Distributing Elements in a Pop-Up Book using a Hybrid Algorithm

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Abstract. This paper discusses the importance of Social Modeling visualization and the correct classification of societies to approach the cultural diversity in the social system described in Memory Alpha, and thus reviews a formal methodology regarding to the construction of the analysis of social and cultural models as an inspiration lent from the social data mining analysis. A case of study is presented regarding to the construction of a Pop-up Book using data obtained from the diversity of cultural patterns described in Memory Alpha. Some futures conjectures and open future analytical works in the Social Modeling studies are described. The intention of the present research is to apply the computational properties of the cultural technology; in this case of corroborating them by means of mining of data to propose the solution for a specific problem, adapted from the modeled Literature about of Societies. Combined to this, we analyzed the location of diverse societies with respect to the social similarity of its neighbors, in a novel & popular representation denominated Pop-up Book. The set of study conformed by 1017 societies allowed to analyze the individual characteristics without affecting the extreme total of the sense of the Pop-up Book (that it represents of all of them), and gave the opportunity to us to emulate the distances that separate each one of them and as these are grouped with respect to a cluster that they belong. Demonstrating that characteristic social, linguistics & cultural specify a position in the Book, by means of this information is possible to predict the best position in the Book, and redistributing to the individuals that conform it; this article tries to explain this representation of the social behavior.

Keywords: Cultural Algorithms, Pattern Recognition, Social networks.

1 Introduction

Cultural Algorithms (CAs) are an approach of Evolutionary Computation, which uses the culture like a vehicle to store excellent and accessible information to all the members of the population during many generations. Like in a human society, the cultural changes act as advances the time, this one provides a line bases for the interpretation and documentation of individual behaviors within a society [1]. CAs

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were developed to model the evolution of the cultural component on the time and to demonstrate how this one learns and acquires knowledge. In agreement with this conception, the cultural algorithms can be used to lead the process of the self-adaptation within evolutionary systems in a variety of diverse social & cultural areas of application to analyze Textile Heritage, Interchange Commerce, Technology capability, Social Networking, Languages, Architecture and Design of Dioramas [9].

The cultural algorithm base can be described by means of the following pseudo code.

```
Begin
  t=0;
  Initialize POP(t); /* Initialization of population */
  Initialize BLF(t); /* Initialization of believing
space */
  Repeat
      Evaluate POP(t);
      Vote (BLF (t), Accept (POP(t)));
      Adjust (BLF (t));
      Evolve(POP(t), Influence(BLF(t)));
      t = t +1;
     Select POP(t) from POP(t-1);
  Until (Term condition is reached)
End
```

Fig. 1. Pseudo code base of Cultural Algorithms.

Initially a population of individuals that represents the solution space, which is represented like a set of solutions within the space search, is generated randomly to create the first generation. In our example, the solution space contains a list of the attributes that can be used in the classification procedure. The space of beliefs is emptiness. For each generation, CAs will be able to involve a population of individuals using "frame" Vote-Inherit-Promote (VIP). During the phase of Vote of this process, the members of the population are evaluated to identify their contribution to the space of beliefs being used the acceptance function. These beliefs allow contributing in most of the solution of the problem and are selected or put to voting to contribute to the present space of beliefs.

The belief space is modified when the inherited beliefs are combined with the beliefs that have been added by the present generation, this is made using a reasoning process that allows updating the space of beliefs. Next, the space of beliefs updated is used to influence in the evolution of the population. The belief space is used to influence on the rest of the population and the acceptance of its beliefs is modified. During the last phase a new population is reproduced using a basic set of evolutionary operators. This new population could be evaluated and the cycle continues successively, until all the population has the same space of beliefs [5]. Cycle VIP finishes when a condition of completion is introduced. The condition of term usually is reached when only a small change or none is detected in the population through several generations or when certain knowledge in the space has emerged from beliefs, as it is possible to be appreciated in Figure 2.

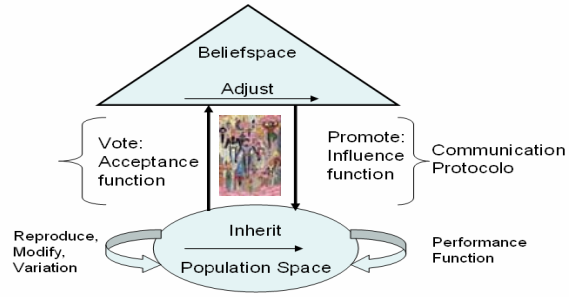

Fig. 2. Conceptual diagram of Cultural Algorithms.

2 Pop up book: A Novel Social Networking Representation

A social networking is a social structure that can be represented making use of different types from diagrams. Both more common types are the graph and dyoram. The graph is a collection of called objects vertices or nodes that are connected by called lines edges or arcs. The nodes represent individuals which sometimes are denominated actors and the edges represent the relations that exist between these actors. The relations can be of different type, like financial interchanges, sexual friendship, relations, or places of tourism. The social networks can be classified in: Dyadic, Valued, Transitive & Directed the representation of a social network can consist of one or more graphs where these graphs conceptualize the network, that is to say, the representation is made mainly on the basis of the relations that exist between the actors who conform the network. On the other hand, dioramas are representations elaborated with materials or elements in three dimensions, which sometimes represent a scene of the real life. They are located in front of a curved bottom that can so be painted on a way that simulates real surroundings and can be completed with illumination effects. In this article, we focused our attention in a practical problem of the Literature related to Modeling of Societies, the accomplishment of several societies in a Pop-up Book, which allows to include the position that keeps a society with respect to others, the capacity to establish the locations on it, allows to establish "the negotiation of the best position" for the given set of societies. The solution to this problem could be given by a sequence of generations of agents, denoted like "community". The agents can only reassigned a position with respect to the other societies, determined this according to previous behaviors, in each one of them [2]. The publication of pop-up books is a production process that involves the skills of a number of individuals. The creation of the book begins with a concept, story line and situation. Once the basics are worked out, the project goes to the "paper engineer" who takes the ideas of the author and the illustrator and puts motion into the characters and action into the scenes. They may even add sound, for example, as in a book where the opening and closing of the pages causes the teeth of a saw to run across a log. In the case of the social modeling, a Pop-up book is proposed to display elements similar to dioramas or graphs, characterizing the social networking, that is to say, in this sequence of scenarios, each one of elements who conforms the network

according to their roll and society's parameters that they have within the same one. The development of a social networking requires on one hand, of the conceptual development, and by another one, of the development of diverse similarity measures that allow establishing locations from a sustained concept in the data. But is necessary to prioritize the conceptual development and the categories of the social system model, and at the same time, thinking about the mathematical model.

Fig. 3. Representation of 1017 Societies [3] displayed first in a Dyoram, and after that, in an improved distribution created for a Pop-up Book.

3 Distributing elements within a Pop-up Book

From the point of view of the agents, this problem of combinatorial optimization is very complex, on account that the best location of a representing individual of a society is not known, with respect to the other representatives. In the algorithm proposed for the cultural change, the individuals in the space of beliefs (beliefscape) through their better paradigm (BestParadigm) are set to zero to represent the fact that the culture increases the amount of expectations associated with the location of a society with respect to others, giving an incentive to the behavior associated with the best paradigm (BestParadigm). For this purpose, we selected 1027 societies described in [3] and characterized their social behavior based on seven attributes: emotional control, ability to fight, intelligence, agility, force, resistance, and speed, these characteristics allow to describe as well as the society as the individual. The development of this tool was based on our desire to share the intuitive understanding about the treatment of a new class of systems, where individuals are able to have empathy, a reserved characteristic to people alive. We identify twelve clusters related with: Ethnicity, Technology, Cultural Identity, Commerce, Architecture, Textile Heritage, Languages, Environment Protection, Spatial Travels and Exocollections, Telepathy and Psycho Abilities, The Art of war, Holographic Societies and Class K Planets. Each cluster is reorganized in two separated groups: a group with highest interclass similarity and other with highest intraclass similarity. We propose seven

different similarity equations to organize the different clusters in the organization of the PopUp Book:

a) Language.

Ordered Symbol and None ordered Symbol and Hamming Similarity to realize disambiguation:

$$d(Q,C) = b+c \,. \tag{1}$$

b) Technology.

Simple Matching Coefficient:

$$\text{Sim}(Q,C) = 1 - \frac{b+c}{n} = \frac{a+d}{a+b+c+d} \tag{2}$$

c) Spatial Location

Euclidian Distance:

$$d(Q,C) = \sqrt{\sum_{i=1}^{n} w_i (q_i - c_i)^2} \tag{3}$$

d) Anthropometry

None ordered Symbol to Qualitative Parts and Ordered Symbol to Quantitative parts.

e) Dyoram

Nearest Neighborhood:

$$\text{sim}(Q,C) = \sum_{i=1}^{n} f(Q_i, C_i) * w_i \tag{4}$$

f) Commerce

Strategies Optimist and Pessimist:

If sim(x,y) is a similarity measure. (5)

If has a value of $\alpha = 1 - \alpha \leftrightarrow \alpha > 1/2$, this is optimist.

With $\alpha > 1 - \alpha \leftrightarrow \alpha < ½$, the strategy turn pessimist.

g) Negotiation

Asymmetric Similarity Measures:

$$\text{sim}(Q,C) = \frac{a}{a+b+c} \tag{6}$$

With these specific seven equations is possible to organize the twelve possible clusters and identify the societies on which each one is involved.

4 Experimentation

In order to be able to achieve the most efficient arrangement of individuals in a social network, we developed an atmosphere able to store the data of each one of the most representing individuals of each society; this was done with the purpose of distributing, in an optimal form, each one of the evaluated societies. One of the most interesting observed characteristics in this experiment was the diversity of the cultural patterns established by each community. The structured scenes associated with the agents cannot be reproduced in general, since they only represent a little dice in the space and time of the different societies. These represent a unique form and innovating of adaptive behavior which solves a computational problem that it does not try to cluster the societies only with a factor associated with his external appearance (genotype), it is trying to solve a computational problem that involves a complex change between the existing relations. The generated configurations can be metaphorically related to the knowledge of the behavior of the community with respect to an optimization problem (to conform to cluster culturally with other similar societies, without being of the same quadrant [3]). The main experiment consisted of detailing each one of the 1017 communities, with 500 agents, and one condition of unemployment of 50 generations, this allowed us to generate different scenes from best Pop-up book possible location in a specific cluster, which was obtained after comparing the different cultural and social similarities from each community, and determining the existing relations between each one of them [10]. The developed tool classified each one of the societies pertaining to each quadrant, with two tonalities, the strong tone for societies that included linguistic identity and a smooth tone for societies only with cultural identity, this allow to identify changes in the time respect to other societies (See Figure 4).

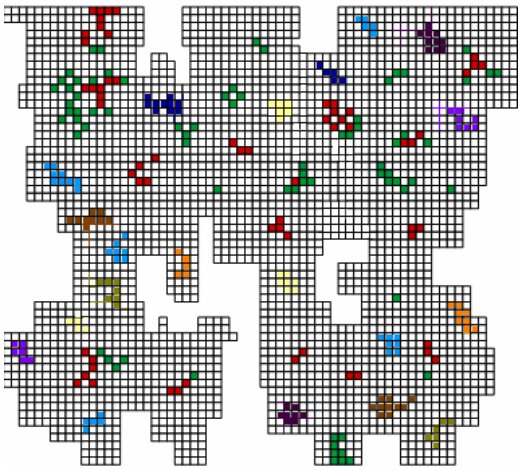

Fig. 4. Environment constructed by means of the use of Cultural Algorithms (Multiagents system) and Clustering which described the twelve kinds of societies (colors), each cluster is organized in two descriptive sets.

5 Conclusions

Using CAs, we improved the understanding to obtain the change of "best paradigm" substantially, because we appropriately classified the agent communities based on an approach to the relation that keep their attributes, this allowed us to understand that the concept of "negotiation" exists with base in the determination of the function of acceptance on the part of the rest from the communities to the proposed location for the rest of the same ones. CAs offers a powerful alternative to optimization problems and redistribution of clustering technique. For that reason, this technique provides a quite comprehensible panorama with the cultural phenomenon represented [7]. This technique allows including the possibility of generating experimental knowledge created by the community of agents for a novel dominion of application. The analysis of the level and degree of cognitive knowledge for each community is an aspect that is desired to evaluate for the future work. The answer can reside between the similarity that exists in the communication between two different cultures and as they are perceived [9]. On the other hand, to understand the true similarities that have different societies based on the characteristics that make them contributor of a cluster and as well as it allows to keep its own identity, demonstrates that the small variations go beyond phenotypic characteristics and are mainly associated to tastes and similar characteristics developed through the time [6]. A new Artificial Intelligence can take care to analyze individually these complexities that each society keeps, without forgetting that still they need methods to understand the original and particular characteristics of each society.

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