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Steganography Using PSO Based Hybrid Algorithm

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Abstract: In this paper we have presented the steganography by using PSO based hybrid algorithm. As steganography is the process of hiding the data in the cover media but it suffers from security problems. For hiding the data effectively in the images we will apply the PSO algorithm which will help us to find the optimal pixels in the cover media where we can hide the data. We will use the simple PSO and PSO based hybrid algorithm i.e. PSO with ACO to hide the data in the cover image which will help in maintaining quality of the image and its security. The quality and the security of the image is calculated for Simple PSO, simple ACO and PSO with ACO is compared .The results we obtain shows that hybrid algorithm is better than others.

Keywords: Particle Swarm optimization, Least Significant Bit, Steganography, Ant Colony Optimization.

I. INTRODUCTION

Steganography is the technique of hiding the existence of data. There are various techniques which we use in steganography for hiding the data in the cover media. These techniques will make it difficult to detect that there is a hidden message inside an cover media. In this way we are hiding the message as well as hiding its existence .Steganography is often confused with the term cryptography, both transfer our data to remote place safely but the is major difference between them that is in case of cryptography anybody can know that two parties are communicating in secret but it is not so in case of steganography. Images in which we hide the secret data are known as "Stego-Images" and the innocent image which we use as cover media is known as carrier or carrier image. There are two fundamental characteristics of the images that are: Quality and Security of image. While hiding the data we have to maintain these two characteristics. The main motive of steganography is to keep the data safe from the notice of hackers. All the digital file formats can be used as cover images but the image and audio files are more suitable because of their high degree of redundancy (Avinash Parsad Kshitij, 2010). Various file formats are:

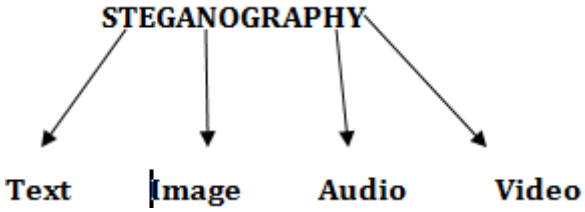


Fig: 1 Steganographic Categories

There are no of approaches for hiding the data in images (C.R.Chowdary,2005): Least Significant Bit, Masking and Filtering and Transform Technique. The basic model of steganography includes cover image, Secret message, technique/algorithm and stego media.

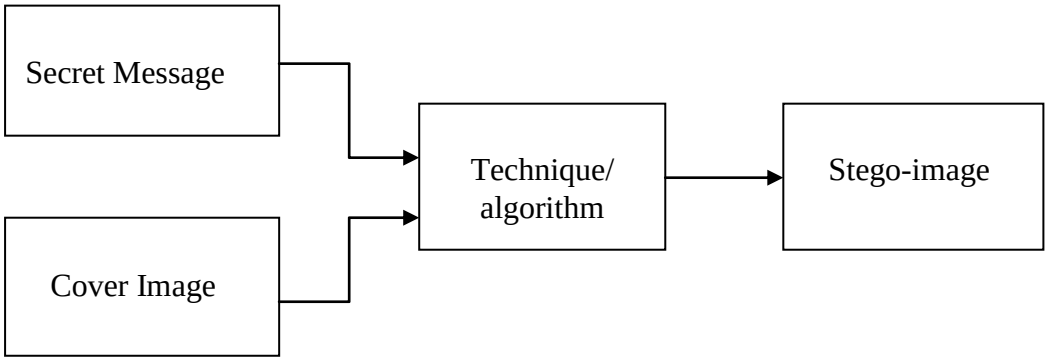


Fig: 2 Steganography Model

In this paper we purposed a new method to increase the security and quality of our cover image. We have applied the steganography on the simple PSO, ACO and PSO with ACO. The results of the existing methods are compared with purposed hybrid algorithm which shows that purposed method is better than existing.

II. RELATED WORK

Ching-Sheng Hsu et al. uses the Least Significant Technique of data hiding. The secret message is embedded into the last bits of the cover image to protect it from unauthorized users. For maintaining the quality we have to keep in mind the two main issues that are quality and security. For this researcher uses optimization matrix that helps in finding the optimal points where we can hide the data .For obtaining optimal matrix they uses optimization algorithm here the used ACO(Ant Colony Optimization). (Ching-Sheng Hsu, 2010)

Maijid kiamini et al. novel method is presented to embed the message into the cover image so that hacker will not notice the existence of the data. This uses the basic concept of the LSB method and in order to improve the quality and security of the image, the cover image is splited into n blocks of 8*8 pixels and message into n partitions. For finding the optimal solutions or optimal matrix we use Particle Swarm Optimization (PSO) Algorithm. The results show that this method is better than the JPEG and Quantitization Table Modification method. (Maijid Kiamini, 2008)

H. Sadjogi Yazdi et al. This paper presents a technique for detecting the lips in the color images using PSO.PSO is used to find optimized solution. The main motive behind this method is that lip has high values of Cr and low values of Cb. The results shows that we have achieved 92% correction rate as compare to previous approach and 11 % increase in lip detection. (H. Sadjogi Yazdi, 2008)

III. PROPOSED WORK

In this part we are presenting the purposed approach. In the purposed approach we apply the ACO algorithm to the cover image, after passing the image through ACO, the image it returns is the optimized edged image. Then we use this image as input to the PSO algorithm, and then image is passed through the 2D FIR filter which returns image. The image we obtained from the filter is the image free from noise. After this we apply the steganography to the obtained image from filter to hide our secret data in it and then we calculated the PSNR, MSE and BER values of the stego image, reverse procedure is followed to obtain the secret data from the stego image. Low BER rate of the image means is that the secret data we obtain after applying reverse procedure is with high accuracy.

A. PARTICLE SWARM OPTIMIZATION

PSO (Particle Swarm Optimization) algorithm was invented by James Kennedy (social-psychologist) and Russell Eberhart (electrical engineer) in 1995. It is bas on the intelligency of swarms (that are birds, fish). It uses the social interaction to solve the problems. PSO is a very simple algorithm because it has very few parameters. There are number of particles from swarm that are moving around the search space and looking for the best solution. Very particle in the swarm is treated as point. PSO keep track of the variables named pbest and gbest.

The position and velocity of the particles are:

$X_i = \{x_{i0}, x_{i1}, x_{i2} \ldots x_{iD-1}\}$

$V_{i=\{}v_{i0}, v_{i1}, v_{i2}, \ldots, v_{iD-1}\}$

PSO equations as in [4]:

$V_i = w \times V_i + c_1 \times rand_1 \times (pbest_i - X_i) + c_2 \times rand_2 \times (gbest - X_i)$

$X_i = X_i + V_i$

$W = W_{max} - n \times W_{max} - W_{min} / iter\_max$

Where c1 and c2 are the acceleration constants, W_{max} and W_{min} inertia weight, iter_max is the maximum iteration number and rand1 and rand2 are two random real numbers. PSNR is calculated as below:

PSNR= (10 * log10 (255. ^2/mse));

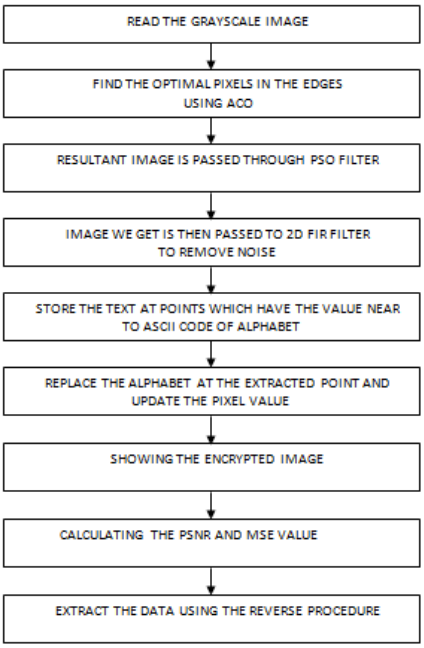
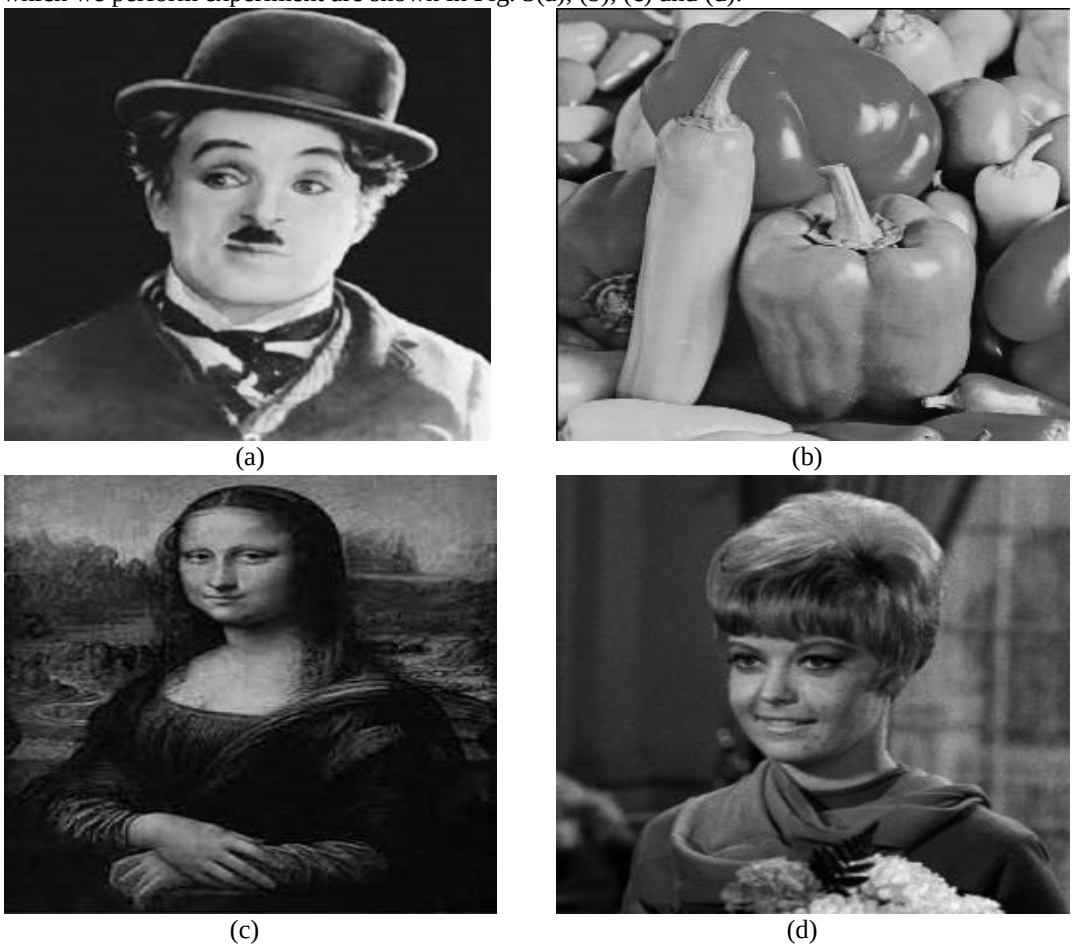


Fig: 3 Flow chart of purposed technique

III. EXPERIMENTAL RESULTS

We have performed various experiments on the purposed method. In our experiment we have tested the cover images of 256*256 sizes and are gray scale images. But the calculation time is large so we resize our images to 128*128.The images on which we perform experiment are shown in Fig. 3(a), (b), (c) and (d).

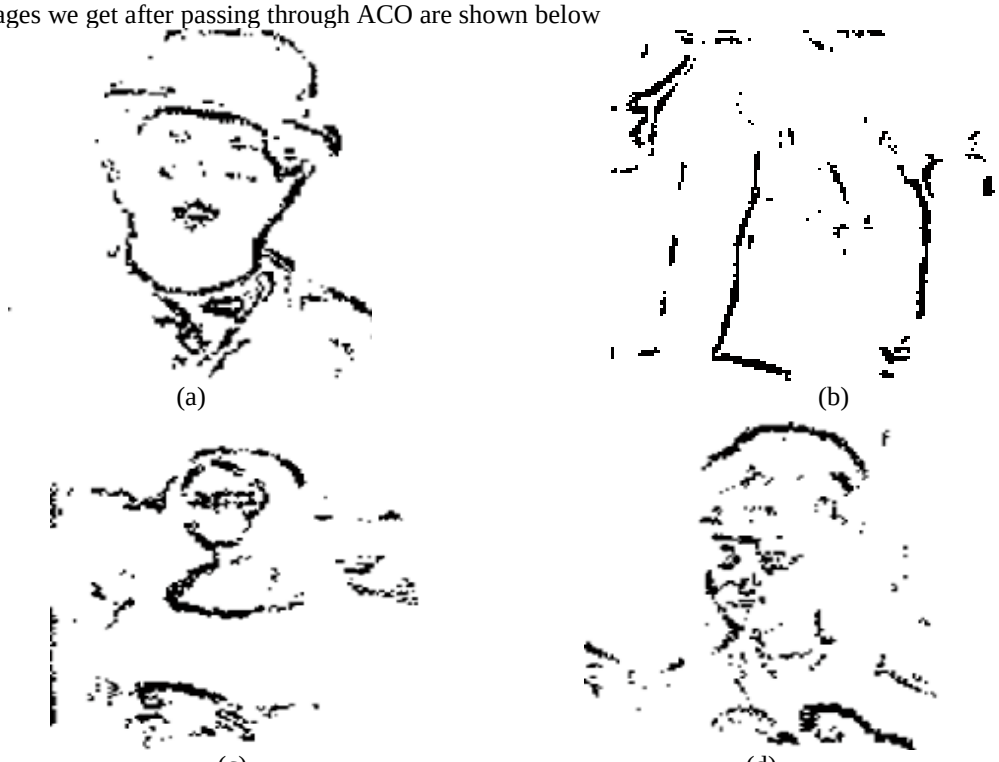


(a) (b)

(c) (d)

Fig: 4.1 Images on which we perform experiment

The cover images we get after passing through ACO are shown below



(a) (b)

(c) (d)

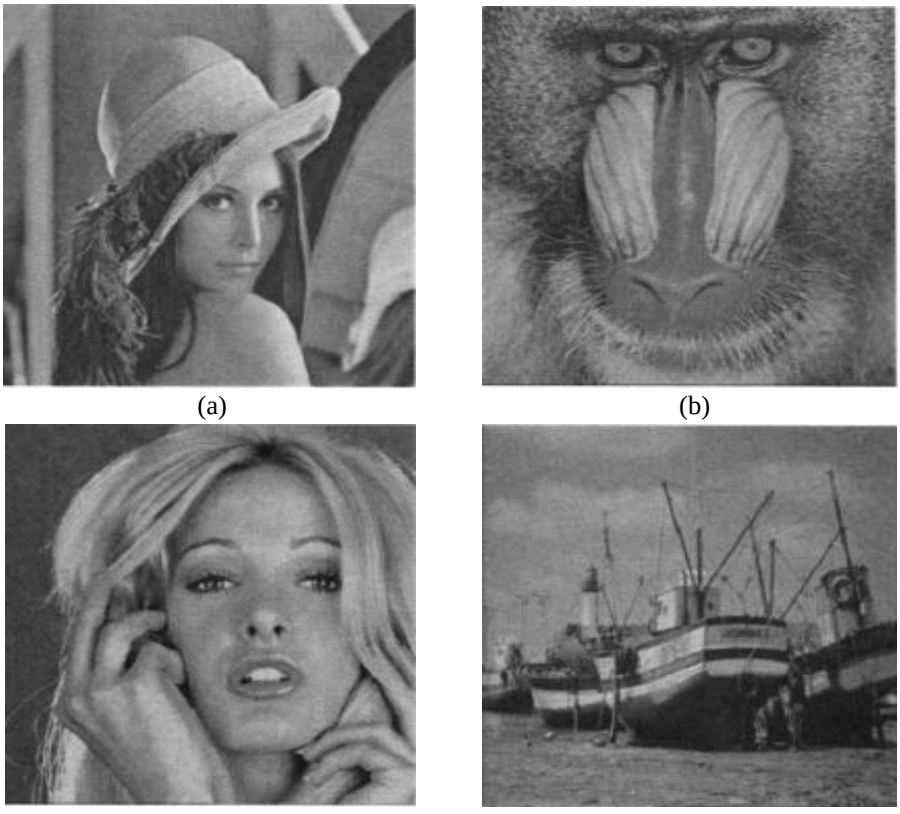
Fig: 4.2 Cover images we pass through PSO

We use the PSNR to evaluate the performance. Calculated PSNR values of the different images are shown in the Table 1 .It is clear from table from previous work done our hybrid approach is better.

Table 1 PSNR values of different images using hybrid method

S.No.	Image Name	PSNR
1	Image1	38.0967
2	Image2	36.8201
3	Image3	38.7111
4	Image4	39.7631

We have compared the results of the hybrid method with existing approach which shows that our hybrid approach is better than existing approach. Table 2 below shows the results. The images used for comparing results of two approaches are



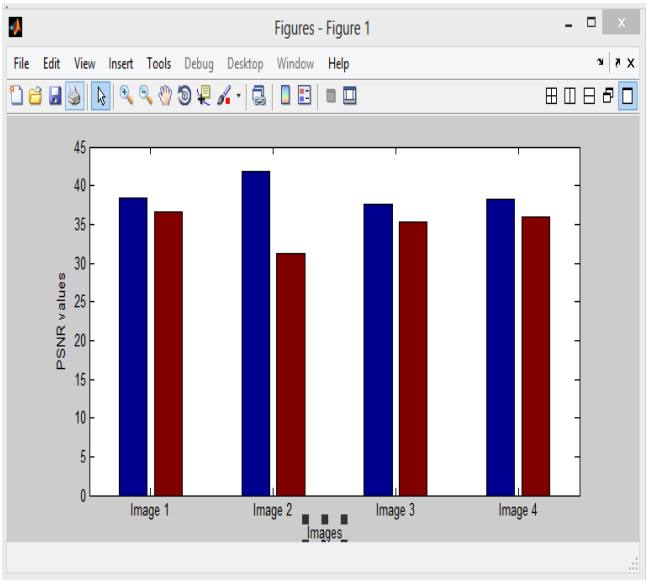
(a) (b)

(c) (d)

Fig: 4 Cover images for comparison of hybrid technique with existing lena.png (a), baboon.png (b), woman.png(c) and boat.png (d) .

Table 2 Comparison of PSNR values with hybrid and existing approach **(Maijid Kiamini, 2008)** with these images.

S.No.	Image Name	Purposed approach	Existing approach
1	Lena	38.4168	36.571
2	Baboon	41.7521	31.144
3	Woman	37.5116	35.353
4	Boat	38.2886	35.877



Graphical representation of comparison between two approaches

IV. CONCLUSION AND FUTURE WORK

Steganography provides a way to hide the data in the cover media i.e. images. While hiding data in the images two main things that we have to keep are the security and quality of the images. In this paper we have purposed a new technique for data hiding that is using the hybrid algorithm. This hybrid algorithm uses the PSO with ACO. The experimental results show that purposed method gives better results than existing methods i.e. with simple PSO and ACO. Results provide increased security and quality of the image that is calculated using PSNR and MSE values. In future we will implement PSO with any other optimization algorithm or improved PSO to get more efficient results and also the calculation time for the images of 256*256 can be improved.

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