*y25, f*y26, g*y27}, the first sum value corresponding to Y2 is sum(a*y21, b*y22, c*y23, d*y24, e*y25, f*y26, g*y27).

These proportionality coefficients are used for representing the weights of the dimension information corresponding to the weights having the mapping relationships with the mapping values in the determination of the target information from the to-be-recommended candidate information, and the larger the proportionality coefficient, the larger the weight, and the greater the influence degree.

The second sum value is the sum of the elements within the reference mapping value subset. The first sum value may be determined by directly suming the elements in the reference mapping value subset. For example, sum(ybase1, ybase2, ybase3, ybase4, ybase5, ybase6, ybase7).

Then, the target mapping value subset is determined from the candidate mapping value subset according to the difference between the first sum value and the second sum value. The determination method is not limited specifically;

for example, with reference to subsequent embodiments, the candidate mapping value subset with the largest difference may be used as the target mapping value subset, and so on.

For example, the target mapping value subset is determined to be Y5={y51, y52, y53, y54, y55, y56, y57} according to the difference between the first sum value sum(a*y51, b*y52, c*y53, d*y54, e*y55, f*y56, g*y57) corresponding to the candidate mapping value subset Y5={y51, y52, y53, y54, y55, y56, y57} and the second sum value sum(ybase1, ybase2, ybase3, ybase4, ybase5, ybase6, ybase7).

For step S300,

the target weight subset is determined according to the determined target mapping value subset after the target mapping value subset is determined. Since the target mapping value subset is selected from the candidate mapping value subsets, and each candidate mapping value subset corresponds to the candidate weight subset having a mapping relationship, the candidate weight subset having a mapping relationship corresponding to the target mapping value subset is used as the target weight subset. That is, the candidate weight subset corresponding to the target mapping value subset is determined as the target weight subset.

The target weight subset includes the target weight of the at least one dimension information influencing the candidate information. The target weight subset includes the target weight corresponding to the at least one dimension information, and the target weight may influence the determination of the target

information from the candidate information, that is, it influences whether a certain candidate information is the target information.

For example, the target mapping value subset is Y5={y51, y52, y53, y54, y55, y56, y57}, and since the candidate weight subset having a mapping relationship with Y5 is X5={x51, x52, x53, x54, x55, x56, x57}, X5 is the target weight subset.

When the first sum value is determined, the proportionality coefficient is added before each element in the candidate mapping value subset, i.e., each candidate mapping value, such that a capability of a Bayesian algorithm in solving waste of calculation time and space is reserved, and a problem that the Bayesian algorithm is prone to get into a local optimum state and the weights of plural dimension information are mutually restricted and influenced, resulting in inaccurate determined target information is reduced, thereby the determination accuracy of the target information is improved.

For step S400,

the recommended target information may be selected from the candidate information according to the target weight subset after the target weight subset is determined. Since the target weight subset includes the weight of the at least one dimension information, the target information may be determined from the candidate information to be recommended according to the weight of the at least one dimension information.

For example, if the target weight subset is X5={x51, x52, x53, x54, x55, x56, x57}, then, a target video is determined from the candidate videos to be recommended according to the elements in the target weight subset, i.e., the weights corresponding to the 7 dimension informations.

The method according to the embodiment may improve recommendation accuracy of the target information, reduce the mutual influences and restriction between the weights corresponding to the plural dimension informations, reduce influences of the weights corresponding to one part of the dimension information on the weights corresponding to the other part of the dimension information, reduce a sacrifice degree of the weights corresponding to the other part of the dimension information on the determination accuracy of the target information, and thus improve an effect of the weights corresponding to the other part of the dimension information on the determination accuracy of the target information, thereby improving balance of the weights corresponding to the plural dimension informations during the determination of the target information, and facilitates an improvement of the determination accuracy of the target information.

In another embodiment, when the first sum value is determined, the proportionality coefficient of each element in the candidate mapping value subset may be a preset value, and the preset value may be fixed. A specific numerical value of the proportionality coefficient is determined according to actual service requirements, that is, according to the candidate information to be recommended. For example, according to recommendation requirements of the candidate information to be recommended, if the degree of the influence of one

part of the dimension information on the determination of the target information is greater than the degree of the influence of the other part of the dimension information on the determination of the target information, the proportionality coefficient of the mapping value corresponding to one part of the dimension information is set to be greater than the proportionality coefficient of the mapping value corresponding to the other part of the dimension information.

Referring to FIG. 2 which is a schematic flow diagram of the determination of the target mapping value subset, step S200 of determining a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value includes:

step S201: determining the first sum value according to the proportionality coefficients of the elements in the candidate mapping value subset.

The first sum value is the sum of the elements in any one of the candidate mapping value subsets, and when the first sum value is determined, each element in each candidate mapping value subset has the proportionality coefficient, and the proportionality coefficient is used for representing the degree of the influence of the dimension information corresponding to the element on the determination of the recommended target information from the candidate information. The first sum value is determined according to the elements in the candidate mapping value subset and the proportionality coefficients of the elements.

For example, for the candidate mapping value subset Y1={y11, y12, y13, y14, y15, y16, y17}, when the first sum value is determined, each element in the

candidate mapping value subset Y1 has a proportionality coefficient; for example, in Y1={a*y11, b*y12, c*y13, d*y14, e*y15, f*y16, g*y17}, a, b, c, d, e, f, and g are proportionality coefficients. The first sum value corresponding to Y1 may be denoted as sum(a*y11, b*y12, c*y13, d*y14, e*y15, f*y16, g*y17). Similarly, each element in other candidate mapping value subsets has a proportionality coefficient; for example, for Y2={a*y21, b*y22, c*y23, d*y24, e*y25, f*y26, g*y27}, the first sum value corresponding to Y2 is sum(a*y21, b*y22, c*y23, d*y24, e*y25, f*y26, g*y27).

These proportionality coefficients are used for representing the weights of the dimension information corresponding to the weights having the mapping relationships with the mapping values in the determination of the target information from the candidate information to be recommended, and the larger the proportionality coefficient, the larger the weight, and the greater the influence degree.

Step S202: according to the difference between the first sum value and the second sum value, determining the candidate mapping value subset with the largest difference or the candidate mapping value subset with the difference greater than a preset difference as the target mapping value subset.

After the determination of the difference between the first sum value and the second sum value, since the optimal target mapping value subset is selected by maximizing the difference, in the present embodiment, the candidate mapping value subset with the largest difference is determined as the target mapping value subset, such that the optimal mapping value subset in all the candidate

mapping value subsets may be determined and used as the target mapping value subset.

The candidate mapping value subset with the difference greater than the preset difference may also be used as the target mapping value subset. The preset difference may be a preset difference determined according to the candidate information and matched with the candidate information. When the difference between the first sum value and the second sum value is greater than the preset difference, the optimal mapping value subset may be determined from the candidate mapping value subsets as the target mapping value subset.

In the present embodiment, the target information may be determined according to the target weight subset corresponding to the optimal mapping value subset.

In another embodiment, referring to FIG. 3 which a schematic flow diagram of acquisition of the candidate parameter set, step S100 of acquiring a plurality of candidate parameter sets of the at least one dimension information includes:

step S101: presetting T initialization parameter sets, wherein each initialization parameter set includes an initialization weight subset of the at least one dimension information and an initialization mapping value subset corresponding to the initialization weight subset.

In this step, the T initialization parameter sets may be preset in a preset manner, each initialization parameter set includes the initialization weight subset of the at least one dimension information and the initialization mapping value

subset corresponding to the initialization weight subset; that is, there is a mapping relationship between the initialization weight subset and the initialization mapping value subset.

Each initialization weight subset includes weights of the at least one dimension information, and the number of the initialization weights in the subset is the same as the number of the weights in the reference weight subset. Each initialization mapping value subset includes mapping values corresponding to the weights of the at least one dimension information, and the number of the mapping values in the subset is the same as the number of the initialization weights in the initialization weight subset.

T may be set according to actual requirements, and it may be, for example, 3, 5, or another positive integer.

For example, the initialization weight subsets are X6, X7, X8, X9, and X10, the initialization mapping value subsets are Y6 to Y10, there is a mapping relationship between X6 and Y6 and a mapping relationship between X7 and Y7, and the rest subsets have a similar fashion. X6={x61, x62, x63, x64, x65, x66, x67}, X7={x71, x72, x73, x74, x75, x76, x77}, and X8, X9, and X10 have similar fashions. Y6={y61, y62, y63, y64, y65, y66, y67}, Y7={y71, y72, y73, y74, y75, y76, y77}, and Y8, Y9, and Y10 have similar fashions. Y61 and x61 have a mapping relationship, y62 and x62 have a mapping relationship, y63 and x73 have a mapping relationship, ..., and y67 and x67 have a mapping relationship. Y71 and x71 have a mapping relationship, y72 and x72 have a

mapping relationship, y73 and x73 have a mapping relationship, ..., y77 and x77 have a mapping relationship, and so on.

Step S102: determining a (T+1)th parameter set according to a third sum value of elements in the initialization weight subset in each initialization parameter set and a fourth sum value of elements in each initialization mapping value subset; the (T+1)th parameter set includes a (T+1)th weight subset and a (T+1)th mapping value subset, and T is a positive integer greater than 1.

In this step, a sum of all the initialization weights in each initialization weight subset is determined as the third sum value according to the elements, i.e., the initialization weights, in each initialization weight subset. A sum of all initialization mapping values in each initialization mapping value subset is determined as the fourth sum value according to the elements, i.e., the initialization mapping values, in each initialization mapping value subset.

Since mapping relationships exist between the initialization weight subsets and the initialization mapping value subsets, each initialization weight subset corresponds to one initialization mapping value subset, and a initialization weight subset and a initialization mapping value subset having mapping relationship may be used as a set of parameters. Each of different initialization parameter sets includes one initialization weight subset and one initialization mapping value subset, such that the third sum value corresponding to one initialization weight subset and the fourth sum value corresponding to one initialization mapping value subset may form coordinates of one initialization

parameter in a coordinate system. The third sum value corresponds to the X-axis and the fourth sum value corresponds to the Y-axis.

Coordinates of the (T+1)th parameter set are predicted according to a development trend of coordinate positions of the first initialization parameter set to the Tth initialization parameter set in the known T initialization parameter sets. The (T+1)th parameter set includes the (T+1)th weight subset and the (T+1)th mapping value subset, and a mapping relationship exists between the (T+1)th mapping value subset and the (T+1)th weight subset.

The specific prediction method may be determined according to Gaussian distribution and conditional probability distribution of each mapping value subset. An example is as follows.

The optimal target information may be determined from the candidate information by adjusting x in X, and whether the target information is optimal is evaluated by Y corresponding to X, i.e., the mapping value subset, for example, Y takes an extreme value (maximum value or minimum value in a certain interval). The method for recommending target information may be implemented by a recommendation model, wherein auc and gauc are generally used in the recommendation scenario to evaluate accuracy of the recommendation model of the target information, and the recommendation accuracy of the model may be evaluated by f(x)=Y using an equation f of auc and gauc. Therefore, in a case of determined f, a set of X are required to be determined to maximize Y.

By constructing a substitute function of the objective function f, an optimal solution of the substitute function may be obtained, wherein the substitute function evaluates its score on X. Assuming that X and Y obey Gaussian distribution, posterior probability distribution of (X, Y) may be fit according to Gaussian distribution, and values of Y may be estimated according to X. Each Y obtained from X can correct the estimation of the posterior probability distribution. Of course, the more samples it takes, the closer the obtained distribution is to the reality, but the calculation cost is huge, and if arbitrary infinite sampling is performed, consumed time is close to that for traversing all X to find Y.

Therefore, in the present embodiment, a sampling limit is set and called a harvest function, which may be max(mean+var). Mean represents a mean value, and the higher the mean value is, the more likely regional sampling of a global optimal solution presents. Var represents a variance, and the higher the variance is, the more likely the global optimal solution is in an unsampled region; that is, a sampling point is acquired in the unsampled region. Optimal X may wander at points around X when the global optimal solution is pursued blindly, which is not favorable for fast fitting of real distribution. Therefore, the variance is required to be added, and the variance is expanded to find some unsampled regions. According to the harvest function max(mean+var) and a constraint relationship between mean and var, optimal X under current distribution may be determined, Y may be obtained using f, and (X, Y) is predicted information which is used to update data distribution for continuous iterations.

Likewise, the function Y=f(X) is also satisfied between y and x, which is equivalent to optimization of y1+y2+y3...yn=f(x1)+f(x2)+f(x3)…..f(xn), x included in X may be determined using the function f, and after x is determined, y may be determined according to the function f. A specific process is not described in detail here, and reference may be made to a Bayesian optimization algorithm.

The sum of all the weights in the (T+1)th weight subset of the (T+1)th parameter set is a local maximum value, and the sum of all the mapping values in the (T+1)th mapping value subset is a local maximum value.

Step S103: determining a (T+n+1)th parameter set according to T+n parameter sets, n being a positive integer, and the sum of the elements in the (T+n)th mapping value subset being a local maximum value.

The (T+1)th parameter set may be determined according to the known T initialization parameter sets; that is, positions of the third sum values and the fourth sum values in the coordinate system, which correspond to the first initialization parameter set to the Tth initialization parameter set respectively, may be determined according to the third sum values corresponding to the initialization weight subsets and the fourth sum values corresponding to the initialization mapping value subsets in the known T initialization parameter sets. According to Gaussian distribution, the positions of the sum value corresponding to the weight subset and the sum value corresponding to the mapping value subset in the (T+1)th parameter set in the coordinate system may be predicted, such that the sum value corresponding to the weight subset and the

sum value corresponding to the mapping value subset in the (T+1)th parameter set are determined, and thus the weight subset and the mapping value subset corresponding to the (T+1)th parameter set are determined.

The sum value of the weight subset and the sum value of the mapping value subset in the (T+2)th parameter set are determined according to the third sum values and the fourth sum values respectively corresponding to the T initialization parameter sets and the (T+1)th parameter set, thereby the weight subset and the mapping value subset corresponding to the (T+2)th parameter set are determined.

In this way, the sum value corresponding to the weight subset and the sum value corresponding to the the mapping value subset in the (T+n)th parameter set may be determined according to the sum values corresponding to the weight subsets and the sum values corresponding to the mapping value subsets in the first T+n-1 parameter sets. The sum value corresponding to the weight subset and the sum value corresponding to the mapping value subset in the (T+n+1)th parameter set are determined according to the sum values corresponding to the weight subsets and the sum values corresponding to the mapping value subsets in the first T+n parameter sets, thereby the (T+n+1)th parameter set is determined.

In this step, n may be determined according to actual requirements, and may be a positive integer from 1 to 10,000, for example. When the (T+n)th parameter set is determined, the sum of the weights of the weight subset in each parameter

set is a local maximum value, and the sum of the mapping values in the mapping value subset is also a local maximum value.

Step S104: determining T+n+1 parameter sets as the candidate parameter sets.

After the determination of T+n+1 parameter sets, the T+n+1 parameter sets are determined as the candidate parameter sets, and the target parameter set is determined from the T+n+1 parameter sets, thereby the target mapping value subset is determined.

In another embodiment, T+n parameter sets may be determined as the candidate parameter sets.

In another embodiment, step S101 of presetting T initialization parameter sets includes:

determining T initialization parameter sets matched with the candidate information according to a historical parameter set of the candidate information, wherein the historical parameter set includes a historical weight subset of the at least one dimension information and a historical mapping value subset corresponding to the historical weight subset.

Number of elements in the historical weight subset and the historical mapping value subset included in the historical parameter set may be equal to the number of the elements in the reference weight subset and the reference mapping value subset.

By determining the T initialization parameter sets in the historical parameter set, a degree of matching between the initialization parameter sets and the

candidate information may be improved, and thus the accuracy of the determined target information is improved.

Or,

T initialization parameter sets are randomly generated according to the candidate information to be recommended.

In another embodiment, the method further includes: updating the proportionality coefficients according to the candidate mapping value subsets.

In this embodiment, the proportionality coefficients may be dynamically changed, and the proportionality coefficient of each element in the candidate mapping value subset may be dynamically updated according to a change in the sum of the mapping values in the candidate mapping value subset by dynamically adjusting the proportionality coefficient, so as to balance the degree of the influence of the at least one dimension information on the target information, and reduce a situation where the determined target information has low accuracy due to the mutual restriction between the target weights corresponding to the plural dimension information, thereby improving the determination accuracy of the target information.

In another embodiment, reference is made to FIG. 4 which is a schematic flow diagram of the update of the proportionality coefficient. The step of updating the proportionality coefficients according to the candidate mapping value subsets includes:

step S10: determining a change trend of a plurality of candidate mapping values corresponding to respective dimension information according to the plurality of candidate mapping values corresponding to the respective dimension information.

After determination of the candidate mapping value subsets in the plurality of candidate parameter sets corresponding to the at least one dimension information, the mapping values in the candidate mapping value subset in each candidate parameter set may be determined, and each candidate mapping value subset includes the mapping values corresponding to respective dimension information, so as to determine the plurality of mapping values corresponding to the respective dimension information, and thus obtain the change trend of the mapping values corresponding to the respective dimension information. That is, each dimension information corresponds to one change trend of the plurality of mapping values corresponding to the dimension information.

Step S20: adjusting the proportionality coefficient according to each change trend until each change trend reaches a target range, wherein the change trends corresponding to the different dimension information have corresponding target ranges respectively. The target range is a threshold range determined according to the proportion of the dimension information in which the target information is selected from the candidate information. That is, each change trend corresponds to one threshold range, and the threshold range is determined by the proportion of the different dimension information in which the target information is selected from the candidate information.

After the change trend corresponding to each dimension information is determined, the proportionality coefficient of the candidate mapping value corresponding to each dimension information may be adjusted according to the change trend, and different change trends are adjusted to be within the corresponding target range. Thus, the degree of the influence of the at least one dimension information on the target information may be balanced, and the situation where the determined target information has low accuracy due to the mutual restriction between the target weights corresponding to the plural dimension information is reduced, thereby improving the determination accuracy of the target information.

For example, the seven kinds of dimension information, which are downloads, favorites, likes, number of following users of the author of the candidate information, the average browsing duration, number of comments and number of forwarding, correspond to threshold ranges of 0 to 0.02%, 0.1% to 0.3%, 0.2% to 0.5%, 0.3% to 0.7%, 0.1% to 0.6%, -0.9% to 0, and 0.05% to 0.08% respectively. When a change rate corresponding to the change trend reaches the corresponding threshold range, adjustment of the proportionality coefficient may be realized. When the change rate is outside the corresponding threshold range, the corresponding change rate is adjusted to be within the corresponding threshold range.

In another embodiment, according to the change trend, when the plural candidate mapping values corresponding to each dimension information exceed the corresponding threshold range, the proportionality coefficients of the candidate mapping values corresponding to each dimension information may be

adjusted, the candidate mapping values corresponding to the dimension information are adjusted within the threshold range, and the threshold range in the present embodiment is a numerical range of the candidate mapping values.

In another embodiment, reference is made to FIG. 5 which is a schematic diagram of an apparatus for recommending target information, including:

an acquiring module 1 configured to acquire a reference parameter set of at least one dimension information of candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set includes a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set includes candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the candidate weight subsets;

a target mapping value subset determining module 2 configured to determine a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets; the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value subsets has a proportionality coefficient, and the proportionality coefficient is used to represent a degree of an influence of the dimension information on

determination of recommended target information from the candidate information;

a target weight subset determining module 3 configured to determine a target weight subset according to the target mapping value subset, wherein the target weight subset includes a target weight of the at least one dimension information influencing the candidate information; and

a recommending module 4 configured to select the recommended target information from the candidate information according to the target weight.

In another embodiment, the proportionality coefficients are preset values;

the target mapping value subset determining module 2 includes:

a first sum value determining unit configured to determine the first sum value according to the proportionality coefficients of the elements in the candidate mapping value subset; and

a target mapping value subset determining unit configured to, according to the difference between the first sum value and the second sum value, determine the candidate mapping value subset with the largest difference or the candidate mapping value subset with the difference greater than a preset difference as the target mapping value subset.

In another embodiment, the apparatus further includes:

a proportionality coefficient updating module configured to update the proportionality coefficients according to the candidate mapping value subsets.

The proportionality coefficient updating module includes:

a change trend determining unit configured to determine a change trend of a plurality of candidate mapping values corresponding to each dimension information according to the plurality of candidate mapping values corresponding to the dimension information; and

an adjusting unit configured to adjust the proportionality coefficients according to respective change trends until the change trend reache a target range, wherein the change trends corresponding to the different dimension information have corresponding target ranges respectively.

In another embodiment, the target range is a threshold range determined according to the proportion of the dimension information in which the target information is selected from the candidate information.

The acquiring module 1 includes:

an initialization parameter set acquiring unit configured to preset T initialization parameter sets, wherein the initialization parameter set includes an initialization weight subset of the at least one dimension information and an initialization mapping value subset corresponding to the initialization weight subset;

a (T+1)th parameter set determining unit configured to determine a (T+1)th parameter set according to a third sum value of elements in the initialization weight subset in each initialization parameter set and a fourth sum value of elements in each initialization mapping value subset, wherein the (T+1)th

parameter set includes a (T+1)th weight subset and a (T+1)th mapping value subset, and T is a positive integer greater than 1;

a (T+n+1)th parameter set determining unit configured to determine a (T+n+1)th parameter set according to T+n parameter sets, wherein n is a positive integer, and the sum of the elements in the (T+n)th mapping value subset is a local maximum value; and

a candidate parameter set determining unit configured to determine the T+n+1 parameter sets as the candidate parameter sets.

The initialization parameter set acquiring unit is further configured to:

determine T initialization parameter sets matched with the candidate information according to a historical parameter set of the candidate information, wherein the historical parameter set includes a historical weight subset of the at least one dimension information and a historical mapping value subset corresponding to the historical weight subset;

or,

randomly generate T initialization parameter sets according to the candidate information to be recommended.

In another embodiment, the target weight subset determining module 3 is further configured to:

determine the candidate weight subset corresponding to the target mapping value subset as the target weight subset.

In another embodiment, the candidate information to be recommended includes at least one of:

a video;

an official account; and

an article;

the dimension information includes at least one of:

downloads, favorites, likes, number of following users of an author of the candidate information, average browsing duration, number of comments, and number of forwarding.

An embodiment of the present disclosure provides an electronic device, including:

a memory configured to store processor-executable instructions; and

a processor connected with the memory;

wherein the processor is configured to be able to perform the method for recommending target information according to any of the foregoing technical solutions by executing the computer-executable instructions stored on the memory.

The processor may include various types of storage media, which are non-transitory computer storage media capable of continuing to remember information stored thereon after a mobile terminal is powered off.

The processor may be connected with the memory through a bus, or the like, and configured to read an executable program stored on the memory, for example, at least one of the methods shown in any of FIGS. 1 to 4 and the method shown in FIG. 7.

Another embodiment further provides another method for recommending target information.

With rapid development of big data technology and machine learning technology, applications of machine learning are becoming more and more rich and complex, such that a great amount of parameter adjustment needs more service knowledge of machine learning backgrounds and algorithms, and particularly in the case of fast models updating and rapid product iterations. A demand for automatic parameter adjustment is also increasingly strong, but traditional automatic parameter adjustment cannot completely realize simultaneous adjustment of a plurality of parameters, and an adjustment result of a plurality of interacting adjusted parameters is not ideal, such that the method is developed, and realizes effective selection of reasonable hyper-parameters under influences of a plurality of parameters.

Generally, the adopted automatic parameter adjusting methods include grid search, random search, Bayesian optimization, or the like. However, these methods have various problems: the grid search usually does not conform to rapid product iterations due to waste of a large quantity of time and space; the random search possibly misses an optimal point; and for the traditional Bayesian optimization, it is prone to get into a local optimum state under a plurality of

interacting parameters although a hyper-parameter black box is provided, or the balance is difficult to realize to achieve an optimal overall effect, and especially in a multi-parameter scenario, if a plurality of parameters are mutually restricted and influenced, an optimal hyper-parameter finally selected by a Bayesian algorithm usually has an unapparent effect.

In the process, Bayesian optimization depends on an objective function y=f(x), i.e., Max(sum(y1, y2, ..., yt)-sum(ybase1, ybase2, ..., ybaset)), but the optimal point which the Bayesian algorithm usually seeks in the adjustment of a plurality of parameters by the traditional objective function is not an optimal result of the effect in many scenarios. It is observed that the above expression seeks maximization of a total value, an ideal effect may be achieved in a scenario with plural mutually independent parameters, but in many scenarios, the parameters are mutually restricted, effects brought by certain parameters are usually sacrificed under influences of the target, and sometimes, the effects brought by the sacrificed parameters play a crucial role in an overall improvement, such that a strong constraint algorithm is defined and combined with Bayesian optimization to improve blindness of an objective equation, avoid obtaining local optimum or effect deviation, strongly limit interaction of the parameters in the process, and effectively convert effective service experience into a solvable equation for repeated use.

Optimization of a single parameter is described first; generally, an objective equation Ysingle=f(Xsingle) is defined, and find an optimal parameter xt to make the result yt an optimal solution, that is, max(yn)n=1, 2, 3...t is obtained; for a plurality of parameters, maximization of a sum of a plurality of Ysingles

may be found; that is, a set of parameters Xt={x1, x2, ..., xn} are found to maximize the result, and Max(Yt) is found. Max(Yt)=Max(y1+y2+y3…yt). Two mentioned problems are revealed here; firstly, each parameter yt changes at a different rate with the change of xt, such that yt which is changed faster is assigned a higher weight; that is, for an equation g(x) with a faster change (a larger slope), the value of g(x+1) increases more compared to f(x+1) with a smaller slope, and thus, the Bayesian algorithm prefers to adjust g(x) with a larger slope. Secondly, it is difficult for the service experience to fall into a Bayesian equation, such that the service experience cannot be learned for any automatic parameter adjustment.

The present embodiment provides a combination method based on a Bayesian principle and a strong constraint algorithm; on the one hand, a capability of the Bayesian algorithm to solve waste of computing time and space is preserved, and on the other hand, the strong constraint algorithm for parameters solves a problem that the Bayesian algorithm is prone to get into a local optimum state and an ideal profit is difficult to realize finally, so that a decrease of an overall effect brought by optimized hyper-parameters due to mutual restriction and influences of a plurality of parameters is avoided, and meanwhile, the usable service experience is converted into a solvable equation, which facilitates repeated use.

In order to achieve the above objective, the following technical solution is adopted in the present invention, and specific steps are as follows:

step 1: manually selecting a set of hyper-parameters X empirically, or randomly initializing a set of hyper-parameters X, and calculating score Ybase={ybase1, ybase2, ybase3, …, ybasen} of each target corresponding to the hyper-parameter set Xbase={xbase1, xbase2, xbase3, …, xbasen}. Thus, a base group (Xbase, Ybase) is formed and used for comparison with an experimental group.

Step 2: defining an optimization target, wherein target score Y={y1, y2, y3, ..., yn} is obtained for each hyper-parameter X selected in the optimization process, and to expand distance between a sum of the target score Y and a sum of the base group is increased, that is, Max(sum(y1, y2, ..., yn)-sum(ybase1, ybase2, …, ybasen)), a result greater than 0 is selected (the experimental group is selected), which is a form of selection of objective equation in a traditional service scenario, an improvement is mainly performed here, and for details, reference is made to detailed explanation in subsequent step remarks. (Not necessary, it may be used to determine step 5 to stop iterations)

Step 3: randomly generating, by the Bayesian, sets of hyper-parameters X1, X2, X3, ..., Xt and sets of corresponding target score results Y1, Y2, Y3, Y4, ..., Yt in an initialization stage. The Bayesian deems that the sets obey Gaussian distribution, and thus, a data set D={(X1, Y1), (X2, Y2), ..., (Xt, Yt)} and a conditional probability distribution of Y after update of D may be constructed.

Step 4: finding, by the Bayesian, balance between development and exploration using the Gaussian distribution initialized in step 3 and the objective equation defined in step 2, finding a next parameter set Dt=(Xt, Yt) for

maximizing Y (sum of y), and then adding Dt=(Xt, Yt) to the total set D. The step may be stopped after a certain number of iterations t.

Step 5: updating the original data set D by the maximized parameter set Dt=(Xt, Yt) found in each iteration, wherein a change of the original data set brings a new conditional probability distribution Y, and a next optimal solution may be found using the new distribution. Then, step 4 is iterated until final convergence, such that posterior distribution is close to real distribution. Optimal hyper-parameters are obtained.

In another embodiment, reference is made to FIG. 6 which is a schematic diagram of change trends of the candidate mapping values in an application scenario.

Wherein, P1, p2, p3, p4, p5 and p6 are 6 kinds of different dimension information, the abscissa represents the number of the candidate mapping values, and the ordinate represents the change rate of the candidate mapping values with an increase of the number of the candidate mapping values. The change of the candidate mapping values corresponding to the ordinate with an increase of the value of the abscissa parameter includes a change of parameter auc.

In traditional Bayesian iterative computation, Y=MAX(X*AUC) is solved, such that eventually, p6 may have an over large value due to its high increase rate, and p3 may gradually disappear due to its rapid progressive decrease. However, this is not desirable, because an online profit from a 1% increase of p1 may be greater than an online profit from a 10% increase of p6.

Therefore, there exists a constraint condition f(X)=Max(a*y1+b*y2+c*y3+d*y4+e*y5).

The profit may be balanced by adding, on p1, a weight 10 times as great as a weight of p6. In this way, all limiting conditions and constraint requirements may be reasonably converted into a solvable equation in conjunction with services.

Reference is made to FIG. 7 which is a schematic flow diagram of another method for recommending target information.

A service experience analyzer in the drawing is configured to determine the candidate information to be recommended, or the like, in conjunction with actual service requirements, and an equation composer in an objective equation builder may be configured to determine the first sum value, the second sum value, the difference between the first sum value and the second sum value, or the like. A numerical value converter may be configured to convert between the weights and the mapping values.

FIG. 8 shows a block diagram of an electronic device 800 according to an exemplary embodiment. For example, the electronic device 800 may be a mobile phone, a mobile computer, or the like. The electronic device may be a terminal for performing the aforementioned method.

Referring to FIG. 8, the electronic device 800 may include one or more of the following components: a processing component 802, a memory 804, a power component 806, a multimedia component 808, an audio component 810, an

input/output (I/O) interface 812, a sensor component 814, and a communication component 816.

The processing component 802 usually controls overall operations of the electronic device 800, such as operations associated with display, telephone call, data communication, camera operation, and recording operation. The processing component 802 may include one or more processors 820 to execute instructions, so as to perform all or a part of the steps of the above-mentioned method. Furthermore, the processing component 802 may include one or more modules to facilitate interaction between the processing component 802 and other components. For example, the processing component 802 may include a multimedia module to facilitate interaction between the multimedia component 808 and the processing component 802.

The memory 804 is configured to store various types of data to support the operations at the device 800. Examples of such data include instructions for any application or method operating on the electronic device 800, contact data, telephone book data, messages, pictures, videos, or the like. The memory 804 may be implemented by any type of volatile or non-volatile storage devices or a combination thereof, such as a static random access memory (SRAM), an electrically erasable programmable read-only memory (EEPROM), an erasable programmable read-only memory (EPROM), a programmable read-only memory (PROM), a read-only memory (ROM), a magnetic memory, a flash memory, a magnetic disk or an optical disk.

The power component 806 provides power for the various components of the electronic device 800. The power component 806 may include a power management system, one or more power sources, and other components associated with generation, management, and distribution of power for the electronic device 800.

The multimedia component 808 includes a screen providing an output interface between the electronic device 800 and a user. In some embodiments, the screen may include a liquid crystal display (LCD) and a touch panel (TP). If the screen includes a touch panel, it may be implemented as a touch screen to receive an input signal from the user. The touch panel includes one or more touch sensors to sense touch, slide, and gestures on the touch panel. The touch sensor may not only sense a boundary of touch or slide action, but also detect duration and pressure associated with touch or slide operation. In some embodiments, the multimedia component 808 includes a front camera and/or a rear camera. The front camera and/or the rear camera may receive external multimedia data when the device 800 is in an operational state, such as a shooting state or a video state. Each of the front camera and the rear camera may be a fixed optical lens system or have a focal length and an optical zoom capability.

The audio component 810 is configured to output and/or input audio signals. For example, the audio component 810 includes a microphone (MIC) configured to receive external audio signals when the electronic device 800 is in an operational state, such as a call state, a recording state, and a voice recognition state. The received audio signal may be further stored in the memory 804 or

transmitted by the communication component 816. In some embodiments, the audio component 810 further includes a loudspeaker for outputting audio signals.

The I/O interface 812 provides an interface between the processing component 802 and a peripheral interface module which may be a keyboard, a click wheel, buttons, or the like. These buttons may include, but are not limited to, a home button, a volume button, a start button, and a lock button.

The sensor component 814 includes one or more sensors for providing various aspects of state assessments for the electronic device 800. For example, the sensor component 814 may detect an on/off state of the device 800, and relative positioning of components, such as a display and a keypad of the electronic device 800; the sensor component 814 may also detect a change in position of the electronic device 800 or one component of the electronic device 800, presence or absence of the contact between the user and the electronic device 800, an orientation or acceleration/deceleration of the electronic device 800, and a change in a temperature of the electronic device 800. The sensor component 814 may include a proximity sensor configured to detect presence of a nearby object in the absence of any physical contact. The sensor component 814 may also include a light sensor, such as a CMOS or CCD image sensor, for use in imaging applications. In some embodiments, the sensor component 814 may further include an acceleration sensor, a gyroscope sensor, a magnetic sensor, a pressure sensor, or a temperature sensor.

The communication component 816 is configured to facilitate wired or wireless communication between the electronic device 800 and other devices.

The electronic device 800 may access a wireless network based on a communication standard, such as Wi-Fi, 4G, or 5G, or a combination thereof. In an exemplary embodiment, the communication component 816 receives broadcast signals or broadcast related information from an external broadcast management system via a broadcast channel. In an exemplary embodiment, the communication component 816 further includes a near field communication (NFC) module to facilitate short-range communication. For example, the NFC module may be implemented based on radio frequency identification (RFID) technology, infrared data association (IrDA) technology, ultra-wideband (UWB) technology, Bluetooth (BT) technology, and other technologies.

In an exemplary embodiment, the electronic device 800 may be implemented by one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), controllers, micro-controllers, microprocessors, or other electronic elements, for performing the above-mentioned method.

An exemplary embodiment further provides a non-transitory computer-readable storage medium including instructions, such as a memory 804 including instructions, which are executable by the processor 820 of the electronic device 800 to perform the above-mentioned method. For example, the non-transitory computer-readable storage medium may be a ROM, a random access memory (RAM), a CD-ROM, a magnetic tape, a floppy disk, an optical data storage device, or the like.

The embodiment of the present disclosure provides a non-transitory computer-readable storage medium, and the instructions in the storage medium, when executed by a processor of a mobile terminal, enable the mobile terminal to perform the method for recommending target information according to any of the foregoing embodiments, and to perform at least one of the methods shown in FIGS. 1, and 3 to 6.

Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed here. The present application is intended to cover any variation, use, or adaptation of the invention which follows the general principles of the invention and includes common general knowledge or common technological means in the art not disclosed in the present disclosure. The specification and embodiments are considered to be exemplary only, and the true scope and spirit of the invention are indicated by the following claims.

It will be understood that the invention is not limited to the precise structures described above and shown in the drawings, and various modifications and changes may be made without departing from the scope thereof. The scope of the invention is limited only by the appended claims.

Claims :

1. A method for recommending target information, comprising steps of:

acquiring a reference parameter set of at least one dimension information of in an candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set comprises a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set comprises candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the respective candidate weight subsets;

determining a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets, the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value subset has a proportionality coefficient, and the proportionality coefficients are used to represent a degree of an influence of the dimension information on determination of recommended target information from the candidate information;

determining a target weight subset according to the target mapping value subset, wherein the target weight subset comprises a target weight of the at least one dimension information influencing the candidate information; and

selecting the recommended target information from the candidate information according to the target weight subset.

2. The method according to claim 1, wherein the proportionality coefficient is a preset value;

the step of determining a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value comprises:

determining the first sum value according to the proportionality coefficients of the respective elements in the candidate mapping value subset; and

determining, according to the difference between the first sum value and the second sum value, the candidate mapping value subset with the largest difference or the candidate mapping value subset with the difference greater than a preset difference as the target mapping value subset.

3. The method according to claim 1, further comprising a step of:

updating the proportionality coefficients according to the candidate mapping value subsets.

4. The method according to claim 3, wherein the step of updating the proportionality coefficients according to the candidate mapping value subsets comprises:

determining, according to a plurality of candidate mapping values corresponding to respective dimension information, change trends of the

plurality of candidate mapping values corresponding to the respective dimension information; and

adjusting the proportionality coefficients according to the respective change trends until each of the change trends reaches a target range, wherein each of the change trends corresponding to the different dimension information has a corresponding target range.

5. The method according to claim 4, wherein the target range is a threshold range determined according to a proportion of the dimension information in which the target information is selected from the candidate information.

6. The method according to claim 1, wherein the step of acquiring a plurality of candidate parameter sets of the at least one dimension information comprises:

presetting T initialization parameter sets, wherein each of the initialization parameter sets comprises an initialization weight subset of the at least one dimension information and an initialization mapping value subset corresponding to the initialization weight subset;

determining a (T+1)th parameter set according to a third sum value of elements in the initialization weight subset in each initialization parameter set and a fourth sum value of elements in each initialization mapping value subset, wherein the (T+1)th parameter set comprises a (T+1)th weight subset and a (T+1)th mapping value subset, and T is a positive integer greater than 1;

determining a (T+n+1)th parameter set according to T+n parameter sets, wherein n is a positive integer, and a sum of the elements in the (T+n)th mapping value subset is a local maximum value; and

determining the T+n+1 parameter sets as the candidate parameter sets.

7. The method according to claim 6, wherein the step of presetting T initialization parameter sets comprises:

determining T initialization parameter sets matched with the candidate information according to a historical parameter set of the candidate information, wherein the historical parameter set comprises a historical weight subset of the at least one dimension information and a historical mapping value subset corresponding to the historical weight subset;

or,

randomly generating T initialization parameter sets according to the candidate information to be recommended.

8. The method according to claim 1, wherein the step of determining a target weight subset according to the target mapping value subset comprises:

determining the candidate weight subset corresponding to the target mapping value subset as the target weight subset.

9. The method according to any one of claims 1 to 8, wherein the candidate information to be recommended comprises at least one of:

a video;

an official account; and

an article;

the dimension information comprises at least one of:

downloads, favorites, likes, number of following users of an author of the candidate information, average browsing duration, number of comments, and number of forwarding.

10. An apparatus for recommending target information, comprising:

an acquiring module, configured to acquire a reference parameter set of at least one dimension information in an candidate information to be recommended and a plurality of candidate parameter sets of the at least one dimension information, wherein the reference parameter set comprises a reference weight subset of the at least one dimension information and a reference mapping value subset corresponding to the reference weight subset; and the candidate parameter set comprises candidate weight subsets of the at least one dimension information and candidate mapping value subsets corresponding to the respective candidate weight subsets;

a target mapping value subset determining module, configured to determine a target mapping value subset from the candidate mapping value subsets according to a difference between a first sum value and a second sum value, wherein the first sum value is a sum of elements in any one of the candidate mapping value subsets, the second sum value is a sum of elements in the reference mapping value subset, each element in the candidate mapping value

subset has a proportionality coefficient, and the proportionality coefficients are used to represent a degree of an influence of the dimension information on determination of recommended target information from the candidate information;

a target weight subset determining module, configured to determine a target weight subset according to the target mapping value subset, wherein the target weight subset comprises a target weight of the at least one dimension information influencing the candidate information; and

a recommending module, configured to select the recommended target information from the candidate information according to the target weight.

11. An electronic device, comprising:

a memory configured to store processor-executable instructions; and

a processor connected with the memory,

wherein the processor is configured to execute the method for recommending target information according to any one of claims 1 to 9.

12. A non-transitory computer-readable storage medium, wherein the computer-readable storage medium stores computer-executable instructions, and the computer-executable instructions, when executed by a processor, implement the method for recommending target information according to any one of claims 1 to 9.