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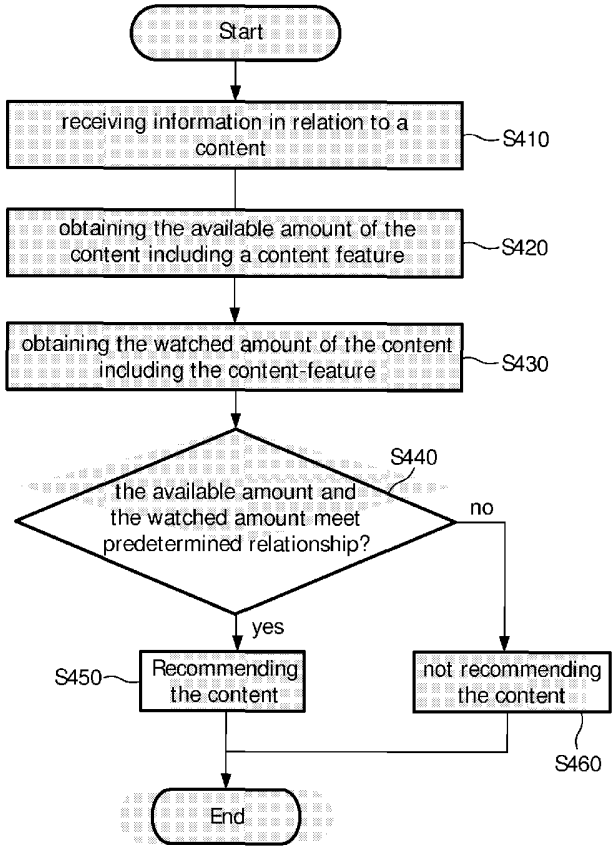
(54) Title: METHOD AND APPARATUS FOR RECOMMENDING CONTENTS



(57) Abstract: The present invention relates to a content recommendation method and apparatus for improving the accuracy of recommending contents to users. According to the method of the invention, it includes the steps of: receiving information in relation to a content, the information comprising at least one content-feature of the content; obtaining the available amount of the content including said content-feature, and obtaining the watched amount of the content including said content-feature by a user; and deciding whether to recommend a content to the user based on the relationship between the available amount and the watched amount.

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METHOD AND APPARATUS FOR RECOMMENDING CONTENTS

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for recommending contents, and more particularly, to a technique for recommending users with contents more accurately.

With the development of modern communication techniques, people are able to obtain large amount of information at any time. However, the sharp increasing of the amount of information tends to render people at lose ends. Therefore, people desiderate some kind of means to help them in finding real interested contents quickly, that is, an individualized content recommendation means.

In an existing recommendation system, each content comprises at least one content-feature, and content-features of a same genre composite a feature-genre. For example, the feature-genre for TV programs can be actor, and the corresponding content-features are Tom Hanks，Brad Pitt etc. The feature-genre may also be program type, and the corresponding content-features are comedy, science documentaries, horror movie etc. The feature-genre may also be director, and the corresponding content-features are Zhang Yimou, Fen Xiaogang etc. These feature-genres may be from information sources such as broadcast, TV, or Internet, and are most typically transmitted to users together with programs through an electric program guide (EPG).

To meet the ever varying user interests, the user profile in a content recommendation apparatus stores information about the user's preference to content-features of a program (Like_degree) and weight (Weight) etc. and updates the user profile continuously.

A recommendation apparatus generally modifies a user profile based on the user's viewing history (e.g. what programs the user has watched) or viewing behavior (e.g. how long the user has watched). Usually, the time duration that the user has watched a particular program is obtained firstly, then a predetermined threshold is subtracted from the obtained time duration, then the ratio of the result to the scheduled televising time duration is calculated to obtain the user's interest degree for this particular program, which can be used to revise the user profile.

In general if the user spends a lot of time watching content of a particular genre then the content recommendation apparatus concludes that the user likes the content of that

genre and recommends more. The architecture of an existing content recommendation apparatus is schematically shown in figure 1. The content recommendation apparatus 100 comprises a content receiving means 101 for receiving content with a particular content-feature; a user profile 102 for storing the user's viewing history; and a filter means 103 for recommending programs to the user according to the viewing history.

For example, a recommendation system is disclosed in the American patent application US10/066453 filed on January 31, 2002, and published on July 31, 2003 under the publication number US2003/0,145,326, and the assignee of which is KONINKLUKE PHILIPS ELECTRONICS Ltd. The system tracks all programs the user watched and generates a user profile indicating the frequency of a particular program being watched. Then the system provides the user with multiple predetermined schemes based on viewing custom stored in the user profile, so that the user may select pay per view programs according to his interests.

One disadvantage of the conventional recommendation system is that it only takes into account the amount that the user actually viewed but not the availability of a certain type of content. Because the user can only watch the televised programs, if the content the user really likes is shown very infrequently then it will not appear strongly in their profile. Therefore the programs the user likes strongly may not appear in the recommendation, so that the recommendation is not very accurate. For example, if a user watches 3 teleplays and 1 documentary in a certain week, the conventional recommendation system will update the user profile based on this, wherein the Like-degree to teleplays will be enhanced 3 times, and the Like-degree to documentaries will be enhanced 1 time. But in fact, there may be 15 teleplays and only 1 documentary available in that week. Since the user watches all available documentaries but watches part of the available teleplays, he may like watching documentaries more, and more enhanced Like-degree to documentaries will reflect the user's preference better.

OBJECT AND SUMMARY OF THE INVENTION

One object of the present invention is to solve the problems discussed above and to provide a content recommendation apparatus with increased accuracy.

According to one aspect of the invention, a content recommendation method is provided including steps of: receiving information in relation to a content, the information comprising at least one content-feature of the content; obtaining the available amount of

the content including the content-feature, and obtaining the amount of the content including the content-feature watched by a user; and deciding whether to recommend a content to the user based on the relationship between the available amount and the watched amount.

In one embodiment of the invention, the received content is program, the available amount is the amount of the contents including the content-feature available within a predetermined time period, the predetermined time period is longer than at least one program with the content-feature; and the watched amount is the amount of the contents including the content-feature watched by a user within the predetermined time period.

In another embodiment of the invention, a program recommendation table for a predetermined time period is obtained firstly. Then the programs with the certain content-feature in the program recommendation table are statistically calculated to obtain the available amount, and the programs recommended in the program recommendation table and watched by the user within the predetermined time period are statistically calculated to obtain the watched amount. Thus the proportion of the recommended programs watched by the user can be evaluated, thereby correct the contents to be recommended and improve the accuracy of recommendation.

In a further embodiment of the invention, a Like-degree indicating the user's preference to the content-feature is included in the user profile. The Like-degree is adjusted based on the relation between the available amount and the watched amount. Whether or not to recommend the program to the user is decided according to the adjusted Like-degree.

In the present invention, the available amount indicates how many hours programs including the content-feature are televised within a predetermined time period, the watched amount indicates how many hours the user actually watched the programs including the content-feature within the predetermined time period.

In the present invention, the available amount may indicate the number of televised programs including the content-feature within a predetermined time period, the watched amount may also indicate the times the user actually watched the programs including the content-feature within the predetermined time period.

In the present invention, the available amount may indicate the ratio of available programs with the content-feature to all available programs within a predetermined time period, the watched amount may also indicate the ratio of the programs with the content-

feature actually watched by the user to all the available programs with the content-feature within the predetermined time period.

According to another aspect of the invention, a content recommendation system is provided, the recommendation system comprises: a receiving means for receiving information in relation to a content, the information comprising at least one content-feature of the content; an available amount obtaining means for obtaining the available amount of the content including the content-feature; a watched amount obtaining means for obtaining the watched amount of the content including the content-feature by a user; and a decision making means for deciding whether to recommend the content to the user based on the relationship between the available amount and the watched amount.

The other objects and advantages of the present invention will be apparent from the following description and the attached claims with reference to the accompanying drawings, and the present invention will be more fully understood from that.

BRIEF DESCRIPTION OF THE DRAWINGS

Now the present invention will be described by way of example with reference to the drawings, in which

Fig.1 shows the structural diagram of a conventional content recommendation apparatus;

Fig.2 shows the structural diagram of the content recommendation apparatus according to one embodiment of the present invention;

Fig.3 shows the structural diagram of the content recommendation apparatus according to another embodiment of the present invention;

Fig.4 shows the flow chart executed by the content recommendation apparatus according to one embodiment of the present invention;

Fig.5 shows the flow chart executed by the content recommendation apparatus according to another embodiment of the present invention;

Fig.6 is a schematic view showing the input of a fuzzy membership function when implementing the apparatus of the present invention using fuzzy logic; and

Fig.7 is a schematic view showing the output of a fuzzy membership function when implementing the apparatus of the present invention using fuzzy logic.

Throughout the drawings, similar reference numbers are assigned to similar or identical features or functions.

DETAILED DESCRIPTION OF THE INVENTION

Fig.2 shows the structural diagram of the content recommendation apparatus according to one embodiment of the present invention. The content recommendation apparatus 200 comprises a receiving means 210, an available amount obtaining means 220, a watched amount obtaining means 230, and a decision making means 240. The content recommendation apparatus 200 may also comprise a user profile 250, and the available amount obtaining means 220 may also comprise a statistically calculating means 260.

The receiving means 210 is used for receiving information in relation to content, the information comprising at least one content-feature of the content. The content is from any information source such as broadcast, TV, or the Internet. For example, the content can be TV program, and the information in relation to the content can be EPG, wherein a feature-genre is "actor", and one content-feature in the feature-genre is "Brad Pitt", and another content-feature is "Tom Hanks". All these content-features are from the EPG.

The available amount obtaining means 220 is used for obtaining the available amount of programs including the content-feature. The program provider may analyze the available amount of the contents including the content-feature within a predetermined time period and store the available amount in the EPG to transmit the available amount information together with the EPG to the recommendation apparatus. Thus the available amount obtaining means 220 may obtain the available amount of the contents with the content feature directly from the EPG. If the program provider did not provide the available amounts of each type of programs in the EPG, the available amount obtaining means 220 may analyze the programs with the content-feature in the received EPG through a statistically calculating means 260 to obtain the available amount of the programs with the content-feature.

The watched amount obtaining means 230 is used to obtain the amount of the programs with the content-feature watched by a user. The watched amount obtaining means 230 may obtain the user's viewing history, analyze the user's viewing history to obtain the watched amount of the programs with the content-feature.

The decision making means 240 receives the available amount and the watched amount respectively from the available amount obtaining means 220 and the watched amount obtaining means 230, and decides whether to recommend the content or add the content into the recommendation list according to the relation between the available

amount and the watched amount. The available amount and the watched amount may be, for example, in proportional relationship, and when the proportion is higher than a predetermined value, the content should be recommended. The relation between the available amount and the watched amount may also be calculated through fuzzy logic etc. as will be described latter. When a predetermined relationship is observed, the content should be recommended.

The recommendation apparatus of the present invention may further have a user profile 250 to store information in relation to the user's viewing programs, such as the current EPG and previous EPGs as well as the available amounts of various programs obtained by the program provider or the recommendation apparatus through analyzing the EPG. The user profile 250 may also store the user's preference to various programs and the relevant weight, as well as information about the viewing history for various programs and actually watched amounts of various programs. In this case, the available amount obtaining means 220 and the watched amount obtaining means 230 can obtain the available amount and the watched amount directly from the user profile 250.

Fig.3 shows the structural diagram of the content recommendation apparatus according to another embodiment of the present invention. The content recommendation apparatus 300 comprises a receiving means 210, an available amount obtaining means 220, a watched amount obtaining means 230, a user profile 250, a statistically calculating means 260 which are identical to those in the embodiment shown in Fig.2. In the present embodiment, the decision making means 310 has a user profile correcting means 320. The user profile correcting means 320 corrects the user's preference to the content-feature according to the relationship between the available amount and the watched amount. For example, if the ratio of the watched amount to the available amount is higher than a predetermined value, the Like-degree to the content-feature in the user profile is increased. Other wise, if the ratio of the watched amount to the available amount is lower than a predetermined value, the Like-degree to the content-feature in the user profile is decreased. In addition, the user's preference to the content-feature may also be corrected based on a relationship between the available amount and the watched amount calculated through, for example, the fuzzy logic that will be described latter.

Upon received the program information from the receiving means 210, the decision making means 310 obtains the preference to the content-feature, and recommends the program to the user if the preference is higher than a predetermined value.

Fig.4 shows the flow chart executed by the content recommendation apparatus shown in Fig.2. Now an embodiment of the content recommendation method of the present invention will be described with reference to Fig.4.

At step S410, receiving information in relation to the content, the information comprising at least one content-feature of the content. The content is from any information source such as broadcast, TV, or the Internet. For example, the content can be TV program, and the information in relation to the content can be EPG, wherein a feature-genre of the content is "actor", and one content-feature in the feature-genre is "Brad Pitt", and another content-feature is "Tom Hanks".

At step S420, obtaining the available amount of the contents with the content-feature. For a EPG, this can be done by statistically calculating the amount of the programs with a certain content-feature available within a predetermined time period. The predetermined time period may be one month, one week, or other time periods. The predetermined time period may be set by the manufacturer of the set-top box or by the manufacturer of the recommendation apparatus. The time period may also be set or modified by the user. Furthermore, the time period should not be shorter than the shortest program with the content-feature, that is, the time period should be longer than at least one program with the content-feature.

The available amount of the programs with a certain content-feature can be obtained in a umber of ways. For example, it can be calculated by the program provider and stored in the EPG, and transmitted with the EPG to the recommendation apparatus. If the available amount of the content is not provided in the EPG, the EPG can be analyzed upon received to obtain the available amount of the content with the certain content-feature. The available amount of the content may also be obtained from a user profile. For example, the user profile may store the available amount of the content with the certain content-feature provided by the content provider. Thus the available amount of the content can be readout directly from the user profile. Another possible case is that the user profile stores the current EPG and previous EPGs. In this case, the available amount of the content can be obtained through reading the EPGs stored in the user profile and then analyzing the EPGs in a statistic manner.

Assume that 5 comedies (10 hours in total) had been televised in the last week, wherein Brad Pitt acts the leading role of a comedy of 2 hours, and Tome Hanks acts the leading role of another comedy of 2 hours. Within the week, there had also televised 3

documentaries(3 hours in total), 2 horror movies (3 hours in total), wherein Jenifer Aniston acts the leading role of a horror movie of 1.5 hours, as well as other programs.

Thus, based on analyzing the available amounts of various types of contents, an available amount table can be generated. For example, based on statistics of the televising hours, the following table can be generated:

Table1. Collected televising hours of various contents

Content Feature	Available Amount（hour）
Comedy	10
Documentaries	3
Horror Movie	3
TV play series	30
• • •	
Brad Pitt	2
Jenifer Aniston	1.5
Tom Hanks	2
• • •	

The content-features can be based on TV-Anytime fields. The system should filter duplicates when creating this table.

At step S430, obtaining the watched amount of the contents with the content-feature. This can be done through analyzing the time the user spent for actually watching various contents within the predetermined time period. The predetermined time period for calculating the watched amount is identical to that for calculating the available amount.

The watched amount can be obtained in many ways. For example, the recommendation apparatus may obtain the user's viewing history through monitoring the set-top box, then analyze the obtained viewing history to obtain the actually watched amount of the contents with the content-feature. In another way, the user profile records the user's viewing history, and the recommendation system may obtain the actually

watched amount of the contents including the content-feature through analyzing the recorded viewing history.

For example, a user watched 3 comedies, 3 documentaries, 2 horror movies, 1 teleplay, and other programs in last week. Based on analyzing the user's actually watched amount within the week, a table 2 may be created (hours the user actually spent for watching various content-features).

Table2. Hours the user actually spent for watching contents with various content-features

Content-feature	Actually watched amount（hour）
Comedy	2
Documentary	3
Horror Movie	1
TV play series	5
• • •	
Brad Pitt	1
Jenifer Aniston	1
Tom Hanks	3
• • •	

At step S440, checking whether the available amount and the watched amount meet a predetermined relationship. If meet, the content is recommended to the user at step S450, or the content is not recommended at step S460. The available amount and the watched amount may be in proportional relationship, and when the proportion is higher than a predetermined value, the content is recommended to the user. For example, the recommendation system may be set so that content with the same content-feature is recommended to the user when the ratio of the watched amount to the available amount is higher than 50%. In this case, the available amount of documentaries in the last week is 3 hours, and the user watched all 3 hours, that is, the watched amount is 3 hours, and the ratio of the watched amount to the available amount is 100%, excess the predetermined value. Therefore, the recommendation system will recommend the documentaries in the

current EPG to the user, or will add the documentaries in the current EPG to a recommendation list for the user to select according to the list.

In addition, the relationship between the available amount and the watched amount can be determined through, for example, the fuzzy logics as will be described latter.

According to an alternate embodiment of the present invention, the available amount of content in step S420 may also be denoted as the number of contents available. The number of contents played with a same content-feature can be calculated to create the following table 3(Numbers of contents with various content-features available in the EPG).

Table 3. Numbers of contents with various content-features available in the EPG

Content Feature	Available Amount（Number）
Comedy	2
Documentary	3
Horror Movie	2
TV play series	10
• • •	
Brad Pitt	1
Jenifer Aniston	1
Tom Hanks	1
• • •	

Similarly, in step S430, the analysis to the user's actually watched amount may be conducted by calculating the number of contents actually watched by the user, and a corresponding table 4 may be obtained.

Table 4. Number of contents with various content-features actually watched by the user

Content Feature	Watched Amount（Number）
Comedy	2

Documentary	3
Horror Movie	1
TV play series	1
• • •	
Brad Pitt	1
Jenifer Aniston	1
Tom Hanks	1
• • •	

According to a further alternative embodiment of the present invention, the available amount of content in step S420 may also be denoted as the actually watched percentage of all the available contents. In this case, the available amount column in the table should be denoted as percentage as shown in table 5.

Table5. the amount of content types in the

Content Feature	Available Amount (%)
Comedy	10%
Documentary	10%
Horror Movie	5%
TV play series	30%
• • •	
Brad Pitt	2%
Jenifer Aniston	1%
Tom Hanks	2%

• • •	

Similarly, in step S430, the watched amount should be denoted as the percentage of the time the user spent for watching contents including the content-feature to the total time the user spent for watching various contents, which is shown in table 6.

Table 6. Ratio of time the user spent for watching contents with the content-feature to the total time he spent for watching contents

Content Feature	Watched Amount (%)
Comedy	10%
Documentary	8%
Horror Movie	0%
TV play series	25%
• • •	
Brad Pitt	10%
Jenifer Aniston	5 %
Tom Hanks	10%
• • •	

According to a further alternative embodiment of the present invention, the available amount and the watched amount may be collected not in all the programs in the EPG. For example, a program recommendation list with respect to the predetermined time period may be obtained from the user profile. Then the contents including the content-feature in the program recommendation list are analyzed to get the available amount. The programs among those recommended in the program recommendation list watched by the

user in the predetermined time period are analyzed according to the user profile to get the watched amount. Analyzing in this way can evaluate the ratio of the programs actually watched by the user to all the recommended programs, whereby correcting the contents to be recommended and improve the recommendation accuracy.

To meet the ever increasing user interests, the user profile in the recommendation system should be varied continuously. Dynamically correcting the user profile in the recommendation system according to the user's interests to recommend the user with really interesting contents can improve the recommendation accuracy. Therefore, figure 5 shows a further embodiment of the present invention. In this embodiment, the recommendation apparatus recommends programs based on the like-degree in the user profile. The steps S410 to S430 in figure 5 are identical to the steps S410 to S430 in figure 4 respectively.

At step S540, adjusting the Like-degree of the content-feature in the user profile according to the relationship between the available amount and the watched amount. For example, when the ratio of the watched amount to the available amount is higher than a predetermined value, the like-degree to the content-feature is increased in the user profile. Otherwise, when the ratio of the watched amount to the available amount is lower than a predetermined value, the like-degree to the content-feature is decreased in the user profile. Thus the like-degree to the content-feature in the user profile is more accurate. For the previously described example, we can assume that the recommendation system will increase the like-degree to the content-feature in the user profile by 10% when the ratio of the watched amount to the available amount is higher than 50%. Therefore, the available documentaries in the last week was 3 hours, and the user watched all the 3 hours, that is, the watched amount is 3 hours. The ratio of the watched amount to the available amount is 100%, higher than 50%. So the recommendation system increases the like-degree to documentaries in the user profile from 50% to 60%.

The relationship between the available amount and the watched amount may also be calculated in the fuzzy logics as will be described latter.

Next, in step S550, upon receiving information about the content, including at least one content-feature of the content, the recommendation apparatus will retrieve the user's like-degree to the content-feature from the user profile and determine whether the like-degree meets a predetermined value. If yes, the content will be recommended to the user in step S560. If not, the content will not be recommended to the user in step S570. For the previously described example, when the recommendation apparatus receives the EPG

and determines that one of the programs is a documentary, it will obtain the user's like-degree of 60% to documentaries from the user profile. Since the like-degree is higher than 50%, the documentary will be recommended.

In the present invention, recommending programs to the user or adjusting the Like-degree in the user profile based on the relationship between the available amount and the watched amount can be conducted in many approaches. Beside those described above, the following approaches can also be applied.

1.Basic approach

In this approach, let W be the watched time as a percentage of the available time for one feature, if this value is high, then we should increase the Like-degree for this feature, if this value is low, then we should decrease the Like-degree for this feature. Of course, each adjustment must be relatively moderate so that over time a continuing trend results in correct updating of the Like-degree but a single non-typical instance does not.

First we map W onto the factor that the Like-degree should be updated by, in general this will be determined by the following parameters:

- BL - Lower bound, values of W below this bound make the Like-degree smaller;
- BH - Higher bound, value of W above this bound make the Like-degree bigger;
- Values of W between BL and BH have no effect on the Like-degree;
- S - Scaling factor, the maximum change in Like-degree

For example, S=20% indicates that Like-degree can be increased or decreased by at most 20%. This is to ensure moderate increases and avoid sudden changes in the Like-degree that might not be representative of a general pattern.

Steps for calculating the Like-degree are as following:

First we calculate two values, WL and WH:

- If W<BL then WL=W else WL=0;
- If W>BH then WH=W else WH=0;

Now we can calculate how much to change Like-degree by as follows:

- ΔL $(WL/BL)\times S$ (amount to lower Like-degree by in percentage);
- $\Delta H = (WH/B)\times S$ (amount to higher Like-degree by in percentage);

Then the actual amount to update Like-degree by is:

- ΔLike-degree = Like-degree × (l00-ΔL)/100 + Like-degree × (100 + ΔH)/l00

Finally, the newly obtained Like-degree is:

Like_degree=Like_degree+ΔLike_degree

In all cases at most one of ΔL and ΔH is non-zero.

Thus, if this evaluate is done every week, then over time Like-degree will converge to the correct value without having any sudden changes.

Alternatively, the available amount may be calculated not for the programs televised within a time period, but for the contents recommended to the user. In this case, the actually watched proportion of the contents recommended to the user by the recommendation system can be analyzed. Adjusting the Like-degree based on this proportion makes the Like-degree to converge to the correct value over time, thereby recommending contents more accurately.

2.Fuzzy logic approach:

Recommending contents to a user may also be implemented using fuzzy logic approach. The advantage of using fuzzy logic approach is that the robust of the content recommendation apparatus is improved, and the content recommendation apparatus is more intelligent.

For example, in another patent application of the present applicant CN200310123354.7, the inventor of which is Shi Xiaowei and the applicant is KONINKLUKE PHILIPS ELECTRONICS Ltd.,filed on December 15, 2003, it was proposed to store the user profiles as a vector or 3-tuples, each entry in the vector represents one of the features (e.g. genre) and the associated Like-degree (how much we think the user likes this feature) and Weight (how important we think this feature is). In general the Weight is the same for all features of the same type (e.g. the Weight is the same for all genres or all actors). This user profile vector can be represented as a table 7.

Table7 Data structure for storing the user profile based Like-degree and Weight

Content Feature	Like-Degree	Weight
Comedy	0.5	0.5

Documentary	-0.1	0.5
Horror Movie	0. 3	0.5
TV play series	0.3	0.5
• • •		
Brad Pitt	0.4	0.3
Jenifer Aniston	-0.2	0.3
Tom Hanks	0.3	0.3
• • •		

Thus, updating Like-degree using the fuzzy logic approach is as follows:

For the kth program, which belongs to feature type t, the related feature parameters of fi can be updated as follows:

$$Weight_i' = Weight_t' = Weight_t + \Delta Weight_t \quad (1)$$

$$Like_degree_i' = Like_degree_i + \Delta Like_\deg ree_i \quad (2)$$

Where, Weighti: the Weight of feature type t. The features, which belong to the same type, have the same Weight. e.g. Weight of Genre, Weight of Actor.

Weighti': the updated $Weight_t$;

Like-degreei: the Like-degree of fi;

Like-degreei': the updated Like-degreei;

ΔWeighti: the change of Weighti. Different kind of term has different Weight difference;

Δlike-degreei: the change of Like-degreei.

If the feature is new, set Like-degreei =0, and Weighti is the same as other feature which belongs to the same categories, such as Genre, Actor.

If Weighti' is larger than its higher-boundary, let Weighti' = higher-boundary;

If Weighti' is less than its lower-boundary, let Weighti' = lower-boundary;

If Like-degreei' is larger than its higher-boundary, let Like-degreei' = higher-boundary;

If Like-degreei' is less than its lower-boundary, let Like-degreei' = lower-boundary.

In the later, the invention will valuate the change of user profile by fuzzy inference theory to simulate human intelligence.

The fuzzy logic approach of the present invention is based on the knowledge base in this content recommendation apparatus, which is from the analysis of available amount available-time (%) and actually watched amount watch-time (%) datum stored in Memory.

In order to apply fuzzy logic calculation to Δlike-degreei, the following procedures will be done:

1> Selection and fuzzification the input variables and output variable. As we know Δlike-degreei have been set as output, based on the analysis, available-time (%) and watch-time (%) are set as the inputs.

The fuzzification: transforms the crisp parameters available-time (%) and watch-time (%) into membership values. The shape and location could be different for different problem. Here, assumed e1= available-time (%), e2=watch-time (%), the corresponding fuzzy memberships can be described as Figure 6.

The fuzzy membership function of the output can be described as Figure 7.

2> Mapping e1 = available-time (%), e2 =watch-time (%), to the fuzzy membership;

3> Getting the fuzzy Δlike-degreei by fuzzy logic inference rules as following,

I. If e1 is "large" And e2 is "large " Then Δlike-degreei is "middle";
II. If e1 is "large" And e2 is "middle" Then Δlike-degreei is "small";
III. If e1 is "large" And e2 is "small" Then Δlike-degreei is "smaller";
IV. If e1 is "middle" And e2 is "large" Then Δlike-degreei is "large";
V. If e1 is "middle" And e2 is "middle" Then Δlike-degreei is "middle";
VI. If e1 is "middle" And e2 is "small" Then Δlike-degreei is "small";
VII. If e1 is "small" And e2 is "large" Then Δlike-degreei is "larger";
VIII If e1 is "small" And e2 is "middle" Then Δlike-degreei is "large";
IX. If e1 is "small" And e2 is "small" ThenΔlike-degreei is "middle".

4> Defuzzification: transferring the fuzzy output variable Δlike-degreei into a crisp value. The most traditional defuzzification methods are "center of gravity" and "mean of maximal value". The method of "center of gravity" takes more useful factors into consideration, so we adopt this method to get feature Like-degree. The method of "center of gravity" is presented as (3),

$$\Delta Like_\deg ree_i = \sum_{l=1}^{m} \mu[l] \quad y_l \Big/ \sum_{l=1}^{m} \mu[l] \tag{3}$$

Where, μ[l] : The height of output area from lth rule;

yi: The gravity's horizontal coordinate of output area from lth rule;

m: The number of the rules.

For feature type t, ΔWeighti can be computed as following,

$$\Delta Weight_t = \frac{\sum_{j=1}^{p} \left| Like_\deg ree'_{tj} \right| - \sum_{j=1}^{p} \left| Like_\deg ree_{tj} \right|}{p} \tag{4}$$

where, the p is the No. of features for some kind of term.

For more details of the process of updating the Like-degree through the fuzzy logic approach, reference can be made to Chinese patent application No. 200310123354.7 filed on December 15, 2003 the applicant of which is KONINKLUKE PHILIPS ELECTRONICS Ltd.， and the inventor is Shi Xiaowei.

The recommendation apparatus and method of the present invention have been described in details in conjunction with the EPG system. But apparently the present invention can be employed for content recommendation in other fields such as Internet search engines. In this case, one or more key words of the search engine is considered as a content-feature, so that the contents of the Internet search engine can be classified into types with a plurality of content-features. When providing a user with contents, the search engine can obtain the relationship between the total amount of contents provided by the search engine and the amount of contents actually watched by the user, and adjust the searching result based on this relationship, thereby improve the hit ratio of the search and recommend more interested contents to the user.

The present invention can be further improved. For example, if the user's device is networked then each user can export a summary of his viewing (i.e. a summary of the amount of time they spend watching each type of content) to a server. Based on this the server can determine the profile of the typical user, deviations from this profile then indicate a stronger or weaker preference for this user. Users may be concerned with privacy issues but this can be done anonymously to avoid such concerns.

Though the present invention has been described in conjunction with specific embodiments, it will be apparent for those skilled in the art that many alternatives, modifications, and variations are possible based on the above description. Therefore the present will cover such alternatives, modifications, and variations that fall within the spirit and scope as defined in the attached claims.

CLAIMS:

1. A method for recommending contents, including steps of:

(a). receiving information in relation to a content, the information comprising at least one feature of the content;

(b). obtaining the available amount of the content including the feature;

(c). obtaining the amount of the content including feature watched by a user; and

(d). deciding whether to recommend the content to the user based on the relationship between the available amount and the watched amount.

2. The method of claim 1, wherein the content is a program, the available amount is the amount of the contents including the feature available within a predetermined time period, the predetermined time period is longer than at least one program including the feature; and the watched amount is the amount of the contents including the feature watched by a user within the predetermined time period.

3. The method of claim 2, wherein the information is from an electric program guide (EPG), and the step (b) further includes calculating the amount of the programs including the feature scheduled in the EPG for the predetermined time period to obtain the available amount.

4. The method of claim 2, wherein the step (b) further includes steps of:

obtaining a program recommendation list for the predetermined time period; and

calculating the amount of the programs including the feature in the program recommendation list to obtain the available amount.

5. The method of claim 4, wherein the step (c) further includes: calculating the amount of the programs including the feature in the program recommendation list actually watched by the user to obtain the watched amount.

6. The method of claim 2, wherein the watched amount is from a user profile.

7. The method of claim 6, wherein the user profile comprises the user's Like-degree for the feature, and the step (d) further includes steps of:

adjusting the Like-degree based on the relationship between the available amount and the watched amount; and

deciding whether to recommend the program to the user based on the adjusted Like-degree.

8. The method of claim 2, wherein the available amount is the total amount of time for the programs including the feature within said predetermined time period, and the watched amount is the total amount of time for the programs including the feature actually watched by the user within said predetermined time period.

9. The method of claim 2, wherein the available amount is the total number of the programs including the feature within said predetermined time period, and the watched amount is the total number of the programs including the feature actually watched by the user within said predetermined time period.

10. The method of claim 2, wherein the available amount is the ratio of the amount of the programs including the feature to the total amount of programs within said predetermined time period, and the watched amount is ratio of the amount of the programs including the feature watched by the user to the total amount of the programs watched by the user within said predetermined time period.

11. The method of claim 2, wherein the step (d) further includes recommending the program to the user when the ratio of the watched amount to the available amount is larger than a predetermined value.

12. A system for recommending contents, comprising:

a receiving means for receiving information in relation to a content, the information comprising at least one feature of the content;

an available amount obtaining means for obtaining the available amount of the content including said feature;

a watched amount obtaining means for obtaining the amount of the content including said feature watched by a user; and

a decision making means for deciding whether to recommend the content to the user based on the relationship between the available amount and the watched amount.

13. The system of claim 12, wherein the content is a program, the available amount is the amount of the contents including the feature available within a predetermined time period, the predetermined time period is longer than at least one program including the feature; and the watched amount is the amount of the contents including the content-feature watched by a user within the predetermined time period.

14. The system of claim 13, wherein the information is from an electric program guide (EPG), and the available amount obtaining means further comprises a calculation means for calculating the amount of the programs including the feature scheduled in the EPG for the predetermined time period to obtain the available amount.

15. The system of claim 13, wherein the watched amount is from a user profile.

16. The system of claim 15, wherein the user profile comprises the user's Like-degree for the feature, and the decision making means further comprises a user profile adjusting means for adjusting the Like-degree based on the relationship between the available amount and the watched amount.

17. The system of claim 13, wherein the available amount is the total amount of time for the programs including the feature within said predetermined time period, and the watched amount is the total amount of time for the programs including the feature watched by the user within said predetermined time period.

18. The system of claim 13, wherein the available amount is the total number of the programs including the feature within said predetermined time period, and the watched amount is the total number of the programs including the feature watched by the user within said predetermined time period.

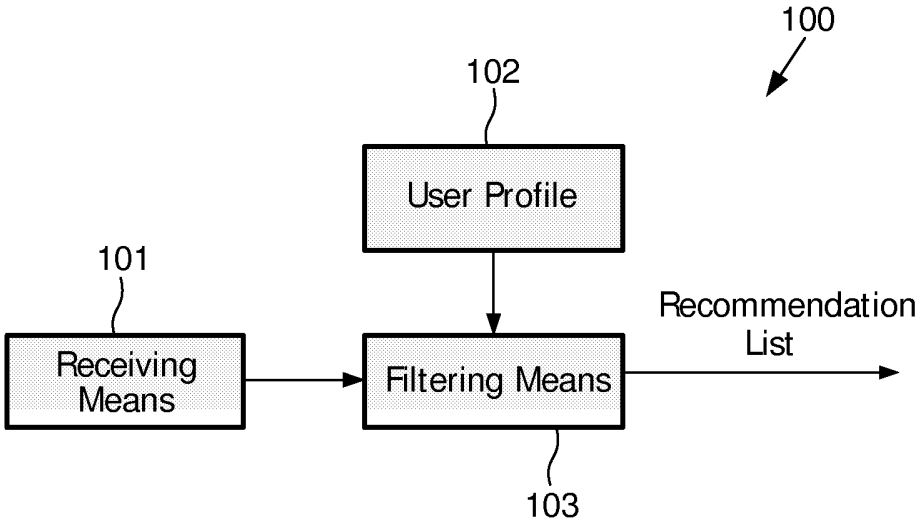

FIG. 1 Prior Art

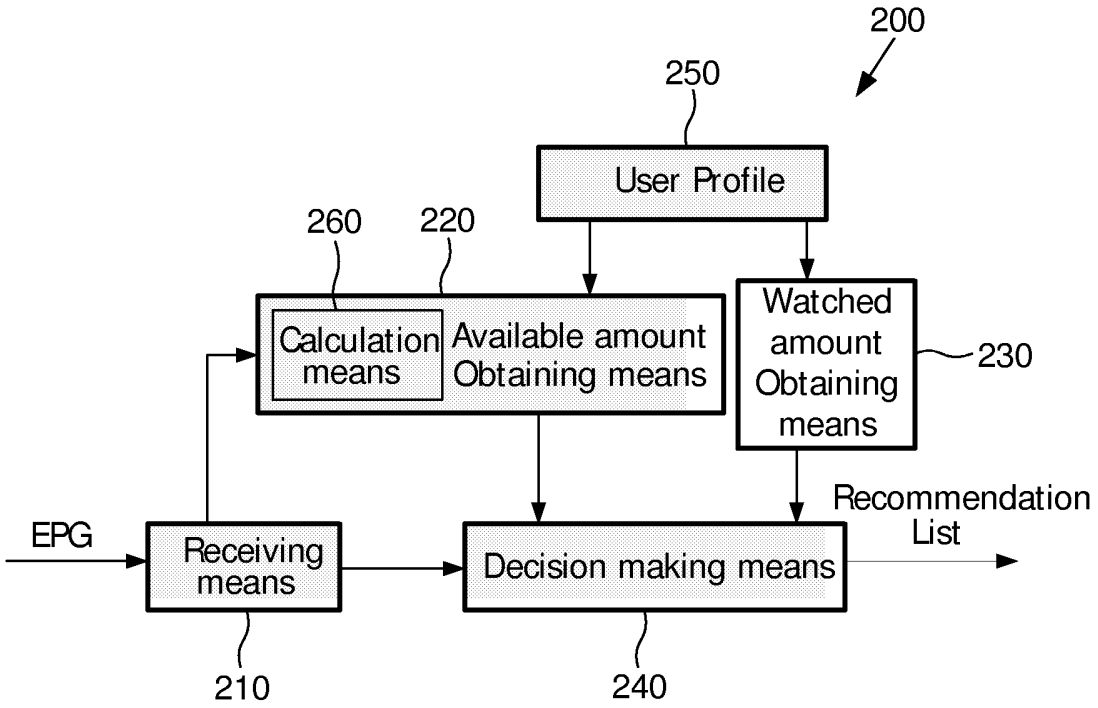
200
250
User Profile
260
220
Calculation means
Available amount Obtaining means
Watched amount Obtaining means
230
Recommendation List
EPG
Receiving means
Decision making means
210
240

FIG. 2

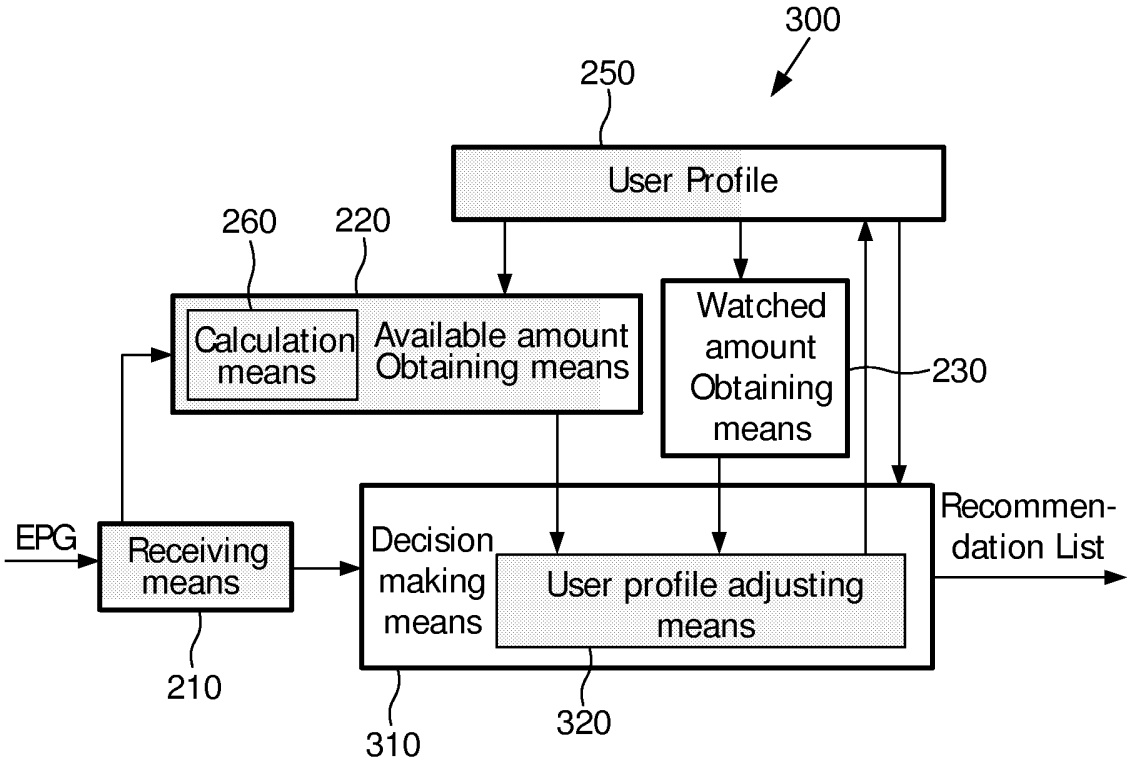
300
250
User Profile
260
220
Calculation means
Available amount Obtaining means
Watched amount Obtaining means
230
Recommen-dation List
EPG
Receiving means
Decision making means
User profile adjusting means
210
310
320

FIG. 3

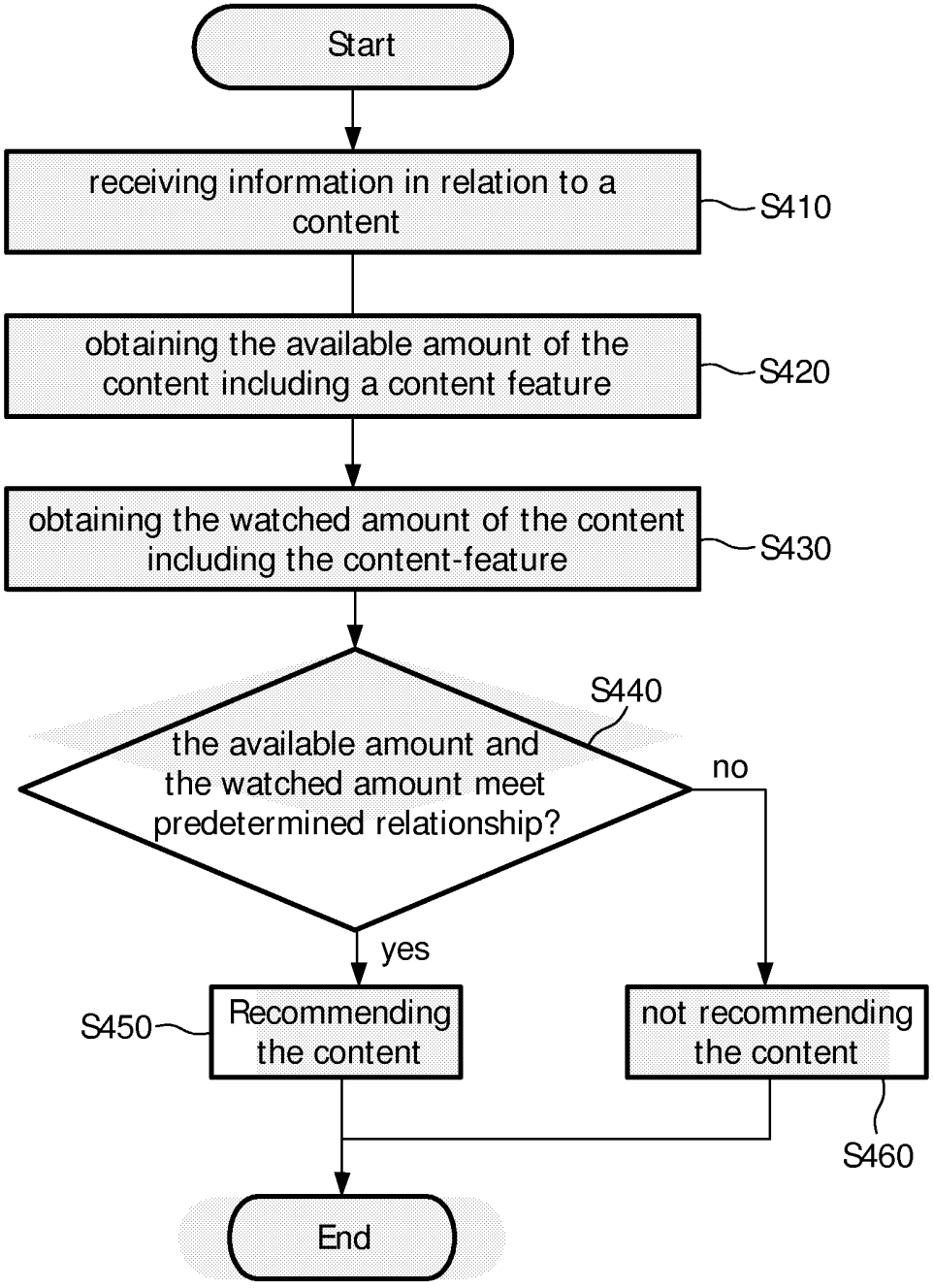
Start
receiving information in relation to a content
S410
obtaining the available amount of the content including a content feature
S420
obtaining the watched amount of the content including the content-feature
S430
S440
the available amount and the watched amount meet predetermined relationship?
no
yes
S450
Recommending the content
not recommending the content
S460
End

FIG. 4

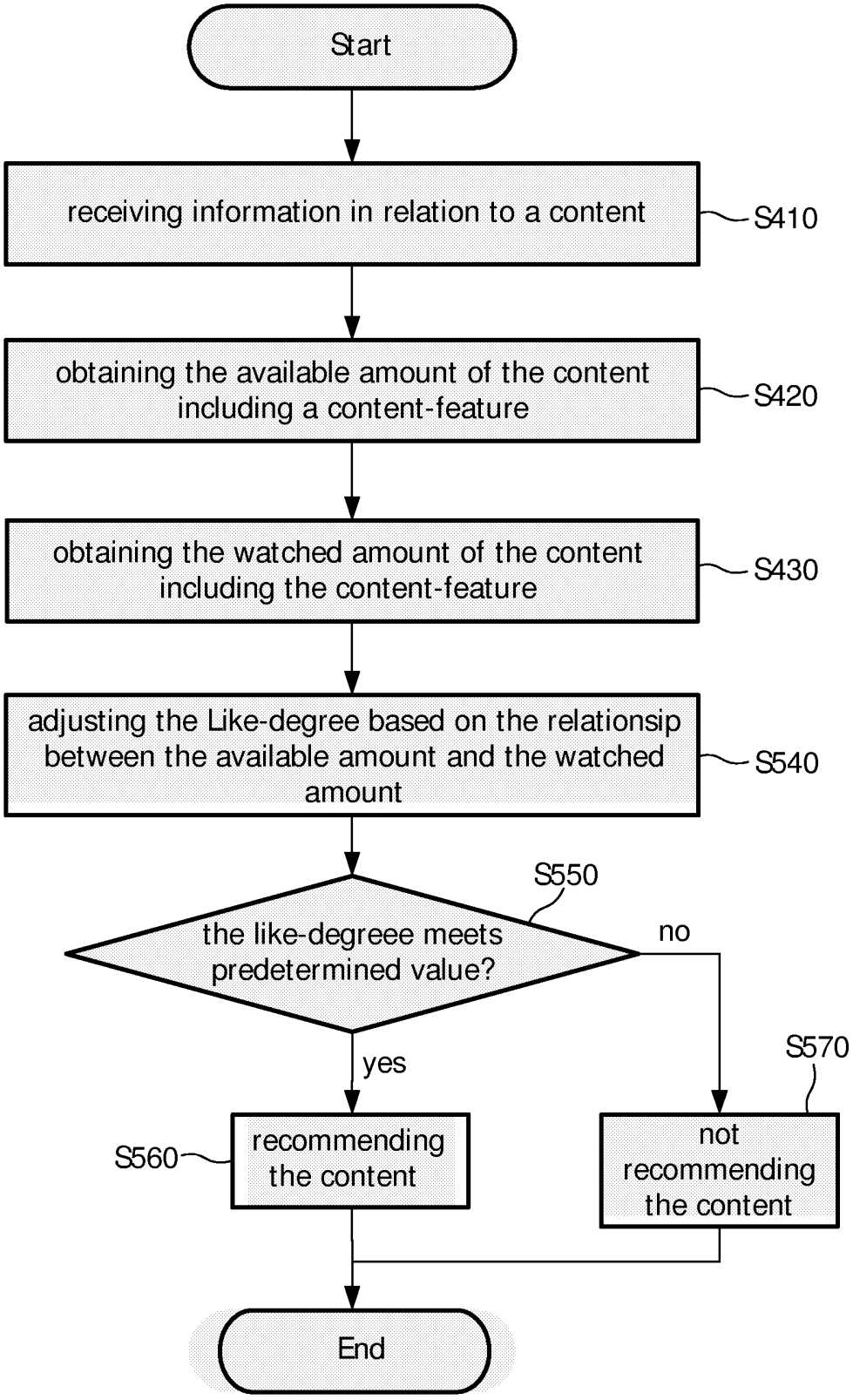
Start
receiving information in relation to a content
S410
obtaining the available amount of the content including a content-feature
S420
obtaining the watched amount of the content including the content-feature
S430
adjusting the Like-degree based on the relationsip between the available amount and the watched amount
S540
S550
the like-degreee meets predetermined value?
no
yes
S570
S560
recommending the content
not recommending the content
End

FIG. 5

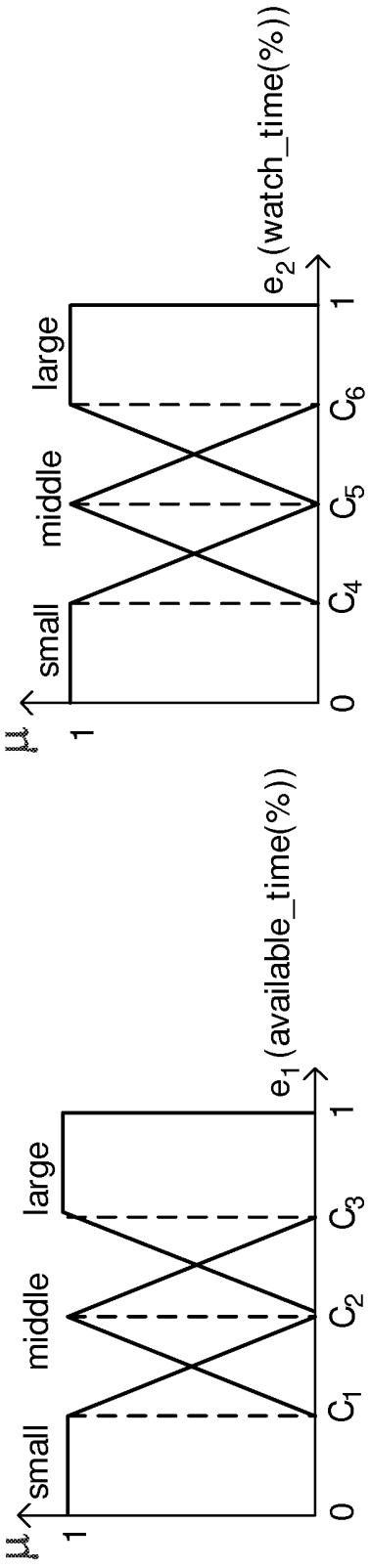
μ
small
middle
large
1
0
C1
C2
C3
e1(available_time(%))
small
middle
large
1
0
C4
C5
C6
e2(watch_time(%))

FIG. 6

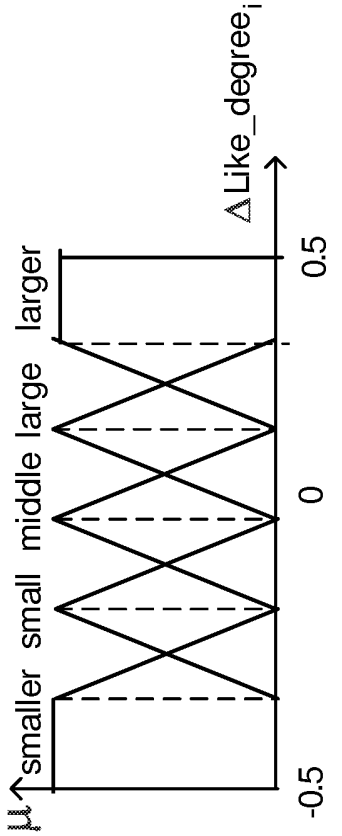
μ
smaller
small
middle
large
larger
-0.5
0
0.5
ΔLike_degree_i

FIG. 7