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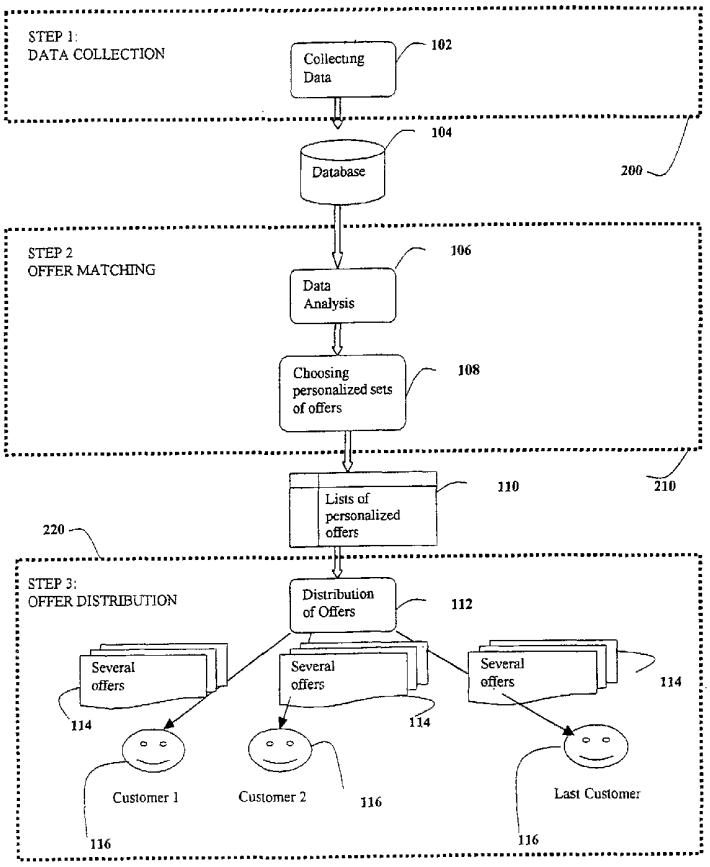
(54) Title: METHOD AND SYSTEM FOR AUTOMATICALLY PRODUCING OPTIMIZED PERSONALIZED OFFERS



(57) Abstract: A method and a system for fully automatically producing optimized personalized sets of offers according to a target function, using collected customer and product or service data. First, in the data analysis stage (106), the possible offers are graded separately for each customer, taking into consideration the predicted contribution (138) of the offer to the campaign's target function (142). Second, in the choosing of personalized offers stage (108), the system chooses for each customer a set of offers that were ranked by the highest grades and which deal with all the posed constraints. This enables automatic production of optimized personalized sets of offers for customers, without the need for statisticians or database experts.

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METHOD AND SYSTEM FOR AUTOMATICALLY PRODUCING OPTIMIZED PERSONALIZED OFFERS

FIELD OF THE INVENTION

The present invention relates to marketing. More particularly, it relates to automatically generating sets of personalized offers.

BACKGROUND OF THE INVENTION

A system for generating and distributing personal offers (coupons, banners, advertisements, etc.) is generally composed of 3 elements (subsystems):

i) System for collecting data about customer behavior.

ii) System for matching between customers and offers. (Which customers will receive a particular offer or which offers will be sent to a particular customer.)

iii) System for distribution of the selected offers.

The present invention focuses on step (ii). The present invention performs a match of personalized offers based, mainly, on the customer's behavior history, in a completely automatic manner. The term "personalized offers" refers to several levels of personalization, most of them unknown before.

One of the most effective ways of marketing different products or businesses is by distributing coupons/banners/advertisements (and in general: offers).

The most popular way to do so is by producing and distributing a uniform set of offers (through various means of offer distribution such as, direct mail, web sites, e-mail, etc.) to the customers.

The problem with this approach is that each person has different interests and needs, making the uniform set of offers very limited in its effectiveness.

In order to overcome this problem, the "1 to 1" marketing approach was developed. The basic idea of this approach is to present each customer with a personal set of offers that will fit him/her best (meaning that it will serve the campaign target in the best way).

The problem with this new approach is the absence of automatic applications to carry out the job. Currently there are no tools to enable a completely automatic treatment of personal sets of offers for each customer in the "1 to 1" marketing approach.

The tools used today implement predefined rules determined by experts, aided by their experience and by statistical tools, combining suggestions for offers. There are many disadvantages to these methods:

1. There is a great need for human resources.

2. They cannot refer to complex campaign target functions.

3. The level of accuracy that can be achieved for personalization is low.

The present invention solves all the above-mentioned problems and enables the accomplishment of true "1 to 1" marketing in a completely automatic way. This is not the case in prior art, some of which is summarized below.

A revolutionary change in techniques of discount coupon distribution began with the system described in U.S. Pat. No. 4,723,212 issued to Thomas L. Mindrum et al., entitled "Method and Apparatus for Dispensing Discount Coupons." In this system, coupons were generated and distributed in the retail store, based on the products purchased by the consumers. If a consumer purchased a "triggering" product that had been previously selected

as part of a promotion, the consumer would receive a discount coupon upon paying for purchased items at a checkout stand. The coupon handed to the consumer typically provides for a discount on a competitive or complementary product when the customer returns to the store on a subsequent visit. Thus, in the system described in the Mindrum et al. patent, discount coupons generated in the store were distributed only to consumers who had been "targeted" because of their purchase of competitive or related products. In addition it only uses last purchases as information for design, and does not look back on previous purchases, nor on any feedback information. The designed rules are pre-determined by experts, and the entire scheme is non-versatile neither with respect to the type of data nor with respect to the distribution channels, and neither with respect to any target function.

De Lapa et al., U.S. Pat. No. 5,353,218 discloses a "focused coupon system". This is a system for distributing coupons with a machine readable code (barcode) containing both customer and coupon identifications. The consumer code may be replaced with a generic code used in a look-up table for coupon verification and information. The entire machine-readable code may be captured and uploaded to a central database for determining coupon and consumer identification. The uploaded information may be used for marketing purposes (to determine which coupons to send next to the consumer) and/or for rebate purposes.

De Lapa et al.'s primary contribution was in the ability to include feedback information, but the rest of the drawbacks are still present, for example, design rules are pre-determined by experts, and the entire scheme is non-versatile, has limited personalization, but most of all the system does not really utilize past information. It makes only crude predictions based on demographic information about coupon redeeming.

O'Brien, et al. U.S. Patent No. 5,832,457 discloses a "Method and apparatus for selective distribution of discount coupons based on prior customer behavior."

A system for automatically distributing discount coupons or certificates in a retail store, conditioned on a pre-selected combination of present and past shopping behavior, and customer-supplied data, of a customer whose order is being processed at a checkout stand. Collection of data pertaining to past behavior of customers is facilitated by filtering all sales transaction data at the point of sale. O'Brien, emphasizes the rule based nature of the system: the term "pre-selected combination" appears several times in the invention and is further emphasized by pre filtering at the store level, which prevents the usage of data later on, for example, when one replaces the type of coupons he/she intends to distribute.

This may help to increase the length of time of past data, but it remains limited with respect to the kind of data it uses. Once again, the other drawbacks of non-versatility, and limited personalization are ignored.

Jermyn U.S. Pat. No. 6,026,370 discloses a "Method and apparatus for generating purchase incentive mailing based on prior purchase history".

Jermyn's method describes in length a method for collecting customer purchase data, including particular implementation for identifying the customers, the products that he buys, and the coupons that he uses. Only a few words about the mechanism for selecting customers are mentioned, however.

Jermyn's invention selects a given number of customers, based on their categorization into 3 levels of loyalty to the brand that gives the incentives: {Very loyal, not loyal, and loyal to the competitive brand}. Here we see for the first time a limited attempt to personalize the incentives but only up to 3 categories, and not up to full scale personalization. The usage of past data remains limited.

No cross product information or purchase of product combinations is used. So, for example, a distributor that gives as an incentive a package of sugar, if

a package of coffee is bought will look only at the loyalty of the customer to the coffee brand and will not look at the effect of giving away the sugar.

In addition Jermyn's method does not deal with the question of which coupons should be given to a particular customer, but only selects a predetermined number of suitable candidates.

The present invention is capable of choosing in a completely automatic manner an optimal set of personalized offers for each specific customer out of a larger set of optional offers, as opposed to all previous inventions, which either selected customers for a given offer or gave (or did not give) an offer to a given customer.

The personal offers can be of different types such as: coupons, banners, advertisement, and so on. And may be used in different applications, while all the above inventions are tailored for a particular application.

The personal set of offers is optimal in the sense that the target function is predefined by the campaign operator (for example, maximum sales, maximum profitability, maximum response to the offers, etc.). This new concept is not evident in any of the prior inventions.

The present invention uses data regarding each customer's behavior history and characteristics. The fact that it uses large sets of data and uses data extending relatively far back in time enables the prediction and compensation for seasonal effects such as Christmas shopping or beach products in the summer time. It can both predict the usage before the season and stop the attractiveness of the product with the season's end and without a time delay (as a short history system might do).

The system can also use customer demographic data such as age, sex, home address, etc, but does not rely on its existence in order to work.

In order to produce a personal set of offers for each customer, the system uses data mining and artificial intelligence (AI) technologies and uses the feedback created from personal offers given in the past.

The present invention goes through a stage of determining the rules for choosing personal offers, this stage is usually done manually while using diverse statistical tools. For example, it is possible to predetermine a rule saying that all those who have purchased diapers in the past will receive a coupon for beer.

The present invention is able to implement this rule on customers. Meaning that in the example cited above, the system will identify which customers bought diapers in the past and will issue them the coupon for beer.

A novel aspect of the present invention is that once the set of personal offers and the target function are defined, it is possible to produce, by one click, a personal set of coupons for each customer, all this without the need to define any particular rules.

Other advantages of the present invention in comparison to prior systems for producing personal offers are the following:

1. The system functions in a completely automatic manner and there is no need for human resources of any kind to create rules so that the personal offers will be issued to the customers according to these rules.

2. The system functions in accordance with the campaign target function: once it is fed into the system the system will produce, automatically, the sets of personal offers that will optimize the target function. A change in the target function will enable, with one click, to produce a new personal set of offers suitable to the new target function.

3. The use of data mining and artificial intelligence (AI) technology together

with the use of the feedback created from personal offers given in the past enable the system to reach improved performance in comparison with the prior systems regarding various target functions.

4. These modern techniques enable the present invention to handle large databases both with respect to time and with respect of the information regarding each customer.

5. The system is able to create a true "1 to 1" marketing system: almost every customer receives a unique personal set of offers. (During a trial of the system seven personal coupons were produced for 10,000 customers (out of 80 possible coupons); 8,000 unique sets of coupons were created.)

6. The system can produce in a completely automatic manner, personalization of each aspect in the personal offer. For example, in a coupon that includes a privilege and the conditions to receive such privilege (for example, get an $X discount if you buy over $Y of goods). Both the privilege (X) and the condition to receive the privilege (Y) and the choice of who will receive the coupon are treated individually in a completely automatic manner.

7. This is not a tailored application, and may be used in different domains and is, therefore, neither limited to particular collected data types nor to particular distribution channels.

BRIEF DESCRIPTION OF THE INVENTION

There is thus provided in accordance with a preferred embodiment of the present invention, a method for fully automatically producing optimized personalized sets of offers according to a target function, using customer and product or service data previously collected, the method comprising:

analyzing the collected data and automatically deriving at least one of a plurality of behavior models for every offer or set of offers;

implementing at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum predicted impact relative to the target function;

optimally matching the best set of offers to each customer in terms of the target function;

thereby enabling automatic production of optimized personalized sets of offers for customers.

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises aggregating the data prior to said analyzing;

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises pruning the data prior to said analyzing;

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises a feedback loop between responses to the offers and said implementing of said behavior models;

Furthermore, in accordance with another preferred embodiment of the present invention, the previously collected data comprises demographic data;

Furthermore, in accordance with another preferred embodiment of the present invention, the target function is user-defined for typical marketing goals, such as increasing redemption rates, increasing revenues, increasing sales, decreasing costs while maintaining impact, or any combination of such goals;

Furthermore, in accordance with another preferred embodiment of the

present invention, the method further comprises applying constraints regarding valid customer–offer combinations with said optimal matching being subject to said constraints;

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises adding real-time information about the customer;

Furthermore, in accordance with another preferred embodiment of the present invention, said adding of real-time information about the customer includes the current time and current customer location;

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises configuring said matching, such that it will select the optimal customers for each set of offers in terms of the target function;

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises configuring of said matching, such that it will select as desirable an offer for each customer or as appropriate a customer for each offer as possible in terms of the target function;

There is thus also provided in accordance with a preferred embodiment of the present invention, a method for fully automatically producing optimized personalized sets of offers according to a target function, using data previously collected, the method comprising:

analyzing the collected data to derive at least one of a plurality of behavior models;

implementing at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum impact relative to the target function;

optimally matching the best set of offers to each customer in terms of the target function;

thereby enabling automatic production of optimized personalized sets of offers for customers.

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises distributing of the sets of personalized offers via at least one of a plurality of automated-teller machines (ATM).

Furthermore, in accordance with another preferred embodiment of the present invention, any marketing method in which personalized offers are distributed via at least one of a plurality of automated-teller machines (ATM).

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises distributing the sets of personalized offers via interactive televisions.

Furthermore, in accordance with another preferred embodiment of the present invention, any marketing system in which personalized offers are distributed via interactive televisions.

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises distributing the sets of personalized offers via at least one of a plurality of electronic information kiosks.

Furthermore, in accordance with another preferred embodiment of the present invention, the method further comprises distributing the sets of personalized offers via cellular telephones.

There is thus also provided in accordance with a preferred embodiment of the present invention, a system for using a computing device to fully automatically

produce optimized personalized sets of offers according to a target function, using customer and product or service data previously collected in a database, the system comprising:

a model-building software module that analyzes the collected data and automatically derives at least one of a plurality of behavior models for every offer or set of offers;

an offers-building software module that implements at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum predicted impact relative to the target function;

an offers-matching software module that optimally matches the best set of offers to each customer in terms of the target function;

whereby optimized personalized sets of offers for customers are produced automatically.

Furthermore, in accordance with another preferred embodiment of the present invention, the sets of personalized offers are distributed via at least one of a plurality of automated-telling machines.

Furthermore, in accordance with another preferred embodiment of the present invention, the sets of personalized offers are distributed via at least one of a plurality of interactive televisions.

Furthermore, in accordance with another preferred embodiment of the present invention, the sets of personalized offers are distributed via at least one of a plurality of electronic information kiosks.

Finally, in accordance with another preferred embodiment of the present invention, the sets of personalized offers are distributed via at least one of a plurality of cellular telephones.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a general architectural view of the components of a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 2 is a block diagram of the database module of a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 3 is an example of loyalty club records in a customer behavior database in accordance with a preferred embodiment of the present invention.

FIG. 4 is a block diagram of the data analysis module of a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 5 is a detailed block diagram of the response prediction module of a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 6 is a sample diagram of a basic classification used in a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 7A is an abstract example of a data structure for a simple learning file for use in a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 7B is an abstract example of a data structure for a simple classification file for use in a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 7C is a detailed example of a simple learning file before

data aggregation and pruning for use in a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 7D is a detailed example of a simple learning file after data aggregation and pruning for use in a personalized offers system in accordance with a preferred embodiment of the present invention.

FIG. 8 is a block diagram illustrating some applications for a personalized offers system in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is software-based. It can be implemented on any computing device from a microcomputer to a mainframe. The specific hardware required will depend on the size of the system parameters, such as database memory requirements, number of variables, or degree of target function complexity.

A personalized offer system contains three sub systems, as illustrated in FIG. 1:

A data collection system 200.

An offer matching system 210.

An offer distribution system 220.

FIG.1 illustrates these steps. The data collection 102, produces a database 104, and composes the first step data collection 200. This database 104 is used as input for the second step, offer matching 210, where it is analyzed 106. Using the results of the analysis the personalized set of offers is produced 108.

The output of the second step, offer matching 210, is a list of personalized offers 110. Based on the list 110, offers are distributed 112 in the third step, offer distribution 220. Each customer 116 receives one or many offers 114.

The current invention improves the capabilities of the second step, offer matching 210. The innovative aspect of the invention is therefore, that, in a completely automatic manner, it produces personal offers out of a potential set of offers and under given constraints. As such, the system produces the best personal set of offers in accordance with a predefined target function using the data mining engine and artificial intelligence (AI) algorithms to produce an efficient and accurate system.

An important point to note is that the features used by the system can be extracted from a person's behavior history, and can be learned about various populations even without knowing their current demographic or economic status.

When the term "personal offer" is used in this description, the meaning can be, among others, one of the following types of offers:

a. A personal coupon - The coupon can be aimed at businesses, products or services. The definition of the coupon, includes one or more of the following elements:

- The privilege the coupon gives. (For example, a 10% discount).

- The conditions to redeem the coupon (for example, [get a $10 discount] on a purchase of more than $100).

- The coupon condition. The conditions that the customer had to fulfill in the past in order to be eligible to receive the coupon. (For example, if a certain store issues a coupon only for customers who did not purchase anything in the store in the past 6 months, then the coupon condition is: "Did not purchase anything in the store in

the past 6 months").

b. A personalized advertisement or message

c. A personalized banner (a banner which is generated specifically for the user and which is displayed when the user opens a Web page from the Internet.)

d. A personal sample (a product sample distributed freely to the appropriate customers.)

The present invention can perform personalization for any or all of the different offer types, and for any or all elements of an offer type, in a completely automatic manner.

In the case of coupons, the personalization might mean not only choosing different coupons for different customers but also:

- Choosing different privileges (discounts, gifts, etc.) for the same coupon for different customers. For example, the coupon for the same cereal might give a 10 cent discount, a 20 cent discount, or a free bottle of milk. The system will fit, automatically, the most suitable privilege for the specific customer.

- Choosing different conditions for cashing in the privilege. For example, a certain customer might get the free bottle of milk if he/she purchases one box of cereal while the other customer will get the free milk only after purchasing three boxes of cereal.

The preferred embodiment of the present invention focuses on personal coupons while the mechanism remains the same for other embodiments.

The preferred embodiment of the present invention requires access to the database 104 through which the behavior history of the customers, the characteristics of the offers, and so on, can be learned.

FIG. 2 is a block diagram of the database module of a personalized offers system in accordance with a preferred embodiment of the present invention.

It should be noted that the system can function even when parts of the database do not exist. For example:

- The system is able to function successfully even without the customer database 104.5.

- The system is able to function successfully even when the length of the tracked data for some customers is significantly shorter than for others, or contains gaps in the tracked period.

- The system is able to function successfully even if it has data from few stores/branches, and not from all branches of a chain store.

- The system is able to function successfully without real time information such as ones current location.

The Customer Behavior database 104.1 contains data that enables the system to learn of the customers' needs, habits and preferences. The contents of this database change depending upon the type of environment in which the system is operated:

When the system functions to produce coupons or personal advertisements for loyalty club members of a certain chain store, the database will contain data concerning customers' purchases (the products bought, the prices of the products, dates of purchases, etc.). In the preferred embodiment of the present invention, the data can be obtained when a customer 116 reaches the Point of Sale (POS) 126 or checkout stand. FIG. 3 illustrates an example of the structure of the internal representation of such a database. The figure contains a list of customer purchase records 130 and 131 for every receipt that a store in the chain has issued.

Each receipt record 130 and 131 may contain the following information:

receipt number 130.1, issue time and date 130.2, the customer's unique identification 130.3 (e.g., an identification number), and a list of purchased items. For each item purchased, the record includes the product number 130.4, the amount 130.5 and the price 130.6.

In different embodiments of the current invention this database may look very different but it will always link uniquely between the customer and his/her activities, and furthermore to activities that collectively contain information about the customers preferences or needs.

The response to offers database 104.2 contains information regarding customer 116 responses to offers 110 given in the past. For example, if the personal offers are coupons for products, the response may be to use the coupon or not to use it, while other parameters connected to the response are measured as well, such as the influence on the customer's purchase basket or the influence on any other predefined target function. Once again, a means for collecting such information in the preferred embodiment exists in information sent from the POS 126 to the offers database 104.2 where it can be compared with the list of previous personalized offers 110. In different embodiments, however, this feedback may be collected differently.

Receiving the feedback from a customer's response to the offer is not imperative for the operation of the system, but it nonetheless enables the improvement of its performance. The feedback is received from the data collected either directly or indirectly about the customers' behavior.

For example, if the personal offer is a coupon for a product given to a loyalty club member, the coupon may contain a barcode. This barcode may be captured in POS 126 and passed on to the response to offers database 104.2 together with other information.

In the case where no barcode exists, the system will conclude that the customer used the coupon if he/she received it and purchased the product

applied to the coupon during the time that it remained valid, while the condition to redeem the offer must have been fulfilled. (If the customer received a coupon that granted him/her a free bottle of Coke on the purchase of another 3 bottles, then the system checks if the 4 bottles of Coke were purchased at the same time in order to conclude that the customer used the coupon.)

The Business/Products database 104.3 contains data about businesses, products and services that appear in the Customer Behavior Database 104.1. For example, in an application of the preferred embodiment comprising a chain store marketing campaign that gives out personal coupons for products to its loyalty club members, the Customer Behavior Database 104.1 will contain information about the products that the customers have purchased and the Business/Products Database 104.3 will contain information about the products in the chain store. This information will include data such as the prices of products, their connection to categories, etc. The information is provided by the chain store running the marketing campaign (campaign manager 118).

The system can function without such a database, but this may harm its performance.

Potential Offers Database 104.4 contains data on the campaigns' sets of optional offers and complete details on each offer. For example, in a campaign of coupons, data on each of the possible coupons, including: the range of possible discounts for each coupon (in that range the system finds, automatically, the appropriate discount for each customer), the range of conditions posed in order to receive the coupon privilege, the minimal and maximal number of customers that will receive the coupons, etc.

This data is fed into the database by the person responsible for the campaign or by the businesses/producers participating in the campaign.

The customer database 104.5 contains:

Demographic information 122: such as the customer's age, sex, address, income, etc. This data is usually extracted from customer registration information 128 (for example, a questionnaire that is filled in by the customer 116 when asking to join a loyalty club, or by handing in a request for a credit card, etc.)

Contact information 120: information required in order to transfer personal offers (if the means of distribution of coupons is by direct mail, there is a need for an address. If the means of distribution is an e-mail, the e-mail address is needed and so forth). This data is also collected from questionnaires filled in by customers (customer registration information 128).

Note that in some embodiments the customer initiates the contact, and contact information 120, therefore, may not be required. for example, the distribution of offers via an automated-teller machine (ATM).

This description has so far covered the types of databases 104 that can be used in the data collection step 200 of a personalized offers system. Now the description covers a preferred embodiment of the current invention, which performs step 2 in a personalized offer system: the automatic production of optimized personalized sets of offers (offer matching 210).

Offer matching 210 consists of two modules: data analysis 106 and choosing personalized sets of offers 108. FIG. 4 is a block diagram of the data analysis 106 module, and its interactions with other system modules.

In order to understand the general structure of the technology, the basic functioning of the system must be first explained.

The system begins to work when the campaign manager 118 (i.e., the user of the system, who could be a retailer as in the preferred embodiment or an e-

tailer, a credit card company, etc. in other applications) defines the target function 142 (which can be, for example, the receptiveness to offers, or the increase of the total amount of purchases, or the increase of profitability) and the optional set of offers intended to be distributed to the customer.

From this point onward, the system will produce personalized sets of offers based on the data stored in the database 104, and on additional real time data 147 if available.

The output of the data analysis 106 and selection of personalized sets of offers 108, therefore, is the list of personalized offers 110 that will be given to each customer.

The data analysis module 106 has the ability to predict the customer's response to personal offers on the basis of the information collected about him/her (via the response prediction module 134). For example, it can predict the chances that each individual customer will use a given coupon for a certain product.

The ability to predict such results (Predict contribution to target function module 138) enables grading the predicted contribution of all combinations of customer and offer 140 in relation to the target function 138 of the campaign. According to the customer-offer grading results 140, the optimal sets of personalized offers are chosen 108 for each customer. This optimal set can optionally be subject to predefined constraints 144 set by the campaign manager 118.

The system can use a closed-loop feedback system 136 to measure the customer's response to the offers and dynamically adjust accordingly.

FIG. 4 illustrates the overall processing steps involved in the production of personalized offers. The process works in two stages:

First, in the data analysis stage 106, the system grades all possible offers separately for each customer, taking into consideration the predicted contribution 138 of the offer to the campaign's target function 142. (If the target function is, for example, the increase of a loyalty club member's purchase basket in a chain store, then offers with high chances of inducing the customer to make a large purchase that he/she would not otherwise have made will receive high grades. On the other hand, offers with low chances of inducement or small purchases or inducement for a purchase that would have been made with or without the offer will receive low grades.)

Second, in the choosing of personalized offers stage 108, the system chooses for each customer a set of offers that are ranked by the highest grades and which deal with the posed constraints. For example, if there is a constraint not to issue two offers of similar products to the same customer then even if there are two offers for cereals that received high grades, only one will be presented to the customer.

The system can distribute a changing number of offers for different customers and can deal with various constraints, such as constraints on the relationship of different offers in the same set (both for the general population and for the subpopulation) and constraints on the minimum and maximum distributions for each offer as well as constraints upon the customers that can take a certain decision (only, for example, those who did not purchase a box of cereal in the last 6 months).

The choosing of personalized offers 108 stage can also choose the X most appropriate customers for each coupon (by choosing the group of X customers with the best grades for the required coupon) or by picking the suitable customers for the offer by choosing all customers with a grade higher than a certain limit.

The response prediction module 134 is the core of the entire process, it is used many times for different purposes, but in all cases it is used to predict

customer responses to particular offers.

The response prediction module's 134 input is the customer database 104. Its output is a prediction of the customers' expected responses to the offer, or the probability the customers will take a particular action. The combined output from all the response prediction modules 134 is delivered to the predict contribution to target function module 138.

In the preferred embodiment of the current invention, such actions may include trivial actions such as the purchase of a particular item or redeeming a coupon. It may also include more sophisticated actions such as the distance that a customer may be expected to be willing to travel in order to buy a particular item or the customer's expected purchase basket in a single visit to a store. It may also include a variety of different actions in different applications (see details later in this detailed description). All of the above examples and more are learned from the customer database 104.

The response prediction module 134 is shown in detail in FIG. 5. Before describing this module in detail, however, it will be helpful to understand the principle of learning how to predict customer response, as shown in FIG. 6.

In this example we will learn to predict the attractiveness of butter based on the purchase history of cheese and meat.

Assume that for a sufficient sample of households, each one denoted by x or o, there is information about their cheese 161 and meat purchase history 162. Every household is represented in the figure by x if it purchases butter regularly or o if it does not.

The location of the marker is determined by two properties: the amount of cheese the household buys per week (the Y-axis 161) and the amount of meat bought per week (the X-axis 162).

Clearly two clusters of dominant behavior, butter-discount cluster 163.a and no-butter-discount cluster 163.b (indicated with ellipses) can be identified.

Molding these clusters 163.a and 163.b in a parametric way, or any other representation, enables us to predict the attractiveness of butter for the rest of the households (those not included in the sample). We simply take their cheese and meat purchases and compute their matches to the detected models. If they fall into one of the clusters 163.a or 163.b the answer is simple: If the model implies that a new household falls in cluster 163.a of mainly x types (butter users) the household will be classified by a preference for butter. If the household will fall into a cluster 163.b of mainly o types (non-butter users) the household will be classified by a lack of preference for butter. Clearly, this can be extended for computing probabilities based on the relative sizes of different populations.

In reality a similar process occurs where, instead of using two features (consumption of meat 162 and cheese 161), a huge number of features that reflect the history of customer behavior (such as customer consumption data in customer behavior database 104.1 coupons redeeming in response to offers database 104.2 and demographic database in customer database 104.5) are used.

The preferred embodiment of this process involves two stages (displayed in the two columns in FIG. 5).

On the left side the first step, learning 150, where the model based on a sufficient sample of data is constructed. On the right side is the second step, classification 152, where the entire population is classified (a detailed implementation will be described later).

Note that the structure of the predictive behavior model in 150.3 is not limited to ellipses. Any modeling method may be applied.

Next, we consider how to implement the steps that identify the clusters of x and o in FIG. 6.

Thousands of algorithms have been proposed in order to identify the patterns (or clusters) in large data sets. To emphasize that the disclosed method does not depend on a particular implementation, we will describe several "text book" implementations, all taken from R.O. Duda & P.E Hart, Pattern Classification and Scene Analysis, J. Wiley & Sons Inc. 1973:

- General Bayesian Learning. p. 57.
- Fisher's Linear Discriminate p. 114.
- The Perceptron p.141.

All the construct models mentioned above aim to describe clusters of customers with similar behavior patterns and tools for determining the likelihood that new customers will belong to the same pattern.

FIG. 5 is a detailed block diagram of the response prediction module 134, which, as mentioned, includes two stages, learning 150 and classification 152.

The learning process 150 is responsible for the construction of the prediction behavior model 150.3. This construction is done in a process of supervised learning, meaning that automatic learning from examples occurs. The learning data record 150.1 contains information about the sample group of customers (or about all the customers). This information, as is seen in FIG. 7A includes fields of class 300 and features 302.1,..,302.N, the idea of this learning process is to find the rules that will predict the class from the features.

In the example presented in FIG. 7C: the aim is to find rules that will enable to predict the monthly consumption of Carlsberg beer according to a given set of features (the data in this case is taken from the loyalty club database).

The output of the learning process applied to the learning data record 150.1 of FIG. 7C could be, for example, the following model, which describes two categories of customers (constructed, of course, in a completely automatic manner).

Category i: If the monthly expenditures on diapers in the past month are $20 or higher and the last date for the purchase of wine was no later than a month ago, then the predicted monthly expenditures on Carlsberg beer is $50.

Category ii: If the monthly expenditures on diapers in the past month is zero, and the last date for the purchase of wine was more than a month ago then the predicted monthly expenditures on Carlsberg beer is $5 or less.

Clearly when more sampled are supplied more categories may be constructed, including models for continuous properties. To conclude, in the general case, shown in FIG. 7.A the model generalizes over feature quantities-values in columns 302.1 - 302.N in order to predict the most appropriate class.

The classifying process 152 is responsible for the implementation of the model that is constructed in the learning process for all customers.

The classification data record 152.1 contains information similar to the learning file but without the class field, as can be seen in FIG. 7B.

The idea is to examine, according to each customer's features, which of the rules out of the rules defined in the learning process the customer falls into, and to receive from this result the predicted outcomes. To illustrate the classification process, we will continue with the two-category model constructed above.

If a new customer, who was not included in the learning file of FIG. 7C, purchased diapers for $30 in the past month and purchased wine two weeks

ago, then this customer will fall into the first category, and as such the system will predict that he/she will purchase Carlsberg beer in the coming month for $50. This, despite the fact that it is possible that this customer has not purchased beer in the same chain store in the past.

The idea is to connect this customer to a group with the potential for purchasing Carlsberg beer and beer in general. As a result the system will probably offer him/her a coupon for beer, for example, that might induce him/her to start purchasing beer in the chain store running the campaign.

As was previously explained, features are required in order to perform the learning 150 and classification 152 processes described in FIG. 5. The data preparation module 146 (FIG. 5) edits the information stored in the databases 104 and computes a set of features for each customer– which can be based on demographic data (age, sex, address, etc.) and on the customer's past behavior. For example, in the case of a chain store's loyalty club database, the features can be based on a customer's total purchases for a given period of time for each one of the chain's products or for different groups of products. In addition the data preparation stage 146 produces the class field 300 for the learning process 150. This field 300 can be for example the amount of purchases of a particular product such as in the example in FIG. 7C, or a binary field that describes the use or lack of use of a certain coupon etc.

The Data Aggregation & Pruning module 148 (FIG. 5) is not imperative in the system but is likely to contribute to the reduction of the amount of features used for each classification 152 and to the improvement of the features that will enable a better performance of the classification.

Several known methods may be used to find meaningful aggregations and combinations, and to delete in advance non-useful properties.

Deleting non-useful properties can be done twice: once, if the property is

irrelevant for identifying purchase patterns of a given product, and secondly, if it contains information that is already known.

For example, assume that the purchase of milk is not correlated to the purchase of corn. Therefore, for offers that are related to corn we tend to identify customers that purchase products that are related to corn.

Note that many mathematical tools may be used, such as statistical correlation, singular value decomposition (SVD), principal component analysis, and more. All are standard mathematical tools that identify statistical importance in a set of data points in many dimensions.

Note that this patent, however, is not dependent on any particular implementation.

Fig 7C illustrates a possible learning file 150.1 after data preparation step 146 but without data aggregation and pruning step 148. Fig 7D illustrates a possible learning file 150.1 after both data preparation step 146 and data aggregation and pruning step 148.

In FIG. 7C we have four features 400, 402, 404, and 406. In this example, applying the data aggregation and pruning step 148 will:

> Aggregate the features "expenditures on diapers in the past month" 400 and "expenditures on baby food in the past month" 402, creating a single "expenditures on diapers + ½ of expenditures on baby food in the past month" feature 408;
>
> prune the feature "the number of purchases of milk in the last year" 406; and
>
> leave unchanged the feature "last buying date of wine" 404.

The result, which is smaller and more informative with respect to the learned class 300, is shown in Fig. 7D.

This concludes the description of response prediction module 134 and brings us back to main processing flow described in FIG. 4.

The next step is to predict contribution to target function 138 by combining the outputs of multiple response prediction modules134.

In this stage the outputs of the various response predictions 134 are combined into a single value that is stored in a large table containing grades for all offers for every customer 140. The computation of the various response predictions 134 is based mainly on pre-stored data in the database 104. However real time information 147, such as the current time, customer current location, and/or customer interactive response (for example, when the customer uses an ATM) are adjoined to the computation at this point.

Assume for example that the likelihood of a discount offer for a business meal in a particular French restaurant is wished to be graded. In this example the target function is to maximize the number of customers that used the offer. There are several parameters that can approximate the contribution to the final goal.

In this case the output of the following response prediction will be used as the input:

a. The probability that the customer will respond to a restaurant offer in general.

b. The probability that the customer will go to a French restaurant.

c. The additional value of the discount in the customer's decision to select a given restaurant.

d. The distance the customer will be willing to travel in order to go to a restaurant (this can be done with respect to the places where the customer usually does his/her transactions in the afternoon or with respect to the customer's current location, if it is known (such

as could be done where an ATM is used for offer distribution).

e. The impact of the time at which the customer receives the offer.

All the values and more are combined together to compute a grade that represents the attractiveness of a particular personalized offer.

Other target functions, for example the company that issues the offer may wish not just to increase the number of customers but also to increase its revenues. In order to accomplish these different tasks, the invention takes into account different target functions – the definition of the party that issues the offer of a desired impact.

In general, the grades produced by this model will illustrate the predicted contribution to the predefined campaign target function.

Another advantage of the present invention is to optimize different goals (target function 142).

A product manufacturer may wish to increase the penetration rate, i.e., to maximize the number of new customers. Another manufacturer might not want to waste discounts on customers that might purchase his product without the offer. In target function terminology, the target function 142 in the first case will be to maximize the total use of offers, or to increase the number of purchases that follow a free sample. In the second case , the target function 142 will be to increase the overall purchase basket. In this case, those customers that will buy the product in any case will not receive the offer. The following example will illustrate the different desired outputs with respect to different target functions:

Assume that the predicted chances for a specific customer to use coupon A will be 70% and for coupon B it will be 60%. Assume also that both give a $10 discount but A for the purchases of products that cost $100 and B for purchases of products that cost $200.

If the target function is to increase the redeeming percentages then coupon A

will receive a higher grade simply because 70% > 60%. On the other hand, if the target function for a coupon campaign is the increase of the purchase basket, coupon B will receive a higher grade because it has a higher potential of contributing to the income of the purchase basket

The computation becomes more complicated if the probability that the customer will purchase the conditional item anyway is taken into account.

Hence, the customer that purchased intensively the product associated with coupon B (in the relevant store) will receive the offer for product A, this will induce him/her to purchase both products: B - that is purchased in any case and A – as a response to the offer.

In the above example it was assumed in every case that the particular offer was new in the sense that there is no particular information about the impact of this offer on the customer. This, however, is not always the case. In many situations there is prior information about the impact of a particular offer (or a very similar offer) from previous given offers (for example, an offer that is valid for a few months).

In this case the particular personalized impact of the offer can be learnt. This is useful as many of the decisions are based on the generalization of a group of people, although such groups always include exceptions. The closed-loop feedback 136, however, enables the system to recognize and deal with such exceptions.

For example, customers that buy a lot of beer and cigarettes tend to reply to offers regarding whisky. But if a particular customer does not respond to such particular offers the system will take it into account and will correct the total grade.

Note that this model relies on the existence of feedback information. Feedback can be received either directly or indirectly.

One of the major advantages of the present invention is that it provides automated offer matching 210 for a wide variety of domains. As was explained before, a personalized offer system includes 3 parts:

A data collection system 200 for collecting information, an offer matching system 210 for matching offers to customers, and an offer distribution system 220 for distributing the offers.

The preferred embodiment of the present invention focuses on collecting data about the history of purchases. The data is collected at the product level (a list of products that every customer bought). The distribution channels are based on the distribution services of the data collecting entity, for example a loyalty club's contact channel.

FIG. 8 illustrates how the current invention, offer matching system 210, may be embedded in numerous types of applications, with various channels for collecting data, and for distributing offers. The data collection system 200 can be one or more of the systems in the left column (product purchases 500, businesses where purchases were made 502, banking accounts 504, phone services used (numbers dialed, etc.) 506, TV usage history 508, e-commerce purchases 510, Web sites visited 512, or other data source 514). The offer distribution system 220 can be one or more of the systems in the right column (direct mail 540, kiosk 542, automated teller machine 544, E-mail 546, Web site 548, TV 550, Cellular phone or other electronic device 552, or other offer distribution channel 554). FIG. 8 is by no means exhaustive, it serves to illustrate some of the wide range of applications to which the present invention can be applied.

Some examples of possible data collection resources 200 for use with the present invention are described below:

The use of product purchase history 500 has been described in depth earlier in this description.

To produce personal offers for credit card holders, the customer behavior database 104.1 will contain the list of stores where the card holders made purchases 502 (businesses where purchases were made, dates of purchases, etc.). The data can be obtained from the credit card company's database or rebate card company's database or the database of any other company that collects such information in any event.

In the case of a credit card company's campaign, where coupons for various businesses are produced, information concerning customers' purchases (where the purchases where made and not the products purchased) is stored in the customer behavior database 104.1, with information about businesses, such as their location, their connection to categories, etc. Such information will come from the credit card company for whom the campaign is made.

For banks 504, the domain of operation is customer accounts and the offers are likely to be banking offers.

For Internet surfers, the customer behavior database 104.1 contains the detailed surfing history 512 for each surfer (names of the Web sites visited, time of entrance to the site, surfing time duration, etc.) The above does not limit the functionality of the system to provide banners only. For example it can offer books in special domains or special prices based on detailed surfing history. In these cases the data can be obtained from the Internet access suppliers. The features can be the accumulative surfing time in each one of web sites or in different groups of sites, the last date surfed in a certain site, etc. The response can be whether a click through was performed on the banner and so forth.

In a telephone application the phone services used (numbers dialed, etc.) 506 and telephone services used (such as voice mail) are a gold mine of information, and are stored in the telephone companies databases (including customer contact information).

In the emerging technology of interactive TV, and in the existing cable "pay per view" channels, the data on viewing history 508 is recorded. This database can be used to analyze domains of interest and can therefore induce relevant offers. Note that these offers are not limited to broadcast material only.

As mentioned, there are also various possible distribution channels 220 that can be used in applications based on the present invention.

If the customer's address is known (if, for example, he/she is a member of a loyalty group). It is possible to actually print the set of offers and send them to the customer by direct mail 540.

Credit card holders may receive a personalized offer attached to their invoices.

The ATM's 544 ability to recognize the customer (by means of his/her credit card, for example) and to present him/her with offers on the machines' display, together with its ability to know the location and time of the customer's transaction, enables the system to provide the customer with offers suitable specifically to him/her according to his/her location and time.

For example, a customer who approaches the ATM 544 at 12:00 p.m. may receive a coupon for lunch in a French restaurant which is close to the specific ATM - this only after the system recognized that the customer likes French cuisine.

Another distribution channel is kiosk machines 542 in stores. Here the customer will introduce a loyalty club card (which can be a credit card) enabling the kiosk to recognize the customer and informing him/her of personalized offers, which the customer can print out on the kiosk machine or receive at the POS 126.

If the consumer's e-mail 546 address is known, the personal set of offers can be sent to him/her through this means of offer distribution.

At a Web site 548, once the site has recognized a surfer, such as through a login or cookie, a personal offer can be presented and the customer can choose to print it out or to redeem it on-line.

There are many methods to distribute coupons through the use of the TV 550.

In cellular phones and other electronic devices 552, such as an interactive television, mobile telephones, personal digital assistants, etc. it is possible to send various types of personal offers (including coupons) to the display.

Here, as in the case of ATMs, the possibility exists to use information about the current location (in the case of mobile telephones), and the current time (in all cases), in order to send personal offers suited to the customer's present location and to the time the offers are sent.

It should be emphasized that the present invention is very flexible is in its capacity to combine any offer distribution channel 220 and data collection channel 200.

In some cases, similar offer distribution 220 and data collection 200 channels might be used, for example, to distribute offers based on Internet surfing habits by E-mail. But if other contact information is available, the regular mail system or the personal cellular phone might be used to distribute the same offers.

This extreme example illustrates that the current invention is not bounded to expected pairs of data collecting and offer distribution channels.

The rest of this detailed description describes examples of some personalized

offer applications in which the present invention can be implemented for offer matching 210. Each example describes possible customer's for such an application, some possible data collection 200 sources, and some possible means of offer distribution 220.

In a product-purchase-history application for the present invention, the data collection 200 resource could be chain stores, retail loyalty clubs, supplier/manufacturer loyalty clubs, or any other company that holds product purchase history data 500 .

The data content could be history of purchases at the level of products purchased by each customer, history of purchases regarding customer reaction to past offers, current time, and/or customer's current location

The offer distribution 220 channel could be direct mail 540, a kiosk placed at the purchase site 542, small screens on a store's shopping carts or similar instruments, E-mail, 546, banners in an Internet/intranet Web site 548, mobile phones 552, Palm pilots 552, call centers, and/or interactive TV 550. Alternatively, instead of distributing offers to customers, a list of optimal customers can be generated by the present invention and given to the manufacturer/supplier or a third party.

The offer set could include regular coupons (discounts on the purchase of a product), coupons with redeeming conditions (e.g., buy two packages and get one free), advertisement offers, samples, gifts, and/or package deals.

In an e-commerce-purchase-history application for the present invention, the data collection 200 resource could be e-commerce Web sites 510, auctions, television sales channels, telemarketing channels, chain stores, retail loyalty clubs, supplier/manufacturer loyalty clubs, or any other company that holds product purchase history data 500 .

The data content could be history of time spent at a certain Web site, the

areas of interest shown by the customer, history of purchases at the level of products purchased by each customer, history of purchases regarding customer reaction to past offers, current time, and/or customer's current location.

The offer distribution 220 channel could be direct mail 540, a kiosk placed at the purchase site 542, small screens on a store's shopping carts or similar instruments, E-mail 546, banners in an Internet/intranet Web site 548, mobile phones or personal digital assistants 552, call centers, and/or interactive TV 550. Alternatively, instead of distributing offers to customers, a list of optimal customers can be generated by the present invention and given to a manufacturer/supplier or a third party.

The offer set could include regular coupons (discounts on the purchase of a product), coupons with redeeming conditions (e.g., buy two packages and get one free), advertisement offers, samples, gifts, and/or package deals.

In a stores-visited-history application for the present invention, the data collection 200 resource could be credit card or rebate card companies, banks, or any other company that holds similar data.

The data content could be personal purchase history (e.g., credit card purchases) that is associated with the customer's identity, data regarding the customer's reaction to past offers, and/or the customer's current location (which can be detected by some means of offer distribution, such as ATMs).

The offer distribution 220 channel could be direct mail 540, ATMs or other types of terminals 544, e-mail 546 banners in an Internet/intranet Web site 548, mobile phones or personal digital assistants 552, call centers, and/or interactive TV 550

The offer set could include regular coupons (discount on the purchase of a product or in a store), coupons with redeeming conditions (e.g., buy at more

than X$, receive Y% discount, where X and Y can be personalized), advertisement offers, samples, gifts, package deals.

In a surfing-history application for the present invention, the data collection 200 resource could be Internet service providers, portals, e-commerce sites, search engine sites, or any other entity holding surfing history data 512.

The data content could be Internet/intranet surfing history (including surfing time, purchases, click-on banners, and other actions) where the data is associated with the customer's identity or that of the computer used for surfing, other personal data , and/or data regarding customer reaction to past offers.

The offer distribution 220 channel could be e-mail 546, banners in an Internet/intranet Web site 548, mobile phones or personal digital assistants 552, small screens on a store's shopping carts and similar instruments 542, call centers, interactive TVs 550 ATMs 554, and/or any type of kiosk 542

The offer set could include regular coupons (discount on the purchase of a product or in a store), coupons with conditions for redemption (buy at more than $X, receive Y% discount, where X and Y can be personalized), advertisement offers, samples, gifts, package deals.

In a banking-history application for the present invention, the data collection 200 resource could be banks or any other type of company holding banking data 504 or similar data.

The data content could be history of banking actions taken by the customer and associated with the customer's identity, other personal data, and/or customer reaction to past offers.

The offer distribution 220 channel could be a personal offer by the banker, direct mail 540, a kiosk placed at the purchase site 542, small screens on a

store's shopping carts or similar instruments, E-mail, 546, banners in an Internet/intranet site Web site 548, mobile phones 552, Palm pilots 552, call centers, and/or interactive TV 550. Alternatively, instead of distributing offers to customers, a list of optimal customers can be generated by the present invention and given to the bank or a third party.

The offer set could include offers of banking activities with personal incentives, general incentives or no incentives at all; regular coupons (discount on the purchase of a product or in a store); coupons with conditions for redemption (buy at more than X$, receive Y% discount, where X and Y can be personalized), advertisement offers, samples, gifts, and/or package deals

In a telephone-activity-history application for the present invention, the data collection 200 resource could be mobile phone service providers, regular telephone service providers, or any other type of company amassing phone service history data 506.

The data content could be the customer's mobile phone use history (length of call, type of call, phone numbers dialed by the customer, other cellular services, etc.), other personal data, and/or data regarding customer reaction to past offers.

The offer distribution 220 channel could be mobile phones, call centers, direct mail, ATMs or other types of terminals, e-mail, banners in an Internet/intranet site, and/or interactive TV.

The offer set could include price packages, packages of accompanying services, regular coupons (discount on the purchase of a product or in a store), coupons with conditions for redemption (buy at more than X$, receive Y% discount, where X and Y can be personalized), advertisement offers, samples, gifts, and/or package deals.

In a television-usage history application for the present invention, the data collection 200 resource could be interactive TV suppliers or any other type of company which stores TV usage data, such as viewing history 508.

The data content could be customer's TV viewing history (programs, viewing hours, viewing time, channel switching, channel switching during commercials, etc.), history of other actions, such as Internet surfing, other personal data, and/or data regarding customer reaction to past offers.

The offer distribution 220 channel could be interactive TV, mobile phone, call centers, direct mail, ATMs or other types of terminals, e-mail, banners in an Internet/intranet site, and/or personal digital assistants.

The offer set could include offers for content packages, price packages, packages of accompanying services, regular coupons (discount on the purchase of a product or in a store), coupons with conditions for redemption (buy at more than X$, receive Y% discount, where X and Y can be personalized), advertisement offers, samples, gifts, and/or package deals.

CLAIMS

1. A method for fully automatically producing optimized personalized sets of offers according to a target function, using customer and product or service data previously collected, the method comprising:

analyzing the collected data and automatically deriving at least one of a plurality of behavior models for every offer or set of offers;

implementing at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum predicted impact relative to the target function;

optimally matching the best set of offers to each customer in terms of the target function;

thereby enabling automatic production of optimized personalized sets of offers for customers.

2. The method in claim 1 further comprising aggregating the data prior to said analyzing;

3. The method in claim 1 further comprising pruning the data prior to said analyzing;

4. The method in claim 1 further comprising a feedback loop between responses to the offers and said implementing of said behavior models;

5. The method in claim 1 wherein the previously collected data comprises demographic data;

6. The method in claim 1 wherein the target function is user-defined for typical marketing goals, such as increasing redemption rates, increasing revenues, increasing sales, decreasing costs while maintaining impact, or any combination of such goals;

7. The method in claim 1 further comprising applying constraints regarding valid customer–offer combinations with said optimal matching being subject to said constraints;

8. The method in claim 1 further comprising adding real-time information about the customer;

9. The method in claim 8 wherein said adding of real-time information about the customer includes the current time and current customer location;

10. The method in claim 1 further comprising configuring said matching, such that it will select the optimal customers for each set of offers in terms of the target function;

11. The method in claim 1 further comprising configuring of said matching, such that it will select as desirable an offer for each customer or as appropriate a customer for each offer as possible in terms of the target function;

12. A method for fully automatically producing optimized personalized sets of offers according to a target function, using data previously collected, the method comprising:

analyzing the collected data to derive at least one of a plurality of behavior models;

implementing at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum impact relative to the target function;

optimally matching the best set of offers to each customer in terms of the target function;

thereby enabling automatic production of optimized personalized sets of offers for customers.

13. The method in claim 1 further comprising distributing of the sets of personalized offers via at least one of a plurality of automated-teller machines (ATM).

14. Any marketing method in which personalized offers are distributed via at least one of a plurality of automated-teller machines (ATM).

15. The method in claim 1 further comprising distributing the sets of personalized offers via at least one of a plurality of interactive televisions.

16. Any marketing system in which personalized offers are distributed via at least one of a plurality of interactive televisions.

17. The method in claim 1 further comprising distributing the sets of personalized offers via at least one of a plurality of electronic information kiosks.

18. The method in claim 1 further comprising distributing the sets of personalized offers via cellular telephone.

19. A system for using a computing device to fully automatically produce optimized personalized sets of offers according to a target function, using customer and product or service data previously collected in a database, the system comprising:

a model-building software module that analyzes the collected data and automatically derives at least one of a plurality of behavior models for every offer or set of offers;

an offers-building software module that implements at least one of said behavior models for every customer and every offer so as to construct personalized offers with maximum predicted impact relative to the target function;

an offers-matching software module that optimally matches the best set of offers to each customer in terms of the target function;

whereby optimized personalized sets of offers for customers are produced automatically.

20. The system in claim 19 further comprising distributing the sets of personalized offers via at least one of a plurality of automated-teller machines.

21. The system in claim 19 further comprising distributing the sets of personalized offers via at least one of a plurality of interactive televisions.

22. The system in claim 19 further comprising distributing the sets of personalized offers via at least one of a plurality of electronic information kiosks.

23. The system in claim 19 further comprising distributing the sets of personalized offers via at least one of a plurality of cellular telephones.

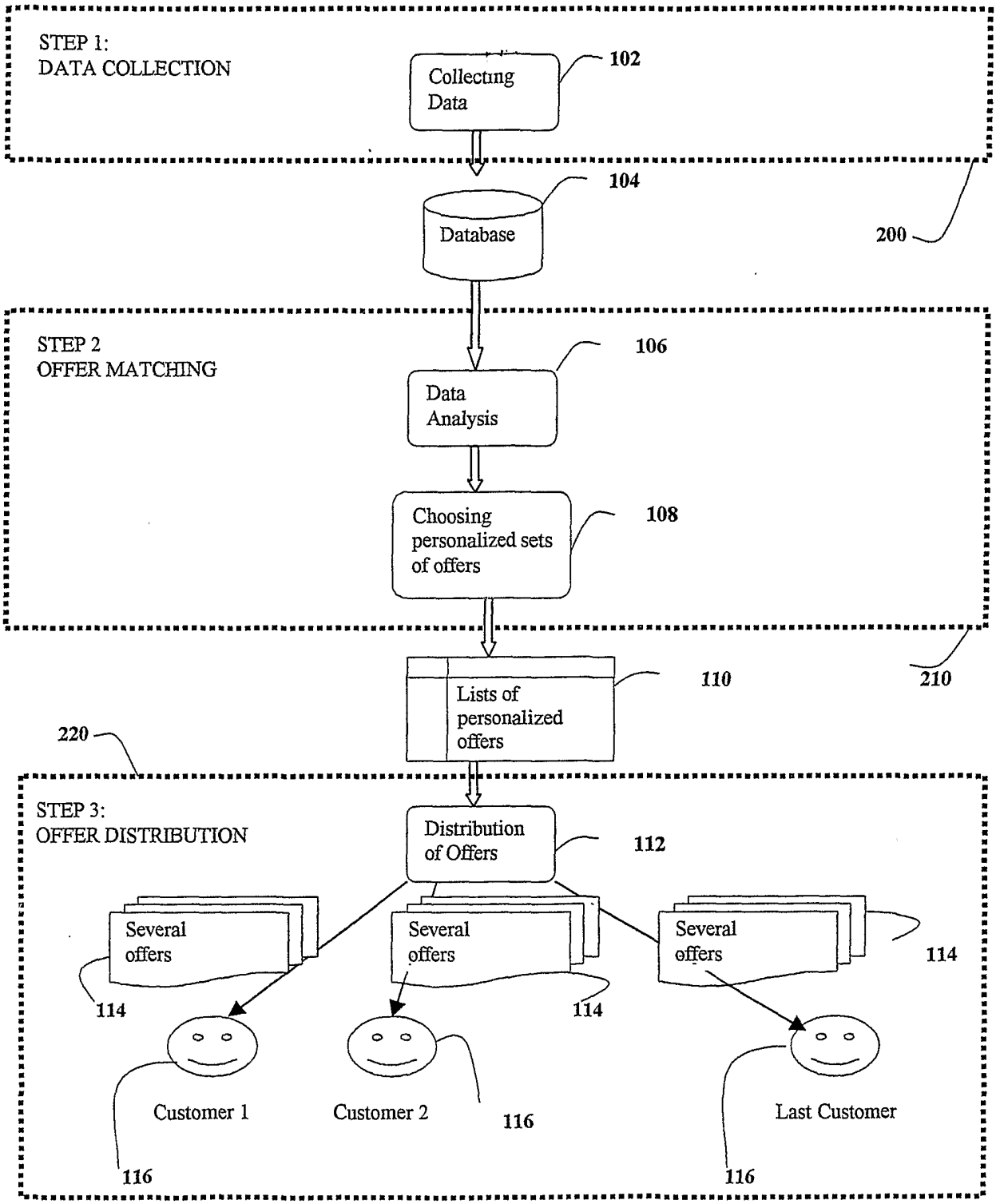
STEP 1:
DATA COLLECTION
Collecting Data
102
104
Database
200
STEP 2
OFFER MATCHING
106
Data Analysis
Choosing personalized sets of offers
108
110
Lists of personalized offers
210
220
STEP 3:
OFFER DISTRIBUTION
Distribution of Offers
112
Several offers
Several offers
Several offers
114
114
114
Customer 1
Customer 2
Last Customer
116
116
116

FIG. 1

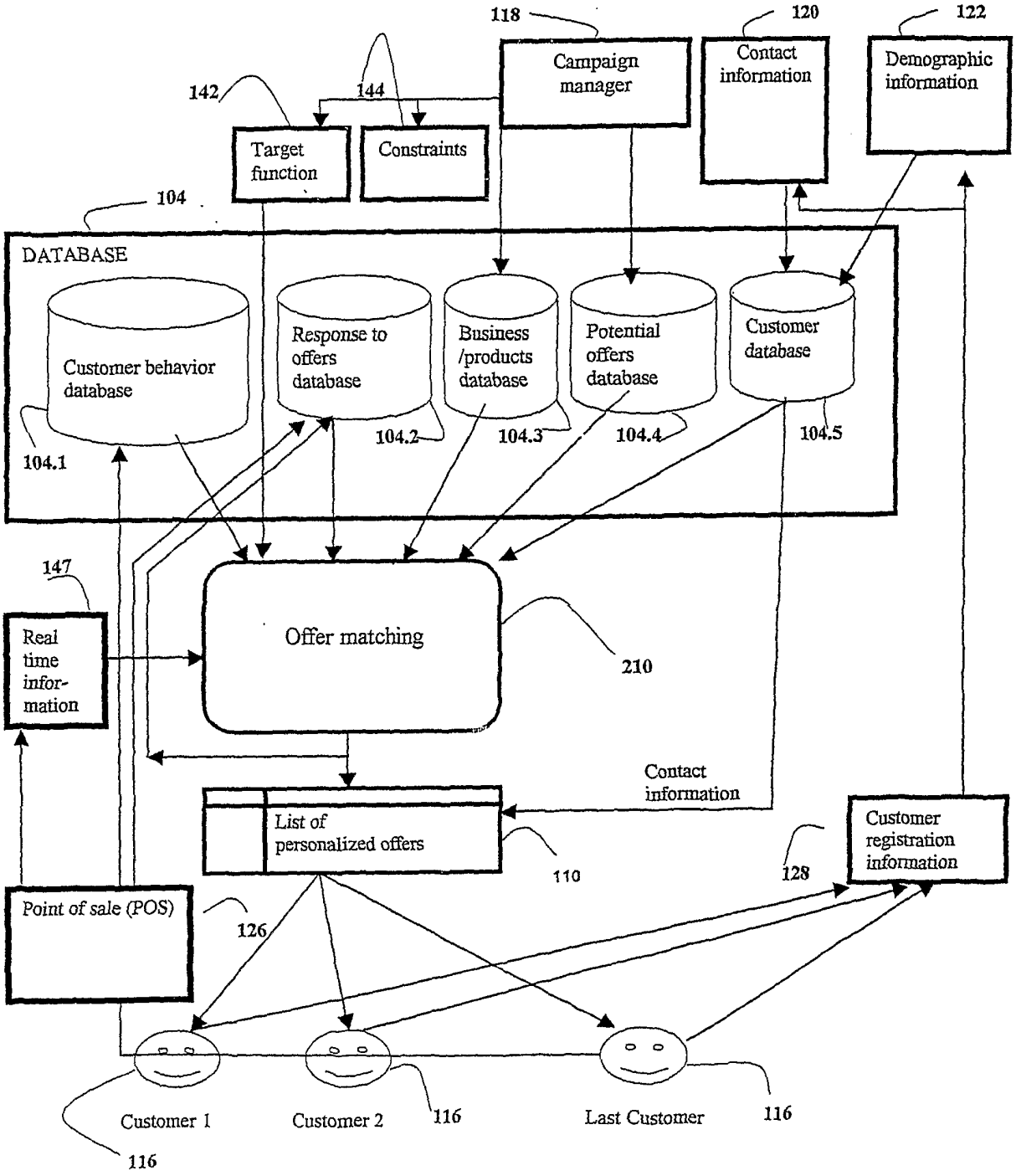
118
120
122
Campaign manager
Contact information
Demographic information
142
144
Target function
Constraints
104
DATABASE
Customer behavior database
Response to offers database
Business /products database
Potential offers database
Customer database
104.1
104.2
104.3
104.4
104.5
147
Real time infor-mation
Offer matching
210
Contact information
List of personalized offers
110
128
Customer registration information
Point of sale (POS)
126
Customer 1
Customer 2
116
Last Customer
116
116

FIG. 2

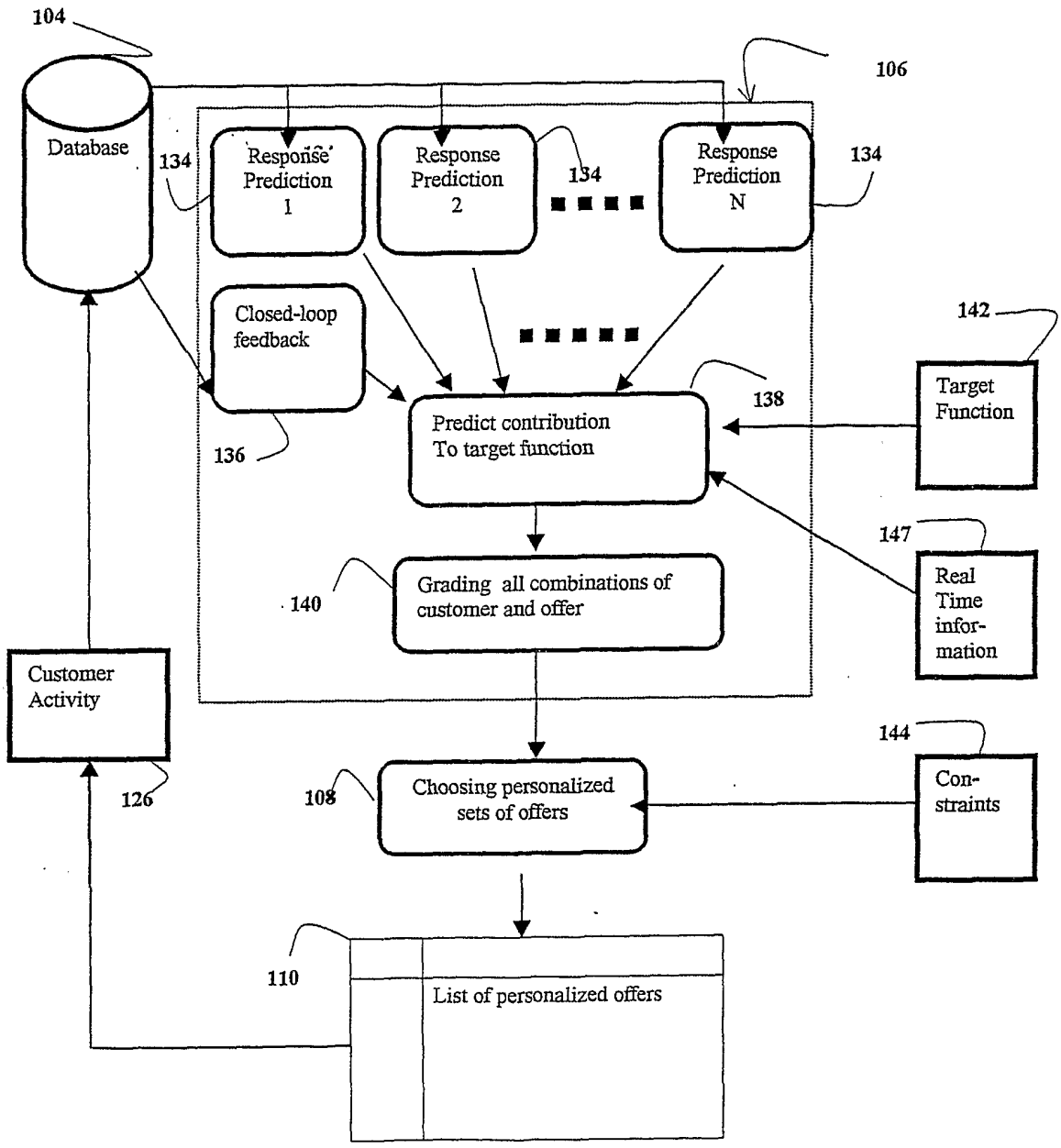
104
106
Database
134
Response Prediction 1
Response Prediction 2
134
Response Prediction N
134
Closed-loop feedback
136
142
Target Function
138
Predict contribution To target function
147
Real Time infor-mation
140
Grading all combinations of customer and offer
Customer Activity
126
144
Con-straints
108
Choosing personalized sets of offers
110
List of personalized offers

FIG. 4

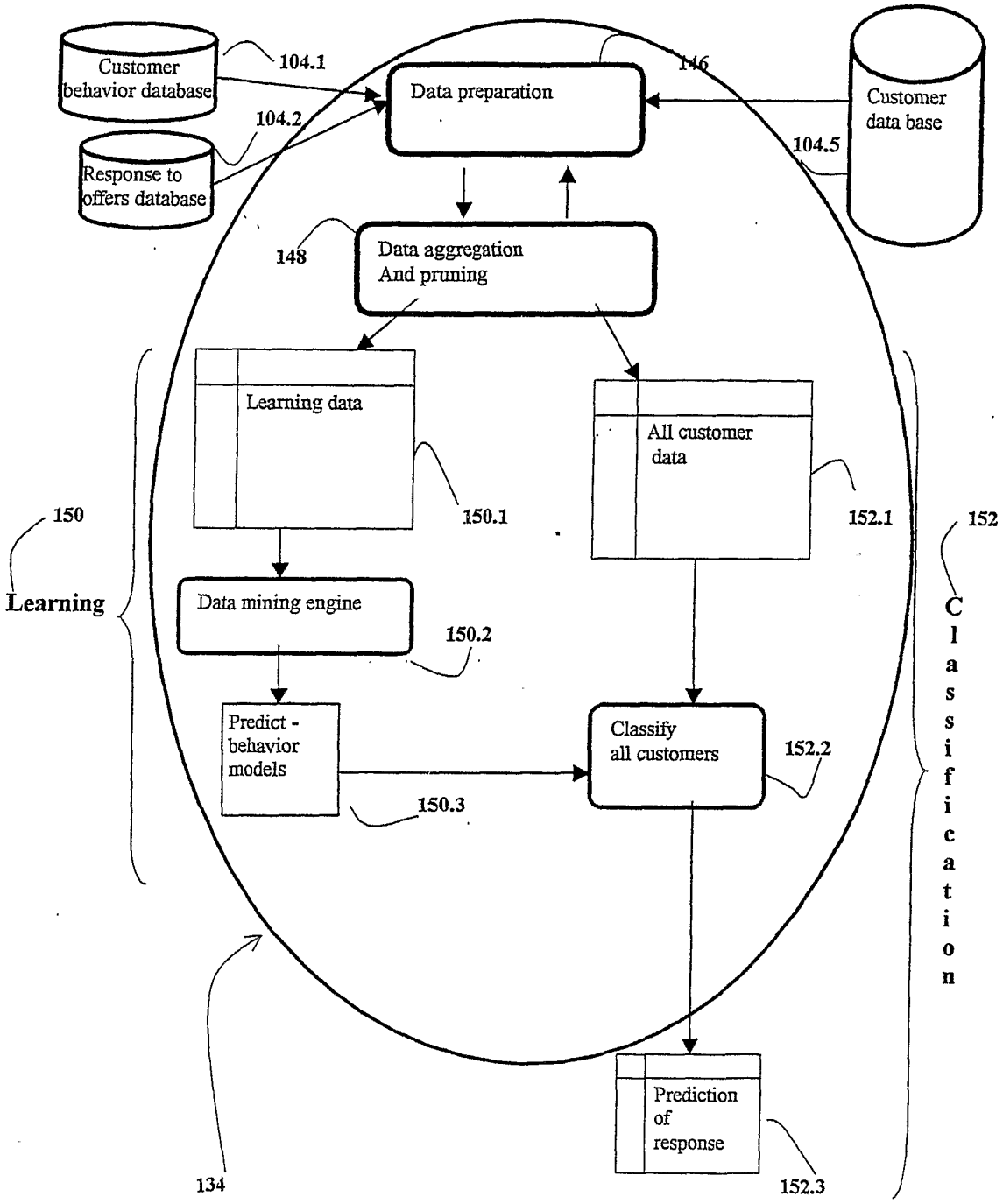
Customer behavior database
104.1
Response to offers database
104.2
Data preparation
146
Customer data base
104.5
148
Data aggregation And pruning
Learning data
150.1
All customer data
152.1
150
Learning
Data mining engine
150.2
Predict - behavior models
150.3
Classify all customers
152.2
152
Classification
Prediction of response
152.3
134

FIG. 5

Data structure for learning file

150.1

Customer Unique Identifier	Class	Feature 1	.....	Feature N
1				
...				
m				

300 302.1 302.N.

FIG. 7A

Data structure for classification

152

Customer Unique Identifier	Feature 1	.....	Feature N
1			
...			
M			

302.1 302.N

FIG. 7B

Example of learning file (for constructing a model that will enable predictig each customer's monthly expenditure on Carlsberg beer)

150.1

	Class	feature 1	feature 2	feature 3	feature 4
Customer Unique Identifier	Expenditures on Carlsberg in the last month	Expenditures on diapers in the last month	Expenditures on baby food in the last month	Last Buying Date of wine	Number purchases of milk in the last year
1	0 -20 $	0	0	3/5/99	50
	50 - 100	64	100	22/7/00	260
	20 -50	94	82	24/7/00	250
M	100 or more	0	0	2/8/00	300
	300	400	402	404	406

FIG. 7C

7.d Example of learning file after aggregation & pruning (features 1 and 2 from FIG 7C were aggregated and feature 4 was pruned)

	Class	feature 1	feature 2	150.1
Customer Unique Identifier	Expenditures on Carlsberg in the last month	Expenditures on diapers + ½ the expenditures on baby food in the last month	Last Buying Date of wine	
1	0 -20 $	0	3/5/99	
	50 - 100	114	22/7/00	
	20 -50	135	24/7/00	
M	100 or more	0	2/8/00	
		408	404	

FIG. 7D

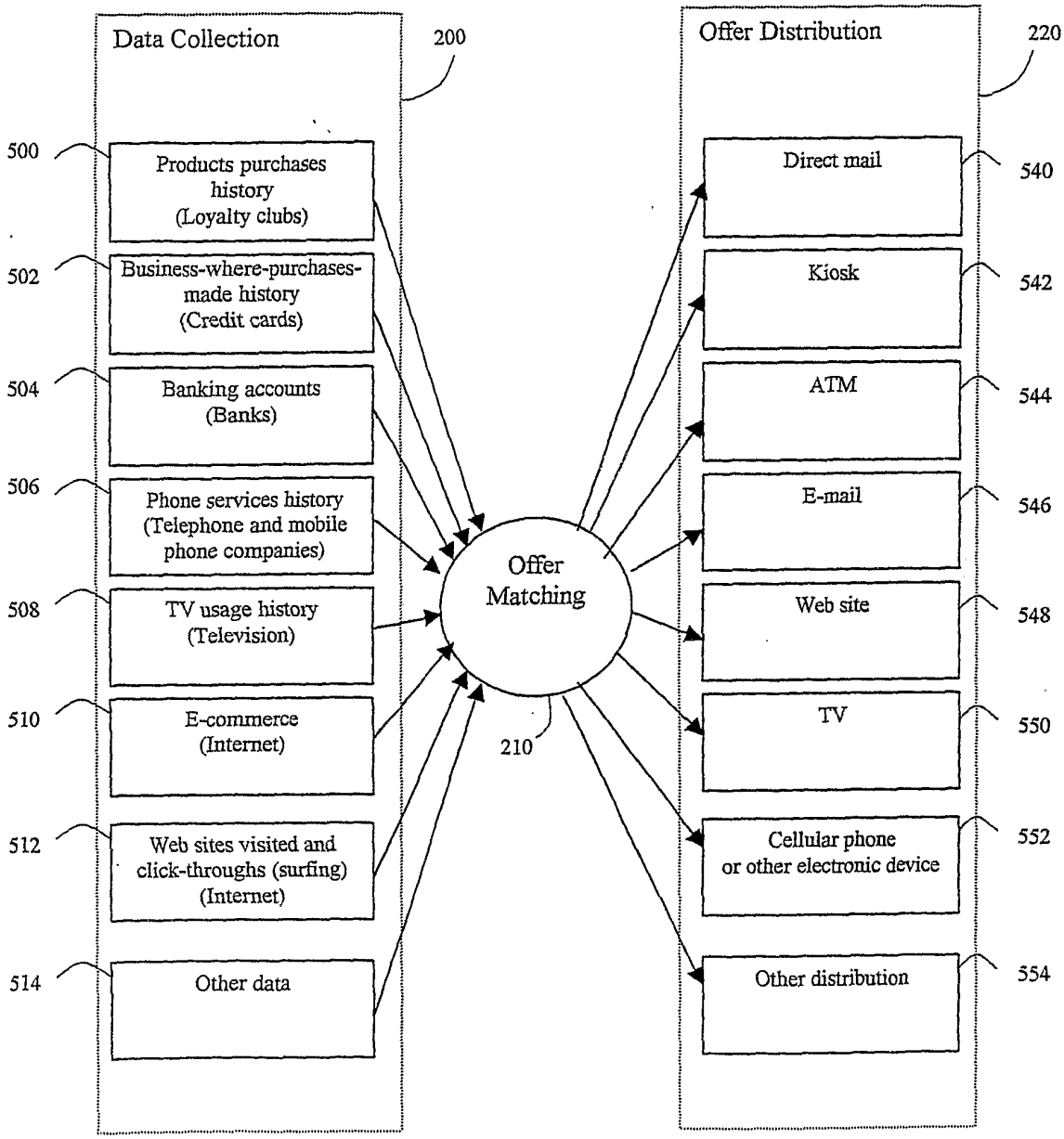
Data Collection
200
Offer Distribution
220
500
Products purchases history (Loyalty clubs)
502
Business-where-purchases-made history (Credit cards)
504
Banking accounts (Banks)
506
Phone services history (Telephone and mobile phone companies)
508
TV usage history (Television)
510
E-commerce (Internet)
512
Web sites visited and click-throughs (surfing) (Internet)
514
Other data
Offer Matching
210
Direct mail
540
Kiosk
542
ATM
544
E-mail
546
Web site
548
TV
550
Cellular phone or other electronic device
552
Other distribution
554

FIG. 8