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Finding Scope for Opinion Formation Based Optimization in Steganography

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Abstract— To send file in a secure way while maintaining its integrity and confidentiality is the desire of every sender. Substitution technique of steganography has been proven to achieve this but with limited functionalities. In order to overcome limitations of substitution technique, it needs to be optimized. This paper discuss and analyze the application of social impact theory based optimizer in substitution technique. The cover file chosen as audio in wav format.

Keywords— Opinion Formation, Social Impact Theory, Substitution Technique, Audio Steganography

I. INTRODUCTION

Being easy to understand and simple to implement, substitution technique of implementing steganography has gain vide popularity among users as well as attackers. As per the work done by Mr.Mazdak,two basic limitations of substitution techniques were reported as follows[1]:

a. Prone to Intentional attacks as collecting and combining LSB's and look for different arrangements so as if it gives some meaningful message.
b. Prone to unintentional attacks like noise as mostly noises target LSB's thereby changing their values which in turn results in loss of hidden data

Objective of the steganography got revealed even if the attackers got suspicious about the presence of some embedded message ; however he not be knowing the content of hidden message[2].

The solution to these two problems lies in targeting higher layer LSB's for substitution; however altering the higher layered LSB's will introduce significant distortion in stego file. This leads to a tradeoff between imperceptibility and robustness. Here comes the requirement of optimization. An optimizer should guide the embedding process in such a way that robustness should be maintained while keeping a tolerable value of imperceptibility.

The nature has so much inspirational behaviors which if modeled computationally and mathematically will give remarkable results. Social Impact Theory is one of such formulation based on human opinion theory[3].

As per Latanes, the attitude of individual changes in a population as a result of interactive, reciprocal and recursive operations[4].

Macas et.al., modified the simulation done by Nowak's Szamrej and Latane's [3] and introduced the concept of fitness function[5].

II. OPINION FORMATION MODEL

Most of the optimization processes got inspired from decision making process in human societies. Generally the consequence of decision making of an individual is some type of opinion., that's why the process is called opinion formation. Various opinion formation models are there in computational psychology.

In this paper, the focus is given on the work of Nowak-Szamrej-Latan´e [3]. They described Social Impact Theory in context of optimizing the things in computational problems.

A. Nowak–Szamrej–Latan´e models

Social effect is any of the awesome kind of modifications in physiological states and subjective emotions, reasons, emotions, cognitions, ideals, values and conduct, that occur in an character, human or animal, because of the real, implied, or imagined presence or actions of other people [8]. Latan´e's Dynamic Social Impact Theory attempts to explain and are expecting the diffusion of beliefs through social structures. A society is built up of interacting individuals. As per Latan´e's, the individuals follow principle of social impact and the society thus formulated is self organizing. The response of a social individual is affected by three factors: Strength, Immediacy and number [7].

Strength is a property of affecting people which says how vital the impacting individual is to an affected individual.

Immediacy speaks to the spatial closeness of the impacting people from the affected person.

Number depicts that the present one is affected by what number of people.

Initially, This shape turned into mimicked by way of Nowak et al. [3], the man or woman's mind-set, indicators of strength (persuasiveness and supportiveness) and its region within the social shape. The affiliation of the simulation is taking after as follows:

Each individual i holds a binary opinion $S_i \in \{0, 1\}$.

Has allocated two power elements: persuasiveness Pi, the capacity to induce people with contradicting convictions to modify their minds, and supportiveness Si, the ability to present social help to individuals with comparative convictions. It changed into assumed in Nowak et al. [2] that Pi ∈ (zero; 100) and Si ∈ (zero; one hundred) are reassigned haphazardly after every mentality trade.

The concept of instantaneousness is built up through organizing the humans in a spatial network of cells. The instantaneousness of human beings i and j is spoken to as reversed Euclidean physical distance 1ijbetween the comparing cells. In addition, each man or woman i has appointed its social neighborhood Ni - an association of people which can impact the man or woman i. At each cycle, each person consolidated fractional social influences into one combination social effect. Every individual ought to effect every other at the start. Along these strains, the social community become the complete population. At

Every emphasis, the pals of i are partitioned into two disjoint subsets, persuaders Pi with feeling inverse to si and supporters Si with the similar estimation of assessment.

The combination social impact Ii that ith character reports from its social community Ni are [9]:

The principle time period of the proper hand side of Eq. (1) represents the strain in prefer of the sentiment alternate. It is the aggregate influential impact IPi on a solitary individual i whose assets are human beings with exceptional assessment:

wherein gip indicates the sort of the persuasive effect function, gp is a persuasiveness scaling function and gδ is a few increasing function of the gap.

The second time period of the right hand aspect of Eq. (1) represents the strain to maintain the modern-day opinion. It is the overall supportive effect on a unmarried man or woman i whose sources are people sharing the opinion with man or woman

where gis signifies the form of the supportive effect characteristic and gs is the supportiveness scaling function. The precise varieties of the capabilities gp, gs , gip, gis, gδ differ from one NSL version to some other. If the supportive impact ISi is smaller than the persuasive effect IPi , the full social effect Ii is fine, the affect of the people that maintain exclusive opinion is greater, and the man or woman i adjustments its opinion:

two strength factors were allocated to each individual: persuasiveness P_i which is the ability to induce and alter the minds of individuals with contradicting convictions, and supportiveness S_i, is the ability to give social support to individuals with comparative convictions. Nowak et al. [2] assumed that that $P_i \in (0; 100)$ and $S_i \in (0; 100)$ are reassigned haphazardly whenever there is a change in opinion.

In order to mimic the concept of immediacy, the individuals were supposed to organized in a spatial network. The immediacy of two people i and j is calculated using reversed Euclidean physical distance $\frac{1}{\delta_{ij}}$ between the comparing cells. In addition, every individual i decides its social neighborhood which is an arrangement of people that can influence the individual i (N_i). At each cycle, each individual consolidated fractional social impacts into one aggregate social impact. Every individual could impact each other originally. Every emphasis, the neighbors of i are partitioned into two disjoint subsets, persuaders P_i with feeling inverse to si and supporters S_i with the similar estimation of assessment.

The aggregate social impact I_i that i^{th} individual experiences from its social neighborhood N_i are [9]:

$$I_i = I_{P_i} - I_{S_i} \qquad \text{(Eq. 1)}$$

The principle term of the right hand side of Eq. (1) represents the pressure in favor of the sentiment change. It is the aggregate influential impact I_{Pi} on a solitary individual i whose sources are people with different assessment[9]:

$$I_{P_i} = g_{ip}\left[\sum_{j \in P_i} \frac{g_P(P_j)}{g_\delta(\delta_{ij})}\right] \qquad \text{(Eq. 2)}$$

where g_{ip} signifies the type of the persuasive impact function, g_p is a persuasiveness scaling function and g_δ is some increasing function of the distance.

The second term of the right hand side of Eq. (1) represents the pressure to keep the current opinion. It is the total supportive impact on a single individual i whose sources are individuals sharing the opinion with individual[9]:

$$I_{S_i} = g_{is}\left[\sum_{j \in S_i} \frac{g_s(S_j)}{g_\delta(\delta_{ij})}\right] \qquad \text{(Eq. 3)}$$

where g_{is} signifies the type of the supportive impact function and g_s is the supportiveness scaling function. The particular forms of the functions g_p, g_s , g_{ip}, g_{is}, g_δ differ from one NSL model to another. If the supportive impact I_{Si} is smaller than the persuasive impact I_{Pi} , the total social impact I_i is positive, the influence of the individuals that hold different opinion is greater, and the individual i changes its opinion[9]:

$$s_i(t+1) = \begin{cases} 1 - s_i(t) & if \;\; I_{Pi} > I_{Si} \;\; (i.e.\ I_i > 0), \\ s_i(t) & otherwise \end{cases} \qquad \text{(Eq. 4)}$$

During simulation, all people change (or not) their personalities and the process leads to an equilibrium state. In most simulations, the value representing persuasiveness, supportiveness or the strength is randomly re-initialized after opinion change. The irregular resetting of the strength parameters is a solid improvement. The future adjustments of Opinion Formation models are not "artificial", but they make the models significantly more regular. The genuine individuals likewise do not change their social strength arbitrarily, but conditionally on an estimation of an unpredictional and inconceivable capacity.

III. PROPOSED WORK

The SITO concept discussed in previous section is applied on substitution technique in audio steganography with the intention of optimizing the result. The proposed algorithm is as follows:

Let Q = {S_1, S_2, . . . , S_N} be a set of L binary vectors Si ∈ $\{0, 1\}^D$, i = 1 . . . L that encode candidate solutions. In a graph, each solution represents a social topology which is associated with one vertex. The topological graph is additionally utilized for distance computation of vertex i, N_i, as a set of vertices connected to the vertex i.

Each vector S_j from the population has assigned its cost value $f_j = f(S_j)$ and its strength value q_j, which is generally derived from the cost value of solution S_j and from the cost values of all the other solutions from Q. There are boundless ways to figure out the strength of an individual to follow the principle of higher strength of fitter individual. One decision can be to let the strength value to be a linearly diminishing function of the cost value:

$$q_j = \frac{f_{max} - f_j}{f_{max} - f_{min}} \qquad \text{(Eq.5)}$$

where f_{max} and f_{min} are maximum and minimum values of the cost function accomplished by the current worst and the current best individual, respectively. One possible choice is – the social strength q_{ji} by which the individual j affects the individual i depends on their cost values according to the following

Formula:

$$q_j = \max(f_i - f_j, 0) \qquad \text{(Eq.6)}$$

where f_i= and f_j are the cost estimations of the individual i j, respectively. This condition implies that fitter individual have a non-zero influence on less fitter individual and is not influenced by it. This sort of mapping is utilized here in mix with improved SITO algorithm (SSITO). This kind of mapping causes considerably more grounded contrasts between the social influence of good and bad solutions and prompts phenomenon analogical to higher selection pressure known from evolutionary computation. Note that the cost-strength mapping can be comprehended as deteriorated instance of the pair wise strength with $q_{ji} = q_j$. Clearly, there is limitless number of conceivable cost–strength mappings and some of them can prompt to much better enhancement capabilities, despite the fact that it is hard to formally infer or support the optimal mapping.

First, Q(0) = {$S_i(0)$}i=1...L ,the initial population is made randomly and all cost and strength values are figured out. At every emphasis, vector $S_i(t)$ is changed into another vector $S_i(t+1)$ utilizing an update rule. The a-th bit of the vector S_i is updated according to its value, the a-th bit of vector values are placed in i's neighborhood as per their strength values. After all S_i vectors updation, the computation of new values of cost and strength can be done and the next emphasis is performed. A new search strategy can be achieved by the whole iterative process with which the binary space can be sampled using the set of candidate solutions Q(t). Here, the halting situation is maximum number of iterations, but it can be whatever other paradigm known from the area of population based metaheuristics (cost increase, diversity degradation, etc.)

A. Update rule

A significant number of OF models consolidate the social information utilizing the thought of social impact function (see Eq. (1)) that numerically portrays the aggregate impact of social neighborhood of a specific person. The primary thought is: A candidate solution is impacted by its social neighborhood. The neighbors with higher strength value have higher influence on the impact value. A positive impact value leads to preference of a^{th} component inversion. Contrary, the negative values have supportive character and leads to preference of keeping the component value.

Considering component a of candidate solution $S_i(t)$, the impact function

$$I_i^a(t) = I\left(S_i^a(t), \{S_j^a(t)\}_{j\in N_i(t)}, \{q_{ji}(t)\}_{j\in N_i(t)}\right) \qquad \text{(Eq.7)}$$

relies on the component a of candidate solutions from i's neighborhood

$\{S^a_j(t)\}_{j\in Ni(t)}$ and on strength value of these solutions $\{q^j_i(t)\}_{j\in Ni(t)}$. The update rule additionally utilizes the estimation of the impact function to create new state for S^a_i. The analogy of Eq. (4) - "a person changes its opinion if a positive value has been taken by an impact function" is used by a simplest deterministic update rule as:

$$s_i^a(t+1) = \begin{cases} 1 - s_i^a(t) & if\ \ I_{Pi}^a > I_{Si}^a\ \ (i.e.\ I_i^a > 0), \\ s_i^a(t) & otherwise \end{cases} \qquad \text{(Eq.8)}$$

Here, the OF models will be followed by the specific type of the impact function described in previous section. The above depicted algorithm overlooks the aspect of individual choice procedures (e.g. experience, memory, inferring mechanisms) and numerous obscure procedures. These can be partly displayed by an arbitrary clamor. Additionally, randomness is fundamental part of any optimization metaheuristic. Subsequently, the random noise is added in our optimizers. The least complex approach to include the random element is to mutate all S^a_i with likelihood of spontaneous opinion inversion (mutation rate) $\kappa \ll 1$. This can keep the diversity and avoid a premature convergence.

B. Algorithm

Algorithm for embedding:

Step 1: Get the secret message and cover audio file as input and get their temporary copies.

Step 2: convert the copies of message as well as audio in equivalent binary format and
initialize len=length(message).
count=len

Step 3: Hide message in audio by substituting 5^{th} and 6^{th} LSB's of each byte of the audio sample with

message bits.
update count=count-2;
Step 4: call SITO function for recently processed audio sample and get it optimized.
move to next audio sample
Step 5: Repeat step 3 and 4 till count >0.
Step 6: Hide len in last 4 audio samples using step 3 and 4.

Function SITO()
initialize all $S_i(0)$
while (stop when condition is not TRUE)
do
for all i
evaluate $f_i(t)=f(S_i(t))$
end for
for all I,j
compute strength $q_{ji} = q\left(f_i(t), f_j(t)\ j \neq i\right)$
end for
for all i,a
compute $I_i^a(t) = I\left(S_i^a(t), \left\{S_j^a(t)\right\}_{j \in N_i(t)}, \left\{q_{ji}(t)\right\}_{j \in N_i(t)}\right)$
compute $S_i^a(t+1)$ from $I_i^a(t)$
invert each bit $S_i^a(t+1)$ randomly with probability (mutation rate) k
end for
end while

IV. CONCLUSIONS

The combination of social optimization techniques is supposed to give better results. The Stego file thus obtained would be having low noise and hard to detect presence of message.

REFERENCES

[1] Mazdak, Z., A.M. Azizah, B.A. Rabiah and M.Z.Akram and M.Zeki : A genetic algorithm based approach for audio steganopgraphy: World Academic Science. Eng. Technol., pp. 360-363, 2009.

[2] Adel Almohammad, Steganography-Based Secret and Reliable Communications: Improving Stenographic Capacity and Imperceptibility (Brunel University, 2010).

[3] Andrzej Nowak et.al: From Private Attitude to Public Opinion: A Dynamic Theory of Social Impact, Psychological Review,1990, Vol.-97 No.-3,pp: 362-376.

[4] B.Latane, The psychology of social impact,Am.Psychol. 36 (1981) 343-356.

[5] M.Macas, L.Lhotska, Social Impact and Optimization,International Journal of Computational Intelligence Research, 4 (2008) 129-136.

[6] Martin Macas et al.,: Binary Social Impact Theory based Optimization and its Applications in Pattern Recognition, Neurocomputing 132(2014), pp:85-96.

[7] B. Latan´e, Dynamic social impact: The creation of culture by communication, The Journal of Communication 46 (1996) 13–25

[8] J.Kennedy,"Thinking is Social:Experiments with adaptive culture model", J.Conflict Resolution 42 (1998) 56-76.

[9] M.Lewenstein,A.Nowak,B.Latane,"Statistical Mechanics of Social Impact ", Physical Review A45 (1992), pp:763-776.

