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Understanding causes and consequences of social isolation using Fireworks Algorithm

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***Abstract*: Social isolation, known as "social withdrawal" occurs when a person is away from their environment involuntary but the other manner might think otherwise. This condition occurs in people of all ages and can be a result of traumatic events in their history, such as being the victim of bullying or as part of any medical condition, such as depression. In this research, we try to explain this social concept using a novel Bioinspired Algorithm named Firework Algorithm. Four minority groups in Chihuahua and Aguascalientes, have high levels of social isolation, thereby generating between different situations, principally school drop due to the lack of equal opportunities for the majority group. This research seeks to elucidate the reasons why it happens this by simulating social behavior.**

***Keywords*:** Social isolation, Firework Algorithm, School droops, Education, .

I. Introduction

At some point in our lives, we have all felt the need to be alone and we walk away from those around us, a very normal thing. However, when this isolation is undefined and the person fails to maintain any kind of relationship with the rest of the environment, the situation should be seen as a problem that needs attention.

In this paper, the authors present comparative data regarding social compositions that characterize two entities represented by minority groups. The first entity is the state of Chihuahua and the second one the estate of Aguascalientes.

Chihuahua, a state in northern Mexico has a social composition. This is characterized by four minority: "Mormons, Mennonites, Raramuris and Immigrants to the rest of Federation", in most elementary schools, these four minority groups are not considered for various activities due to differences: ethnic, religious and cultural factors, resulting to have low rates of school performance and lack of opportunities on their communities.

Aguascalientes, a state located in central Mexico has been deeply rooted in religion in the most social composition of its population. The results in contrast are four minorities and the evangelical protestant religion without evangelical bible.
. Of these minority groups, INEGI reported a low percentage with access to higher education due to various social situations associated with blocking greater extent than to the lack of opportunity for your community. The statistics report that the 49.5% of the doctrine of the Jehovah's Witnesses did not complete basic education, 21.3% have completed primary education, and 19.8% are above average or higher education and 8.5% without education.

In this study, derived from minority groups and the low rate of access to higher education, it is required to understand the reasons why individuals have a social gathering behavior. In designing this knowledge, higher education institutions can generate new strategies and social inclusion activities at an early stage to college.

From another perspective, understand the problem of "social isolation" leads to determine and simulate social behavior by algorithm bioinspired problem related to student performance in college students , this problem is associated with a behavior of social isolation. The authors seek the reasons giving rise to this social behavior from data and analysis minority groups in society. For data analysis technique identified as specialized Fireworks analysis algorithm is used. The algorithm helps to note that students may have this status due to submit associate poor school performance. This study delves into the group of individuals in Aguascalientes.

Although we have conducted several studies to identify the specific causes of social isolation, the reality is that these are very diverse and depend on each particular situation. In some cases, it may be because the person has lived abnormal conditions in childhood, such as being bullied or has been under extreme overprotection, which prevented them to interact normally with other people of the same age, creating a lack of security and knowledge to establish new relationships as an adult. Another case, when the person has some kind of medical condition that difficult or preclude getting out. In this situation, people may find that after a medical accident completely away from other people. You can also find this condition in people who suffer from a serious medical condition, but facing away medical conditions that generate stereotypes, as some mental disorders.

For access to higher education at the Polytechnic University, it has applied in the selection process a diagnostic tool that aims to identify factors that collect traits of Emotional Intelligence to detect some conditions, which could prevent the student to interact with their environment. The instrument can assist in identifying the social isolation. The table 1 shows the instrument categories.

Category	Item
C1. Intrapersonal intelligence	Adaptability, motivation, Self-Awareness Self-regulation
C2. Leadership	Mediation and influence, Empathy
C3. Self-affirmation	Assertiveness, self-confidence and easy to relate
C4. Personal Development	Self-esteem, optimism and resilience

Table 1. Categories of income

C1: The indicator looks at the degree of flexibility and adaptability to change habits. A good score describes the control of emotions and identify sources of motivation.
C2: The indicator looks at the ability to engage in an idea. A good score describes empathy and resolution to conflict situations.
C3: Indicator of social and professional field notes the ability to take decisions and overcome. A good score facilitates social inclusion.
C4: The indicator looks at the perception we have of the world around us. A good score facilitates social inclusion.

Social inclusion included the category C3 and C4. Individuals presenting a percentage below 50 % in the categories are candidates to present a social isolation. Any result above 50 % indicates a satisfactory level of competence to the corresponding dimension. The authors consider that exist hidden patterns in social behavior.

TechFerry is a company that has experience in Predictive Business Analytics, Machine Learning & AI, Analytics of Things (AoT), Massively Scalable Applications, Big Data, Rich UI & Usability, Mobility and has published an article about Swarm intelligence as an emerging field of biologically inspired artificial intelligence based on the behavioral models of social insects such as ants, bees, wasps, termites etc.

A. Ant System

Inspired by the pheromone communication of the blind ants regarding a good path between colony and the food source in an environment, the phenomenon known as stigmergy. The probability of the ant following a certain route is not only a function of pheromone intensity but also a function of distance to that city, the function known as visibility.

B. Bees Algorithm

Inspired by the foraging behavior of the honeybees. The hive sends out the Scout bees that, when locate nectar (a sugary fluid secreted within flowers), return to the hive and communicate the other bees the fittest, the quality, distance and direction of the food source via waggle dance.

C. Gravitational search algorithm

GSA is a newly developed stochastic search algorithm based on the Newtonian gravity- "Every particle in the universe attracts every other particle with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them" and the mass interactions.

D. Fireworks Algorithm

It is inspired by observing the firework explosion.

II. Proposal Methodology: Fireworks Algorithm

Strategy: In the FA, two explosions (search) processes employed and mechanisms for keeping the diversity of sparks well designed. The explosion process of a firework viewed as a search in the local space around a specific point where the firework is set off through the sparks generated by the explosion [13].

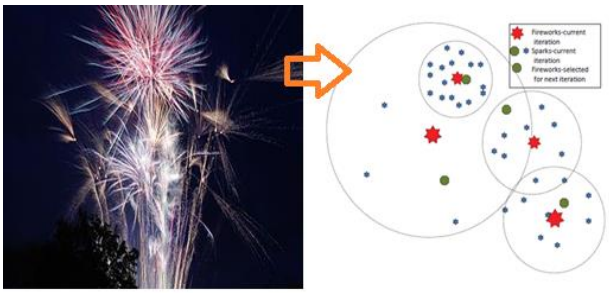


Figure 1. Fireworks Algorithm

We consider this behavior to simulate a different bio-inspired algorithms evaluated in the literature, such as algorithms Cultural and Multi-Agent Systems Algorithm Fireworks, determining that the latter properly considered clustering between communities and how to visually show how social isolation increased with time in the absence of a model of social integration, and public policies for this. Inclusive we consider evaluating a model of predator-prey game to analyze

the relationships between these minorities and the rest of the majority group [3, 4].

When a firework is set off, a shower of sparks will fill the local space around the firework [1, 2]. In our opinion, the explosion process of a firework viewed as a search in the local space around a specific point where the firework is set off through the sparks generated by the explosion. When we are asked to find a point xj satisfying f(xj) = y, we can continually set off 'fireworks' in potential space until one 'spark' targets or are fairly near the point xj. Mimicking the process of setting off fireworks, a rough framework of the FA depicted in Figure 2. In the FA, for each generation of explosion, we first select n locations, where n fireworks are set off. Then after the explosion, the locations of sparks are obtained and evaluated. When the optimal location is found, the algorithm stops. Otherwise, n other locations are selected from the current sparks and fireworks for the next generation of explosion. From Figure 2, it can be seen that the success of the FA lies in a good design of the explosion process and a proper method for selecting locations, which are elaborated in subsection 1) and subsection 2).

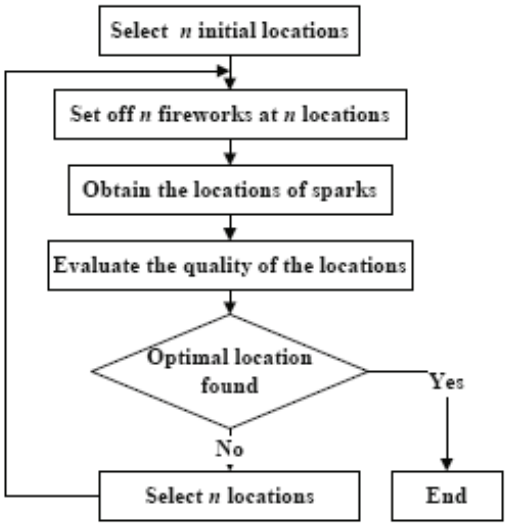
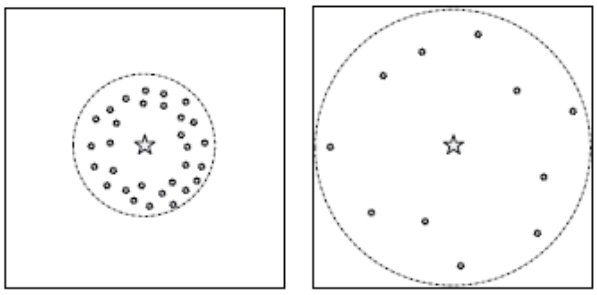


Figure 2. Framework of fireworks algorithm

1) Design of Fireworks Explosion

Through observing fireworks display, we have found two specific behaviors of fireworks explosion. When fireworks are well manufactured, numerous sparks are generated, and the sparks centralize the explosion center. In this case, we enjoy the spectacular display of the fireworks. However, for a bad firework explosion, quite a few sparks are generated, and the sparks scatter in the space. The two manners are depicted in Figure 3. From the standpoint of a search algorithm, a good firework denotes that the firework locates in a promising area, which may be close to the optimal location. Thus, it is proper to utilize more sparks to search the local area around the firework. In the contrast, a bad firework means the optimal location may be far from where the firework locates. Then, the search radius should be larger. In the FA, more sparks are generated and the explosion amplitude is smaller for a good firework, compared to a bad one [11].



(a) Good explosion (b) Bad explosion

Figure 3. Two types of fireworks explosion

Number of Sparks. Suppose the FA is designed for the general optimization problem:

$$Minimize f(x) \in R, x\min \le x \le x\max, \quad (1)$$

Where $\boldsymbol{x} = x1, x2. \ldots xd$ denotes a location in the potential space, $f(\boldsymbol{x})$ is an objective function, and $\boldsymbol{x}$min and $\boldsymbol{x}$max denote the bounds of the potential space. Then the number of sparks generated by each firework $\boldsymbol{xi}$ is defined as follows:

$$Si = m \bullet \frac{Y\max - f(xi) + \xi}{\sum_{i=1}^{n}(Y\max - f(xi)) + \xi}, \quad (2)$$

Where m is a parameter controlling the total number of sparks generated by the n fireworks, ymax = max(f(xi)) (i = 1, 2, . . ., n) is the maximum (worst) value of the objective function among the n fireworks, and ξ, which denotes the smallest constant in the computer, is utilized to avoid zero-division-error. To avoid overwhelming effects of splendid fireworks, bounds are defined in Equation 3.

$$Si = \begin{cases} round(a \bullet m) & if \quad si < am \\ ronund(b \bullet m) & if \quad si > bm \\ round(si) & otrherwise \end{cases}, a < b < 1, \quad (3)$$

Where *a* and *b* are constant parameters.

2) Amplitude of Explosion.

In contrast to the design of sparks number, the amplitude of a good firework explosion is smaller than that of a bad one. The amplitude of explosion for each firework is defined as follows.

$$Ai = \hat{A} \bullet \frac{f(xi) - Y\min + \xi}{\sum_{i=1}^{n}(f(xi) - Y\min) + \xi}, \quad (4)$$

Where Aˆ denotes the maximum explosion amplitude, and Ymin = min (f (xi)) (i =1, 2 . . . n) is the minimum (best) value of the objective function among the n fireworks.

Generating Sparks. In explosion, sparks may undergo the effects of the explosion from random z directions (dimensions). In the FA, we obtain the number of the affected directions randomly as follows.

$$z = round \ (d \bullet rand(0,1)), \quad (5)$$

Where d is the dimensionality of the location x, and rand (0, 1) is a uniform distribution over [0, 1].

The location of a spark of the firework xi is obtained using Algorithm 1. Mimicking the explosion process, a spark's location ˜xj is first generated. Then, if this location is found to fall out of the potential space, it is mapped to the potential space according to the algorithm.

Algorithm 1. Obtain the location of a spark

Initialize the location of the spark: $\tilde{x_j} = x_i$;
z=$round(d \cdot rand(0,1))$;
Randomly select z dimensions of $\tilde{x_j}$;
Calculate the displacement: $h = A_i \cdot rand(-1,1)$;
for each dimension $\tilde{x}_k^j \in$ {pre-selected z dimensions of $\tilde{x_j}$} do
  $\tilde{x}_k^j = \tilde{x}_k^j + h$;
  if $\tilde{x}_k^j < x_k^{\min}$ or $\tilde{x}_k^j > x_k^{\max}$ then
    map $\tilde{x}_k^j$ to the potential space: $\tilde{x}_k^j = x_k^{\min} + | \tilde{x}_k^j | \%(x_k^{\max} - x_k^{\min})$;
  end if
end for

Figure 4. Algorithm 1

To keep the diversity of sparks, we design another way of generating sparks Gaussian explosion, which is show in Algorithm 2. A function Gaussian(1, 1), which denotes a Gaussian distribution with mean 1 and standard deviation 1, is utilized to define the coefficient of the explosion. In our experiments, ˆm sparks of this type are generated in each explosion generation.

Algorithm 2. Obtain the location of a specific spark

Initialize the location of the spark: $\hat{x}_j = x_i$;
z=$round(d \cdot rand(0,1))$;
Randomly select z dimensions of $\hat{x}_j$;
Calculate the coefficient of Gaussian explosion: $g = Gaussian(1,1)$;
for each dimension $\hat{x}_k^j \in$ {pre-selected z dimensions of $\hat{x}_j$} do
  $\hat{x}_k^j = \hat{x}_k^j \cdot g$;
  if $\hat{x}_k^j < x_k^{\min}$ or $\hat{x}_k^j > x_k^{\max}$ then
    map $\hat{x}_k^j$ to the potential space: $\hat{x}_k^j = x_k^{\min} + | \hat{x}_k^j | \%(x_k^{\max} - x_k^{\min})$;
  end if
end for

Figure 5. Algorithm 2

3) Selection of Locations

At the beginning of each explosion generation, n locations should be selected for the fireworks explosion. In the FA, the current best location x⋆, upon which the objective function f (x⋆) is optimal among current locations, is always kept for the next explosion generation. After that, n − 1 locations are selected based on their distance to other locations to keep the diversity of sparks. The general distance between a location xi and other locations defined as follows.

$$R(xi) = \sum_{j \in K} d(xi, xj) = \sum_{j \in K} | xi - xj | \quad , \quad (6)$$

Where K is the set of all current locations of both fireworks and sparks. Then the selection probability of a location xi is defined as follows.

$$p(xi) = \frac{R(xi)}{\sum_{j \in k} R(xi)} \quad . \quad (7)$$

When calculating the distance, any distance measure can be utilized including Manhattan distance, Euclidean distance, Angle-based distance, and so on [9]. When d (xi, xj) is defined as | f (xi) − f (xj) |, the probability is equivalent to the definition of the immune density based probability in [10].

III. Study Case

The consequences of social isolation for our study describe that this Bioinspired Algorithm can describe better whom living under this condition often face different situations and problems, the most common and severe depression. However, several studies have been conducted indicate that people living in social isolation often have learning disabilities, attention and decision making [6, 7]. Table 1 described by categories aspects of evaluation applied to students who passed the preparatory course and are (1) o not (0) in First Grade Student (FGStudent) as shows Table 2.

Candidate	C3	C4	FGStudent
ASP01	54%	35%	1
ASP02	61%	61%	1
ASP03	56%	52%	0
ASP04	17%	13%	1
ASP05	75%	66%	0
ASP06	0%	0%	1
ASP07	50%	49%	1
ASP08	0%	0%	0
ASP09	62%	46%	1

Table 2. Categories of income

The C3 and C4 contains features that can be viewed in the same way each candidate. To Self-affirmation (C3): self-confidence, easy to relate and assertiveness ad Personal Development (C4): Self-esteem, optimism and resilience (Table 3). C3 Self-affirmation: This category covers aspects dimension or highly related to the social sphere. Supports decision making and improvement. A high score (greater than 50 %) in this dimension, as support strategy as lack of social isolation. C4 Personal Development: This dimension allows you to see the perception we have of the world. It relates to self-esteem and optimism about the future. A low score favors presenting social isolation.

Candidate	SC	ER	AS	ST	OP	RS
ASP01	6,1	6,4	5	3,9	7,8	1
ASP02	6,1	6,4	7,5	4,7	5,3	8,3
ASP03	6,7	4,2	6,1	5	6,7	4
ASP04	3,6	2,5	4,4	6,4	5,3	0
ASP05	5,3	6,4	6,7	7,5	9,4	5,7
ASP06	2,2	4,4	3,3	1,9	3,1	0,3
ASP07	4,7	5,8	5,3	6,4	6,9	3,7
ASP08	3,9	3,6	5,3	4,7	7,2	5,7
ASP09	7,8	6,1	8,9	8,3	7,5	6,3

Table 3. Featuring diverse aspects related with the social isolation

In the database of Aguascalientes, students enter as candidates for undergraduate studies at the UP Aguascalientes. In the initial course, students develop different activities that are defining the total score to determine whether to approve the course. However, the evaluation applied to a questionnaire emotional intelligence is important since during the course characteristics with various factors that can trigger social isolation. Social isolation incite learning problems and consequently dropouts. Figure 6. Summarizes the observed characteristics and compared with the standard ASP_IS00 candidate. In the Figure 6, we can observe as candidates 01, 06, 07 and 08 have scores below the standard that who keeps score with at least 50% of expected. The following aspects related to social isolation are:

- Self-confidence: Believing in one's own abilities, an issue impels them to act, overcome. This aspect relies on decision making and reduces social isolation when acting calmly to changes and unforeseen
- Easy to relate: It is the ability to establish and maintain good relations with the environment. In social isolation, it is difficult to show emotions and feelings, so they are not comfortable in a group.
- Assertiveness: It is the ability to prevail without making use of a useless aggressiveness. A high level of this capacity is far to the social isolation.
- Self-esteem: This aspect is part of value judgment on itself. It also allows recognizing the strengths and weaknesses of each person. It allows freedom from the opinions of others and emphasizes the feeling of being loved and valued.
- Optimism: This aspect is a consequence of emotional intelligence. This aspect relies on identified to be good about yourself and others gives greater confidence about the future. This aspect relies on seeing the bright side of things; think the best is yet to come. Finally believe that failures are part of the risks and life learning is obtained.
- Resilience: The aspect of resilience is one of the most critical because it is the ability to "rise" after heavy events as a disappointment or failure. The have a good level of resistance cannot be social isolation or out of this.

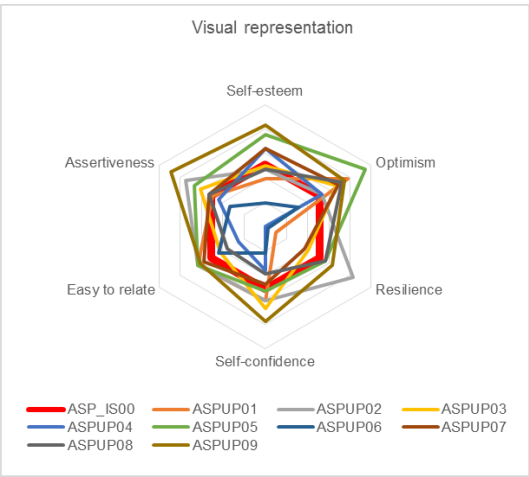


Figure 6. Visual representation of the sample, featuring diverse aspects as Self-esteem, Optimism, Resilience, Self-confidence and Easy to relate

The listed candidates have a tendency to social isolation. This is because when we interact with our environment, our brain does not receive the appropriate stimulus and does not work properly. For this reason, people who live in social isolation may seem a bit clumsy or slow when making decisions [9, 10].

For proper testing our algorithm Fireworks analyze a database related to dropout in Chihuahua, a state in northern Mexico, with four minorities, two ethnic, religious and one for ubiquity. To do this we detail each of the situations that occur in schools first level and thus try to determine how you could view each student to discover whether there were clusters among minorities or each decided survive in a lonely way the day-by-day according at its members [8].

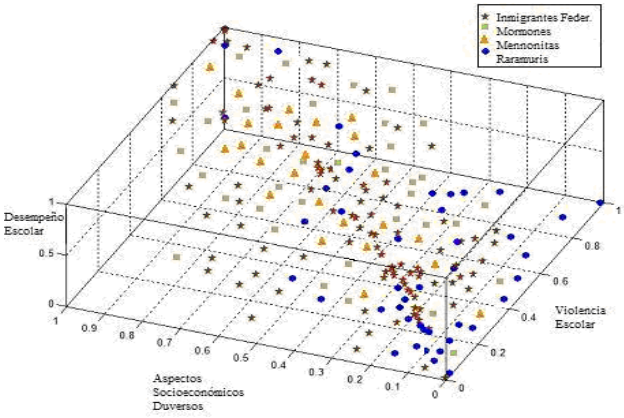


Figure 7. Visual representation of the sample, featuring diverse aspects as socioeconomic, school violence, including social locking and reflected in school.

Several situations cause dropouts. This due to social cohesion and the time. Most of the communities that make Chihuahua cannot be justified as a cause of dropout. Only the relationship of coexistence with the largest group among the various causes unemployment affecting 9.87% of the population economically, for example the state of Chihuahua is reaching a figure of 14.17% in January 2012. The other aspects are primarily involved with food because indigenous groups have a lower percent (21%) than the average caloric intake of the majority group.

Once interviewed in written form, the selected sample a model of social distance Bogardo (See Figure 7), which reflected us variant forms of ascertaining the situation in each of the four minorities analyzed in Chihuahua was developed and how it affects the daily lives of people who are not considered part of the majority group.

IV. Recommendations of our research

Is necessary considering many contemplations with respect to this research. The first is that while there are no adequate social programs that affect the minority population. May not achieve an integration model that allows to give the children and young people, equal opportunities, one of the crucial aspects in this proposed model using bio-inspired algorithm was to determine the number of individuals in these communities that were continuing at the highest level or graduate school was reduced to values less than 1%.

In Aguascalientes, for the initial course, the recommendation is to identify cases of social isolation from the interview process. The goal is that students have to be greater monitoring of these minorities. It is required that an integrative model that allows students to be treated with equal opportunities is proposed. It is necessary to provide alternatives for them to continue university studies.

A public policy proposal for its implementation, would be a self-evaluation as follows: If you've noticed that you live under this condition and you really want out of it, the first thing to do is find the social circles in which you feel comfortable and you start to visit. For example, if you like, dogs and you have one; you can take a walk in the park. This way, you will begin to socialize with other dog owners. To exit the social isolation is essential that you open to new experiences, to learn to get out of your comfort zone and put yourself in new situations.

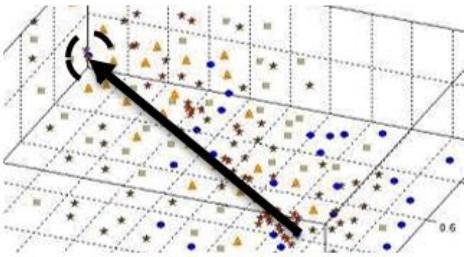
One of the important aspects that are blurred in this study, are individuals in communities in urban areas. These areas are considered not owning a pet to feel they could not display it. While people in rural areas had on average up to three pets, even squirrels, raccoons and spotted salamanders, unlike dogs, hamsters and fish ornament popular among children related to the majority social group.

There are few studies that adequately detail the use of a bioinspired algorithm to properly classify social aspects, and we believe it will be useful to predict properly serious problems such as bullying, social discrimination, or in our case the social isolation that many of cases carries with him as the final result suicide. In some social modelling groups in videogames inclusive in serious games as “The Tribe”, the people more different has less social skills or is considerate more vulnerable to die, simulations analyzed with another bioinspired algorithms as in [5]

In future research, we consider another society with much multiversity as China, India or Federation Russia with almost over 47 minorities and analyze the social politic publics applied on them. We try to simulate more minority groups. in Mexico, for example, exists 57 dialects spoken, and people that descending from African roots as the Seminoles in Coahuila (see Figure 8) and Scottish and Welsh pirates as in Tabasco, but these minority groups try to hide these situations in the school, the reason the social isolation, a pendent signature to the next generation.

Figure 8. A Coahuila Seminole Lass

In another way to improve our future research, we will be use a model based on a colored graph to understand the similarity between specific communities without descriptive values associated with locations, as the purpose in [12], with this model we featuring different attributes in a society as is shown in Figure 9 (a). With this descriptive model we try to explain diverse situations associated with a gender role in a community and prevent complex social behaviors as cyberbullying, in our case prevent discrimination associated with not have a written language.



(a) Visual representation

(b) Isolation problem

Figure 9. Comparison between visual representation and solution search isolation problem

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Alberto OCHOA Bs'94 Eng.Master'00; PhD'04. Postdoctoral Researcher'06 & Industrial Postdoctoral Research'09). He joined at Juarez City University in 2008. He has 11 books, 37 chapters in books related with AI and 287 papers related principally with Logistics and Social Modelling using different Artificial Intelligence Techniques. He has review of two important Journals from Elsevier: Applied Soft Computing and Computers in Human Behavior. His research interests include ubiquitous compute, evolutionary computation, natural processing language, social modeling, anthropometrics characterization and Social Data Mining. In his second Postdoctoral Research participated in an internship in ISTC-CNR in Rome (2009), Italy. In May 2016, begin a Sabbatical year in Super Computing Center at UPC (Catalonia) and an internship in International University of Monaco.

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