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Increasing the Animation Study Management Services Functioning Efficiency

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***Abstract*—the research deals with the issues of animation of the animation studio services market, and the advantages and disadvantages of their functioning, both for the ordinary user and from the developer. It made clear that it is appropriate to provide information to the client about two areas: pricing policy and content of services. The services automation methods within animation studios are researched using modern methods of Data Mining.**

It is proposed to build the work logic using data mining methods, Decision Trees methods, for the animation studio management services effective functioning. It is determined that in case of client priority search criteria choice is related to pricing policy, it makes sense to organize the operation of the animation studio management service based on the backtracking algorithm. In the case of client's search criteria choice priority are content-related topics of services, apply algorithms for constructing decision-making tree.

Keywords — information technology, Data Mining, Decision Trees, animation studio, entertainment

I. INTRODUCTION

Recently, there has been a rapid development of the entertainment industry worldwide. This is the entry into a post-industrial stage of development most the developed countries in the world, a characteristic feature is the significant growth of services and service industries. Despite the fact that the entertainment industry is one of the youngest sectors of the socio-cultural sphere, it accounts for about 6 % of the world's capital [1].

In today's conditions of informatization and computerization of the society [2] and the rapid increase in demand for services of the entertainment industry [3-4]. Business development in this area requires new approaches to information processing and decision-making.

The most notable change is in the travel companies that actively involve organizations for process activities advanced digital technology [5-9]. These include global computer reservation / reservation systems, integrated communications networks, multimedia systems, smart cards, management information systems, and more.

However, they are mostly dedicated to addressing the digitization of tourism animation services and, unfortunately, very little attention has been paid to digitizing the children's animation studio segment. Modern animation is the activity of developing and implementing special leisure programs [10]. Although the demand for services in this particular segment of the entertainment industry is huge. With a data web - site for parents Britain Netmum, parents spend on children's holiday from $ 200 to several thousands of dollars, and in general, the market value of children's parties is over $ 1.5 billion [11]. Similarly, in Ukraine, on average, the organization of children's holidays costs about 5 thousand UAH [4].

II. PROBLEM STATEMENT

Of course, today most animation studio, event -agency etc. have their own web services, where the highlight information about their services and show potential customers their own successful experiences conducted their activities, etc. However, this is not enough. The client (animation customer) needs the ability to quickly and conveniently view the offerings of different animation studios with the ability to compare their services, pricing, quality of service and the ability to provide these services in the right location and time range, etc.

Analyzing typical for the market of Ukraine, web services animation studio "Children's Planet" [12] "Igroland" [13], "Papashon" [14], event - agency "Empire holidays" [14] it is difficult not to notice, that the data the services are not convenient and do not meet the above requirements.

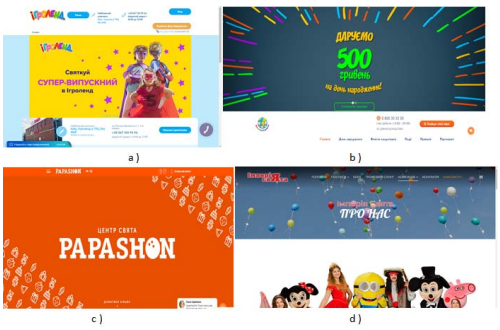

Fig. 1. View of the main pages of services of children's animation studios: a) children's animation studio "Igroland"; b) children's animation studio "Children's Planet"; c) the PAPASHON entertainment complex; d) "Empire of the Holiday" event-agency

Obviously, all four main pages of web services (Fig. 1) are not radically different and do not carry information regarding the choice of possible services. They do not have an intuitive or adapted interface. After pressing certain buttons and selecting menus, which, by the way, are not easy to find, the information becomes not much more. So, for example, to find the list of services of the children's animation studio "Children's Planet", you must use the page scrolling, on the website of the children's animation studio " Igroland " you need to find the "Menu" button, and click on the "Details" button on the main page of the entertainment complex PAPASHON. However, even after such manipulation of information comes not much more. None of these services is immediately accessible to the complex of services that can be obtained based on a certain budget. Also, none of these services has the opportunity to introduce, for example, topics that are interesting for the child to get information about the range of services that the company can provide and the price range of these services, it is difficult to find differentiation of services by age categories and so on.

In addition to imperfect client-side work, these services are not functional enough to meet the needs of animation studio staff. Here are some of the main unsolved problems:

- does not have a cumulative database of customer preferences and needs;
- there is no service of forming comparative characteristics (cost, duration in time, age restrictions and number of participants, etc.) of different offers;
- when ordering a client an offer to the administrator comes just a message about this event, which is not processed by the service itself, respectively, with a large influx of people who want to order the same service, the service will not help the administrator with this problem;
- there is no dynamic selection of the set of possible offers for the client according to the criteria he / she has set;
- there is no dynamic selection of possible offers for the client, taking into account time and quantitative parameters, the possibilities of the studios themselves, etc.

III. THE METHOD OF IMPROVING THE WORK OF CHILDREN'S ANIMATION STUDIO SERVICES WITH THE USE OF DATA MINING METHODS IS PROPOSED

For fast and qualitative sampling of data, modern methods of analysis of intellectual data must be applied by certain criteria. We believe that it is most appropriate for the organization of the effective operation of a service for managing the work of animation studios to use the Decision Trees methods, such as to enable, step by step , based on the client's answers, to form from the existing set of services, the set of the most client-friendly solutions.

To construct Decision Trees most widely used in practice, algorithms binary search tree (BST) ; returning search algorithm (backtracking algorithm) and algorithms decision tree.

In our opinion, to sample a variety of possible services, it is most advisable to use the backtracking algorithm when choosing a client as a priority, the direction of pricing.

The operation of this algorithm can be interpreted as a process of bypassing a tree. Each peak corresponds to it a sequence $(x_1, \ldots, x_i)$, with peaks that correspond to sequences of the form $(x_1, \ldots, x_i, y)$, sons of the summit. The root of the tree corresponds to an empty sequence.

This tree is being traversed by searching deep. In addition, a predicate P is specified on all tree vertices. If $P(v) = False$, then the subtree vertices with root at vertex v are not considered, and the volume of the bust decreases. The predicate $P(v)$ acquires the value False when it becomes clear that the sequence $(x_1, \ldots, x_i)$, corresponding to vertex v cannot in any way be added to the complete solution. To apply this method, the solution of the problem must look like a finite sequence of elements $(x_1, \ldots, x_n)$.

In our case, the elements $x_1, \ldots, x_n$ of this sequence are the cost of the services that can be provided to the client within the budget that he or she determines (predicate P). This is exactly what a client wants, based on a specific budget.

Initially, the client is offered a set of services that can be provided within a given budget, considering a possible set of services, the client is able to remove / add certain of them, then the budget for other services increases / decreases. The algorithm returns the customer to the previous selection step, with the other set of service elements until the desired set of services within the client's budget is formed.

Description of the backtracking algorithm

After entering in the search window the "budget" of the amount that the client focuses on, the logic of the system employs a backtracking algorithm , which allows to form from the existing set of services, the set of services that can be provided within the specified budget.

Let us illustrate the algorithm for generating multiple offers (search with returns) in case the client chooses as a priority, the direction of the pricing policy, that is, according to the criterion "budget", in a specific example.

Suppose that table 1 sets the sets of services $\{p_1, \ldots, p_n\}$.

TABLE I. SET OF EXISTING SERVICES

Code	Service	Cost	Duration
p1	Costume photoshoot	1000 UAH	1 hour
p2	Rolledrome	600 UAH	1 hour
p3	Birthday greetings with cake	550 UAH	30 minutes
p4	Weaving of African pigtails	500 UAH	1 hour
p5	Soap bubbles show	500 UAH	1 hour
p6	Trampoline arena	120 UAH	1 hour
p7	Aqua makeup	90 UAH	30 minutes
p8	Trampoline «Treasure Island»	80 UAH	30 minutes
p9	Maze	60 UAH	unlimited

Each service is matched by its cost. You need to find a subset of which the cost of the elements does not exceed the client's criterion "budget" (CB). If the sum is so large that the addition of any new number exceeds CB then we go back and change the last addition of the sum. Let $CB = 1$ *thousand UAH*. Figure 2. illustrates part of the backtracking algorithm for the problem of finding a subset of a set of services $\{p_1, \ldots, p_n\}$ with the criterion "budget" equal to 1 thousand UAH.

In general, when a subset of the set of services $\{p_1, \ldots, p_n\}$, given in Table 1. from the criterion "budget" is equal to 1 thousand UAH. The client may be offered 6 possible service options. Formed variants of subsets of possible services are given in Tables 2-7, respectively. And it should be noted that these options are provided, with information on the possible duration of the organized holiday.

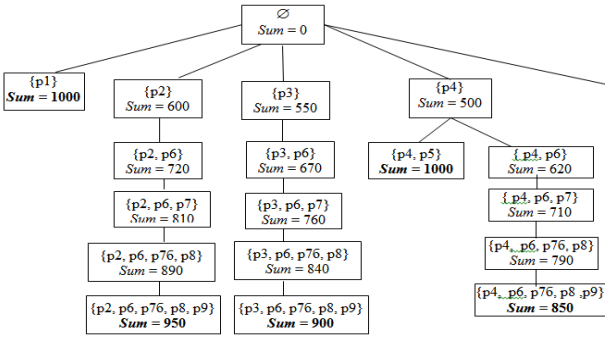

Fig. 2. Part of the backtracking algorithm for problem of finding the subset of a set of services $\{p_1, \ldots, p_n\}$ with the criterion "budget" equal to 1 thousand UAH.

TABLE II. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p1	Costume photoshoot	1000 UAH	1 hour
	Sum	**1000 UAH**	**1 hour**

TABLE III. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p2	Rolledrome	600 UAH	1 hour
p6	Trampoline arena	120 UAH	1 hour
p7	Aqua makeup	90 UAH	30 minutes
p8	Trampoline «Treasure Island»	80 UAH	30 minutes
p9	Maze	60 UAH	unlimited
	Sum	**950 UAH**	**unlimited**

TABLE IV. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p3	Birthday greetings with cake	550 UAH	30 minutes
p6	Trampoline arena	120 UAH	1 hour
p7	Aqua makeup	90 UAH	30 minutes
p8	Trampoline «Treasure Island»	80 UAH	30 minutes
p9	Maze	60 UAH	unlimited
	Sum	**870 UAH**	**unlimited**

TABLE V. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p4	Weaving of African pigtails	500 UAH	1 hour
p5	Soap bubbles show	500 UAH	1 hour
	Sum	**1000 UAH**	**2 hour**

TABLE VI. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p4	Weaving of African pigtails	500 UAH	1 hour
p6	Trampoline arena	120 UAH	1 hour
p7	Aqua makeup	90 UAH	30 minutes
p8	Trampoline «Treasure Island»	80 UAH	30 minutes
p9	Maze	60 UAH	unlimited
	Sum	**820 UAH**	**unlimited**

TABLE VII. SET OF OFFERED SERVICES

Code	Service	Cost	Duration
p5	Soap bubbles show	500 UAH	1 hour
p6	Trampoline arena	120 UAH	1 hour
p7	Aqua makeup	90 UAH	30 minutes
p8	Trampoline «Treasure Island»	80 UAH	30 minutes
p9	Maze	60 UAH	unlimited
	Sum	**820 UAH**	**unlimited**

Once a client is selected, a subset of the solutions that are most appropriate for him / her, he / she can make changes by removing / adding certain services (this will result in a certain budget change) and make an order.

If the client chooses as a priority, the content area of services, the most appropriate is to use the algorithm of building a decision tree. In this case, we need to solve the typical classification problem.

After all, when we consider a client's request in terms of the content topics of animation studio services , we need to make decisions about the set of existing objects (animation studio services), assigning them to certain thematic classes, that is, providing these objects with classification features. So we need to solve a typical classification problem whose set of conditional attributes ***A*** will be made up by the client's requirements. The set ***W*** is an active animation studio service; the set ***d*** is a decision attribute - two elements {"good luck", "bad luck"}.

Description of the algorithm for building a decision tree

After selecting a search box of your request priority area "subject", the customer will be asked to answer a few questions that are conditional attributes and accordingly help shape due to the algorithm for constructing Decision Tree , the set of possible proposals for a client under given his attributes.

Let's use one of the algorithms for building a Decision Tree, namely the algorithm ID3 (Iterative Dichotomizer-3 algorithm) [15]. To illustrate the algorithm for generating set of proposals using the algorithm for constructing Decision Tree to a specific example.

Let Table 8 provide information on options for a children's holiday. We construct Decision Tree for given Table 8.

TABLE VIII. SET OF OFFERED SERVICES

Version	Age	Gender	Number of participants	Subject	Type of entertainment	Duration of entertainment	Budget (UAH)	Holiday
1.	up to 5 years	boy	up to 4	not thematic	are active	unlimited		Yes
2.	up to 5 years	boy	up to 4	ninja	science	30 minutes – 1 hour	5000-1000	No
3.	5-10 years	boy	4-8	ninja	science	30 minutes – 1 hour	5000-1000	Yes
4.	up to 5 years	boy	more than 8	Peppa	art	до 2 hour	unlimited	No
5.	up to 5 years	girl	more than 8	Peppa	art	unlimited	5000-1000	Yes
6.	5-10 years	girl	4-8	ninja	team entertainment	unlimited	5000-1000	No
7.	5-10 years	girl	4-8	Lady bug	team entertainment	unlimited	5000-1000	Yes
8.	5-10 years	boy	more than 8	Lady bug	team entertainment	unlimited	5000-1000	No
9.	5-10 years	boy	more than 8	pirates	team entertainment	unlimited	up to 500	No
10.	more than 10 years	girl	more than 8	Peppa	art	до 2 hour	5000-1000	No
11.	more than 10 years	girl	up to 4	Peppa	art	до 2 hour	5000-1000	Yes

12.	more than 10 years	girl	more than 8	Peppa	are active	unlimited	5000-1000	No
13.	more than 10 years	girl	more than 8	not thematic	beauty and fashion	до 2 hour	unlimited	Yes
14.	more than 10 years	boy	more than 8	not thematic	beauty and fashion	до 2 hour	unlimited	No

A holiday is a decision-making attribute. The set of all conditional attributes $\boldsymbol{A}$ = {"age", "gender", "number of participants", "subject matter", "type of entertainment", "duration of entertainment", "budget"} corresponds to the root node. Select the attribute "age" and mark it the root vertex. The set of values of this attribute consists of three elements: up to 5 years, 5-10 years, more than 10 years. Put the root vertex in correspondence with three edges, each of which is attributed to the value of the attribute "age". Set examples will be divided into three subsets that correspond to the values of the attribute "age"; these subsets correspond to each of the vertices 2, 3, 4 of the tree shown in Figs. 3 We remove the attribute "age" from the set A and get the set $\boldsymbol{A}$ = {"gender", "number of participants", "subject matter", "type of entertainment", "duration of entertainment", "budget"}.

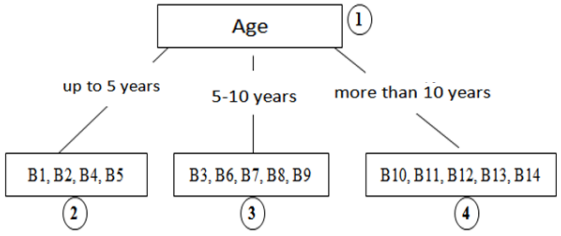

Fig. 3. The first step of the ID3 algorithm (removing the "age" attribute).

Consider the vertex number 3. It is matched by the subset of examples {B3, B7} that have the value of the decision attribute "*yes*" and the subset of examples {B6, B8, B9} that have the value of the attribute of the decision "*no*". We select the following attribute from the set $\boldsymbol{A}$; let it "gender". Denote by vertex 3, construct two edges with the values of this attribute, and divide the set of examples in vertex 3 into two subsets, in each of which the values of gender are the same.

Consider the vertex number 6. It corresponds to the subset {B3}, which has the value of the decision attribute "yes", and the subset of examples {B8, B9}, which have the value of the decision attribute "no". We select the following attribute from the set $\boldsymbol{A}$; let it be the "number of participants". Denote by vertex 6, construct three edges with values of this attribute and divide the set of examples in vertex 3 into two subsets, in each of which the values of the number of participants are the same.

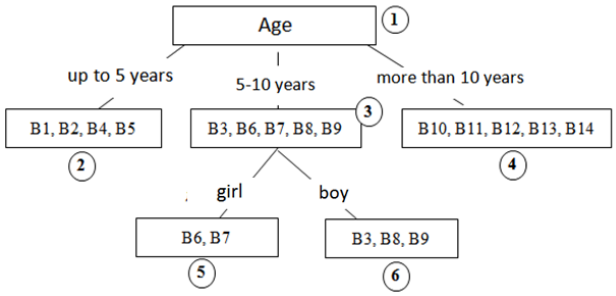

Fig. 4. The second step of the ID3 algorithm (removing the "gender" attribute)

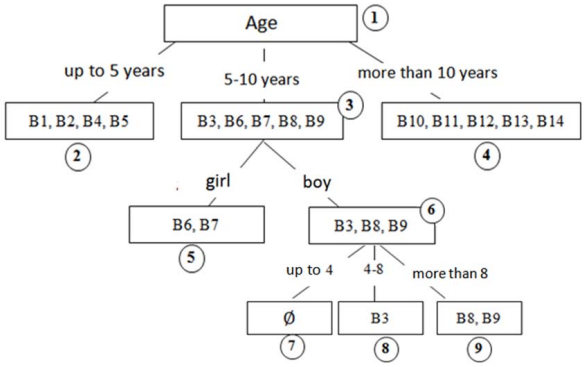

Fig. 5. The third step of the ID3 algorithm (removing the "number of participants" attribute)

In Fig. 5 in verse 7 we have an empty set, which indicates that under such criteria given by the client, we will not be able to offer him anything, that is, a holiday cannot be organized, so we will mark this vertex "no" and it will become a leaf. In verse 9, examples B8 and B9 have the same attributes of the game attribute - no. Therefore, we denote this vertex by "no" and it will become a leaf. Similarly, we denote vertex 8 as "yes" and it will also become a leaf

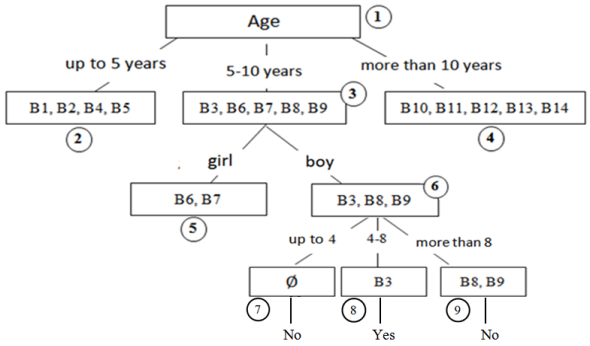

Fig. 6. The fourth step of the ID3 algorithm.

IV. CONSIDERATION OF THE DEVELOPED FUNCTIONAL OF THE SERVICE

The main page (see Fig. 7) of the service for managing the work of children's animation studios, includes buttons: "Offers" - for viewing, all available offers, "Order" - go to the window where you can place an order, "Register" - to register for service, "Login" - to enter the service and also 3 offers that can be accessed by clicking on the "Details" button.

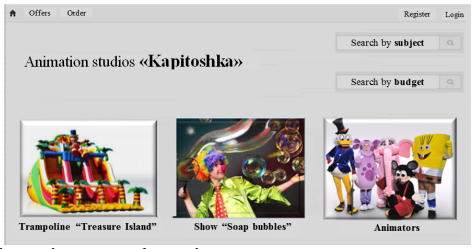

Fig. 7. The main page web service

After the user, when logging in to the site, chooses a budget search option and enters the amount for which he wants to organize a holiday, he will be offered as many services as possible within the selected budget, as shown in the figure. 8.

Fig. 8. A list of suggested holiday options

If someone at the entrance to the site will select the search option offers the direction of "subjects" and introduce subjects on which it wants to organize a holiday, he will be asked to respond to several questions, such as: the age of the child; to become a child; budget, the number of children on holiday, he will be offered as many services within the chosen subject. One of the variants of the proposals when choosing the theme "Active entertainment" and given attributes: "age" - 11 years; "gender" - boy ", budget - 1000 UAH, shown in the figure. 9.

Having determined the optimum number of services, the user can order the selected offers.

V. CONCLUSIONS

To organize the effective functioning of animation studio management services, taking into account the specifics of their work, the logic of query processing systems must be built using modern methods of Data Mining, namely the "Decision Tree" methods. In order to provide quality services, in a user-friendly format, it is most appropriate to provide information to the client in the context of two areas: price policy and content topics of services. If the client chooses as a priority , the direction - pricing policy, it is advisable to use the backtracking algorithm when choosing the client, as the priority , direction - the content of services - algorithms for building a decision tree.

Fig. 9. A list of the proposed "Active Entertainment" holiday option

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