A Method Based on Interactive Evolutionary Computation for Increasing the Effectiveness of Advertisement Texts for Clusters of People

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ABSTRACT

Interactive Evolutionary Computation (IEC) is used in this work in order to perform the optimization of several advertisement blocks of text. The advertisement texts follow a format similar to the one used in a technique called Article Spinning. This format allows an IEC algorithm to evolve the text for a certain cluster of people, using words and phrases as variable parts which change according to the subjective evaluation of the corresponding cluster of people interacting with the algorithm. After several generations, the IEC algorithm provides a version of the advertisement text that, in theory, should exhibit an increased performance, according to the subjective evaluation function it was evolved with. In order to demonstrate the efficiency of the texts, these are compared against a version determined by an expert in a field related to marketing. For this comparison, three tests are performed: recall, recognition, and persuasion tests. The results obtained show that IEC could effectively be used to increase the impact of an advertisement text, but more experiments need to be conducted. A recommendation of an advertisement text is accomplished by determining an individual's corresponding cluster, and showing an evolved version of the text for that particular cluster.

Categories and Subject Descriptors

H.1 [**Models and Principles**]: User/Machine SystemsSoftware Psychology; J.1 [**Administrative Data Processing**]: [Marketing]

General Terms

Human Factors

Keywords

Interactive Evolutionary Computation, Textual Advertising

1. INTRODUCTION

This paper presents a method for optimising advertisement texts through the use of Interactive Evolutionary Computation (IEC) techniques, and a method for the recommendation of these texts based on clustering algorithms. The advertisiment texts can be of arbitrary length, but short texts are used in the conducted experiments. For an advertisement text to be evolved, it needs to follow a proposed format, described in Section 3.1. This format allows the representation of the text as a chromosome that can be used by a genetic algorithm (see Section 2.1) for its evolution.

The texts are evolved in different environments or habitats, defined by a clustering algorithm. Before individuals interact with the IEC algorithm, a clustering algorithm will decide to what cluster these users belong to, based on their profile. After determining a user's cluster, the user can then interact with the evolution process (see Section 3.3). The number of habitats where the texts will be evolving will depend on the predefined number of clusters.

The reason for the development of the proposed method in this work is the potential to lower monetary costs in advertisement campaigns and simplification of advertisement logistics, as text plays an important role in e-commerce applications, as this is one of the most common ways of giving information about a commercial product to the consumers [12].

For example, this method could be implemented in a website. The profiles of the users could be obtained using their Facebook profiles' information, and user clusters would be created based on this information. Visitors would be assigned to a cluster and would participate in the evolutionary process of the advertisement texts whenever they decide to click on certain advertisements, or ignore them. The website's visitors would be optimizing their own advertisements.

2. BASIC CONCEPTS

2.1 Genetic Algorithms

Genetic algorithms are inspired in biological evolution; they evolve a population of individuals by performing genetic recombination and mutation. A selection of the best solutions is made by the use of certain criterion and a fitness function,

and based on their performances, the more fit individuals survive and the less fit are discarded. Optimization based on genetic algorithms is a search method based on probability [13].

The process is based on the probabilistic recombination of genetic material. The used mechanism consists on the exchange of fragments of genetic material two chromosomes, a father and a mother. In this research, we used one-point crossover as the crossover operator. This algorithm can be elitist, as it can save the best element in the population without modification.

As the number of generations or iterations increases, the probability of finding the optimum solution tends to increase.

2.2 Interactive Evolutionary Computation

Evolutionary algorithms are a subfield of artificial intelligence. They are mainly used in optimization problems where the search space is very large and complex. These algorithms search for solutions based on the theory of the Darwinian evolution.

These kind of optimization methods generate a set of individuals that represent possible solutions. These solutions are usually generated randomly at the beginning of the evolution process. After each generation, the best solutions share part of their information to create other possible, better, solutions. All of the individuals compete to be the fittest solutions; the better solutions are conserved, while the worse ones are destroyed, according to a fitness function that evaluates their performance [1].

Interactive Evolutionary Computation (IEC) is very similar to classic Evolutionary Algorithms, but the difference is that the fitness function is determined by the subjective evaluation of a human being, e.g., a person considering an advertisement text to be better than another.

2.3 Article Spinning

Article spinning is a method used to create multiple versions of a text article without creating versions considered as plagiarism, due to the uniqueness achieved of the generated content. Duplicated content is not accepted by several search engines like Google, Yahoo and Bing, so this method is used to generate many different versions of a single article that have a higher probability of being considered as unique content by these search engines. Words and phrases are randomly changed by other text blocks that have the same meaning, resulting in another version of the article with the same meaning, but different text content [11].

2.4 Related Work

In 2007, Kazienko and Adamski proposed the extraction of user patterns through the use of web content and web usage mining techniques, and the creation of clusters from this information [7]. Zheng, Chen, and Jiang, 2012, compared the performance of text-only, image-only and text and image ads, and concluded that there is no significant difference among their performances [15]. Keng and Liu, 2013, analyze how websites need to be designed according to the user's

Figure 1: A sample of an advertisement text in article spinning format

personality and their interests [8]. Wu, Zongda, et. al., 2013, focus on the optimal positioning of an advertisement, rather than what ad to show to the user [14]. Fan, Teng-Kai, and Chia-Hui Chang, 2011, propose a software framework to analyze the content from blogs, determines their subject, and recommends advertisements that are relevant according the blog's content [3]. Dao, Tuan Hung, Seung Ryul Jeong, and Hyunchul Ahn, 2012, developed a tool that recommends ads according to the context of an individual. They use the user's location to provide better advertisements. Their recommender system is based on collaborative filtering [2]. Hsieh, Yu-Chen, and Kuo-Hsiang Chen, 2011, and Lewis, Whitler and Hoeg, 2013, study how the type of content (i.e., videos, text, images, or a mix of these types) of a website affects the users' attention towards website advertisements [6] [9]. Finally, the persuasion test used in this work has already been used before in [10].

3. METHODOLOGY

3.1 Article Spinning Format

The text in Figure 1 contains different sections enclosed by curly braces, which contain different text blocks. These text blocks can be of arbitrary length, from a single word to whole sentences and paragraphs. The bars present in the text work as separators, indicating the algorithm that the text before a bar will represent one of the possible choices of a combination of text. The text blocks that are outside of the curly braces (represented by grey text in Figure 1) won't have any modifications when the texts evolve; they are constant throughout all the generations of the evolutionary algorithm. The text's structure is very similar to that used in Article Spinning algorithms.

3.2 Constructed Texts

At the moment, two advertisement texts have been evolved and tested against five different versions generated by five different experts (see Section 3.5). The first advertisement is about a hamburger, and the second advertisement is about an automobile. The results can be seen in Section 4.

3.3 Evolution of the Texts

The texts were evolved for 30 generations, one generation being an evaluation by an user between two different versions of an advertisement.

The evolution process consists on the random selection of twelve chromosomes (i.e., a version of the text), where six chromosomes will act as possible fathers, and the other six as possible mothers. A fitness value is calculated for each chromosome, with the following formula:

$$f = \frac{s + 1}{v + 1} \tag{1}$$

where f is the fitness of the chromosome, s is the number of times the chromosome has been selected, and v is the number of times the chromosome has been viewed. The chromosomes with a low number of views (i.e., 2 views) are exempt from the evolution process, as it would be too soon to consider them with a low fitness already. Then, the father and the mother with the highest fitnesses are chosen, and, according to a probability of crossover (i.e., 0.8), they will interchange genetic material to produce two children. Two chromosomes with the lowest fitness will be discarded, and will be replaced by the offspring of the more fit father and mother.

Additionally, there's a chance of 2% for a mutation to occur to the offspring. This mutation consists on the random alteration of the genetic material of the chromosomes.

3.4 evoSpace Adaptation

evoSpace [4] [5] had to be modified in several areas of its programming. A new module accepts a chromosome as input, and produces a version of the advertisement text based on it. The front end of the application changed to be able to display text instead of animations, as in the Shapes application. The social features of the platform are not shown in this adaptation, so they don't have the possibility of confusing the participants in the experiments. Also, the new design allows a picture to be added in the middle of the template. The purpose of this picture is to give a general idea of the product being advertised to the user.

In Figure 2, the adapatation of evoSpace for the evolution of advertisement texts is shown. Two different versions of the text are shown to the user in the bottom, a picture of the product being advertised is shown in the middle, and a button for getting more text versions is shown in the top right corner.

3.5 Advertisement Text Efficiency

Measuring the efficiency of an advertisement text is performed by comparing a version resulting from the evolution of the texts, against a version constructed by an expert. For the experiments, any person specialized in an area related to marketing is considered an expert.

For the first part of the experiment, a group of 30 people, randomly chosen, are asked to choose what version they think would persuade them the most. The text with the majority of the votes is then considered to be the better at persuading a person to buy the advertised product. Although this test could present flaws, as the best strategy to measure the effectiveness of an advertisement text would be to put it in actual practice, the test can produce a rough idea of the real results.
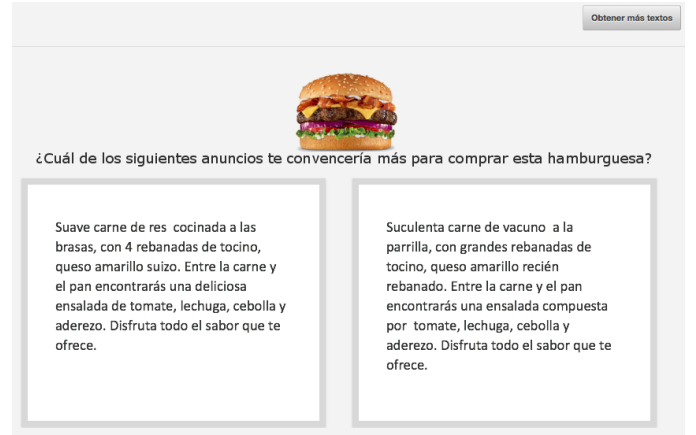

Figure 2: Adaptation of evoSpace for the evolution of advertisement texts

This part of the experiment is repeated with five different versions from different experts, against the same evolved text.

For the second part, recall and recognition tests 3 are performed. The recognition test consists on showing a group of 30 people a dummy website, where a movie trailer is played for 30 seconds. Above this video, the advertisement text is displayed. After the completion of the video, the website is hidden, and the participants are asked if they saw an advertisement above the video. If the participants saw the video, this means they recognized the advertisement. In the end, the number of people who recognized the text is divided by 30, the total number of participants, and this represents the percentage of recognition for the given advertisement.

The recall test is performed after the recognition test. The same group of people that participated in the recognition test, and that successfully recognized the advertisement, are asked if they recall what was the subject of the text. Like in the recognition test, the number of people who recalled the subject of the text is divided by 30, the total number of participants, and this represents the percentage of recall for the given advertisement.

In Figure 3, the dummy website is illustrated. The video can be seen on the right, and the advertisement text on its top, surrounded with a blue border.

3.6 Clustering and Recommendation

Before an individual interacts with the application developed in evoSpace-Interactive, a profile of the user is gathered. Using the users' profiles, user clusters can be created. This allows the IEC process to be isolated for each of the clusters, thus, creating different, optimized, versions for each cluster of people. In this way, a recommendation of an advertisement text can be achieved.

4. PARTIAL RESULTS

Table 1 presents the results of the experiments conducted using the hamburger advertisement text, while Table 2 presents the results of the automobile advertisement text. An expla-
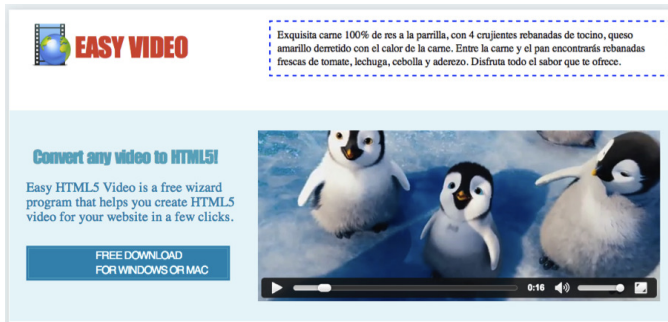
Figure 3: Dummy website built for the recognition and recall tests

Type of Test	Evolved Text Rating	Expert's Text Rating
Recognition	60/150 = 40%	69/150 = 46%
Recall	41/150 = 27.3%	33/150 = 22
Persuasion	84/150 = 56%	66/150 = 44%

Table 1: Results of the hamburger advertisement experiment

nation of the experiments can be found in Section 3.5.

The percentages shown in the tables represent the ratings given by the participants to each advertisement text version. For example, 60/150, or 60%, means that 60 people out of the 150 people that participated in the experiment, successfully recognized or recalled the given text. In the persuasion test, the results are complementary, meaning that, for example, 56% of the participants preferred the evolved version of the hamburger text, while 44% of the participants preferred the expert's choice.

As was mentioned in Section 3.5, 30 people participated for each part of the experiment. 150 different people were needed for each test, because every part was performed five times (the evolved text competed against five different experts' choices).

5. CONCLUSIONS

More and better designed experiments need to be performed in order to obtain more reliable results. Also, an experiment must be designed to test the efficacy of the recommendations by the clustering method proposed in Section 3.6.

Although conclusive results have not yet been generated, the partial results presented in Section 4 demonstrate that the proposed method in this work can potentially aid in the development of a marketing campaign.

6. REFERENCES

Type of Test	Evolved Text Rating	Expert's Text Rating
Recognition	98/150 = 65.3%	98/150 = 65.3%
Recall	49/150 = 32.6%	36/150 = 24%
Persuasion	81/150 = 54%	69/150 = 46%

Table 2: Results of the automobile advertisement experiment

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- PHP

Programming Languages (Little to Medium Experience)

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- Java
- MATLAB

Domain specific languages

- HTML
- CSS
- SQL

Database Systems

- MySQL

Programming Paradigms

- Object Oriented Programming

Operating Systems

- Windows:
  - Windows XP
  - Windows Vista
  - Windows 7

- Mac OS:
  - Mac OS X

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2007-2012	**Tijuana Institute of Technology** Bachelor Degree Computer Systems Engineer	
2007-Present	**Tijuana Institute of Technology** Master's Degree Computer Science	

Projects where I have participated

WeSeekIt!
Web site that functions as a human search engine. People do a search on a chat and an operator helps to find the answer to your search. WeSeekIt! helps people with search queries that search engines were unable to find. WeSeekIt! search queries must be resolved within 15 minutes.

HoodiaGordoniiSideEffects
Web site where weight loss products are sold, and weight loss articles can be found. PHP is used to manage the static content.

iWiks
Social Network made in PHP and MySQL. iWiks was divided into 3 parts, a public section, a semi-private section where your information was seen only by your friends, and a public section where the information was private. On this social network you could add friends, create photo albums, post information, pictures, videos, visit other profiles and socialize.

Languages	Computing	Other Data
Spanish **English**	**GIMP.** Digital images processing and editing tool. **Visual Studio.** Integrated Development Environment for .NET technologies. **Adobe Flash.** Application creation and manipulation of vector graphics.	Driver's license VISA USA Mexican Passport

I'm sending my paper to this doctoral symposium seeking for more people to know about my research, and hoping to be lucky enough on finding other people that could be interested in collaborating with my research in the future. I'd really appreciate if someone could make a contribution or offer assistance to improve my work. As a specific question, I'd like to know if the symposium mentors find my research interesting, and if not, how do you think I could make it more attractive?