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A method based on Interactive Evolutionary Computation and fuzzy logic for increasing the effectiveness of advertising campaigns

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ABSTRACT

Optimization of advertising texts is aimed at increasing the number of users who take notice of the ad. The work presented in this paper proposes a method to optimize advertising texts through Interactive Evolutionary Computation and fuzzy logic. This is done by utilizing user preferences for word combinations to build a fitness function. After several generations, the Interactive Evolutionary Computation algorithm should produce a version of the advertising text that exhibits an increase in efficacy (as judged by the subjective evaluation function used for its evolution). To demonstrate the efficacy of the evolved texts, they are compared against word combinations chosen by experts in marketing and related fields. Recognition, recall, and persuasion tests were performed to evaluate the efficacy of the proposed method. The obtained results show that Interactive Evolutionary Computation can be used to increase the efficacy of an advertising text.

1. Introduction

Even with the rising popularity of image, video, and audio content on the web, text continues to play an important role in both web content [20] and web advertisements [25]. A hypothesis explaining this is that users are not necessarily looking for a unique type of resource but a mix of content types, with users finding some content more convenient when it is presented in a textual form. For example, an individual can prefer to read a novel instead of listening to an audio version of it. This phenomenon can also be explained as an issue of context: a person attending a conference can find it imprudent to watch a video on a mobile phone and, as a consequence, opt to read a news article or view pictures instead. This same situation can also occur in regard to textual advertisements. Advertisement texts play an important role in e-commerce applications, being one of the most common ways to pass information about a commercial product to a consumer [24]. For example, an image-based advertisement can perform poorly when trying to explain a product, while a textual advertisement could potentially do better. Regardless of the reasons, text remains a powerful force in web communication.

The meaning of a textual passage can be communicated in many different ways. For example, a person can write a greeting using a single word such as “Hello” or could use an entire sentence such as “Good evening.” In both cases, the receiver of the message will understand it the same way: the transmitter is sending a greeting. However, communication is not always as simple as this. A message can have different meanings depending on its connotation [27], or even its choice of synonyms, as is often the case in localization and internationalization. Bondurant [3] analyzes how poor software localization

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can cause a failure to merchandise it in foreign countries. It is clear that a careful selection of words is important for the creation of any textual content, including advertisement texts.

This paper presents a method for optimizing advertisement texts through the use of Interactive Evolutionary Computation (IEC) and Fuzzy Logic (FL) techniques. The overall objective of the proposed system is to simplify the logistics of creating advertising campaigns and thereby enhance their performance. Performance in this case depends on two factors: a high volume of clicks and a low Cost Per Click (CPC). Click count is increased through the use IEC techniques to generate a more effective advertisement, and to lower the cost of the advertising campaign, a Fuzzy Inference System (FIS) is used. The FIS controls the advertisement's maximum bidding price, using as inputs its Click-Through Rate (CTR) as well as its current maximum bidding price. Although these modules have not been integrated into the implementation yet, they would be applied by having the IEC system calculate scores for all advertising campaigns in terms of the CPC and the number of clicks, and then use these scores to perform the evolutionary process.

The advertisement texts used in our method can be of arbitrary length, though short texts were used in the performed experiments for the sake of convenience. It should be noted that to evolve an advertisement text, it needs to be encoded in a set format. This allows for the representation of the text as a chromosome, which can then be used by a genetic algorithm for its evolution. The EvoSpace-Interactive [9,11] platform was used to implement the evolutionary process of a text and measure its persuasive impact on users. EvoSpace-Interactive was adapted to the needs of this work by having the graphical user interface display a picture of a hamburger or an automobile, depending on the experiment being performed. Some additional modifications were made on EvoSpace-Interactive so it could translate a chromosome into a text, and vice versa.

In future implementations of this work, information could be obtained from a user's Facebook profile and utilized to create user clusters. Visitors would then be assigned to a cluster and would participate in the evolutionary process of the advertisement texts whenever clicking on one. In this way, the website's visitors would be optimizing their own advertisements.

To better understand the proposed method, we recommend starting with Section 2, which presents a review of related work. In Section 3, the method and its implementation are discussed in more detail. To test the presented method, an experiment based on the work by Hsieh and Chen [17] is performed, and its results are discussed in Section 4. Finally, conclusions are offered in Section 5.

2. Related work

A web content author is a person who specializes in creating content for a website. Each website has a target audience and requires a certain type of content for that audience [20]. This web content should contain keywords and phrases that attract and retain visitors, be focused on a specific topic, and be easy, informative, and pleasant to read.

In 2007, Kazienko and Adamski [18] proposed the extraction of user patterns through web content and usage mining techniques, as well as the creation of clusters from this information. Related to this work, the method we propose will gather information about web users using Google Analytics, which will then be used to determine the effectiveness of an advertisement. Zheng et al. [32] compared the performance of text-only, image-only, and text-image combination ads, and concluded that there is no significant difference in performance between them. This guided the authors of this work to focus on text-only ads, as these ads are easier to optimize using an IEC system.

Keng and Liu [19] analyzed how websites should be designed according to the user's personality and interests, which supports the idea of customizing advertisements so that what is presented is more appealing to the users (and in potential future work, using our proposed method to optimize the textual content of a website as well). Wu et al. [31] focused on the optimal positioning of an advertisement rather than the ad's content, which is in contrast to this work, which focuses specifically on the textual content of the advertisement. Fan and Chang [8], in 2011, proposed a software framework to analyze the content from a blog, determine its subject, and recommend advertisements that are relevant to the blog's content; this work proposes the customization of the advertisements so they become more likeable to the user, rather than merely choosing from a pool of potential advertisements. Dao, Tuan Hung, et al. [6] developed a tool that recommends ads based on an individual's personal information, such as the user's location, to provide better advertisements. This recommender system is based on collaborative filtering. Hsieh and Chen [17], and Lewis et al. [22] studied how the type of content (i.e., videos, images, text, or a mix of these types) of a website affects the user's attention towards its advertisements, and showed that textual content is relevant despite the presence of other types of content such as videos, which supports the effectiveness of our method. Finally, the persuasion tests used in this work to validate the proposed method have been used before in previous work [23].

The proposed method performs valence shifting by applying IEC techniques. This method is generally inspired by several previous works, such as those used by Trujillo et al. [29], where IEC was applied to evolve animations. The platforms that these authors used are the same as those used in our experiments, namely, EvoSpace [10] and EvoSpace-Interactive [11], which were both developed by García-Valdez et al. Other works that use IEC to evolve likable products (as influenced by the people involved in the process) are: Picbreeder [26], an online service that allows users to collaboratively evolve images, and EndlessForms.com, a website that allows its users to collectively explore a series of CPPN-encoded [5] objects by having them select the objects they are interested in, which then serve as parents for the next generation.

In general, one can note that IEC can be used to find solutions to problems in which the fitness function of the evolutionary algorithm is the subjective opinion of a human being.