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An approach of Information Hiding by the Guidance of Noise

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Abstract - *The proposed methodology is based on the deliberate addition of the noise to image in varying level. The PkDp frame design is utilized to hide the payload into the carrier image. The strategy is to embed the data by portioning the picture in same sized bin of same size. Second variation embedding the data into the entire image without any segmentation. The data is finally hidden in the histogram peaks and location map is formed. The simulation is implemented using MATLAB and four standard images are tested. The practical results show that the proposed methodology is acceptable.*

Key Words: **PkDp algorithm, PSNR, histogram peaks, data hiding, location map.**

1.INTRODUCTION

The histogram shifting method is one of the most common methods used in reversible data hiding area. The global digital village is marked by high amount of the data exchange. There is a trend of copy right violation. There is modern demand of the protection of data over public channel like internet. This has motivated many modern researchers to develop an efficient and leak proof content hiding. This is called data security. The promising part of the secret message embedding is known as the steganography. The data is present in the transmitted image and even then, this goes detection free. In the recent past the modern research in the field of steganography has gained the momentum. The classical methods like LSB (least significant bit) hiding method is based on the changes in bit in least significant bit position. The image containing the secret data cannot be easily. Transformation is facilitated by modern algorithms like DWT, DFT and DCT. The modern methods help to maintain high quality image. The PSNR value above

40 DB goes without detection by human perception. Steganography has a bright past. The art was practiced at political level to keep the messages secret. The modern cryptography is ciphered text. It is very difficult to detect without training. The steganography can be classified on the basis of the contents used for hiding the secret message. The popular categories are semantic steganography, audio based, image based etc. [2] [1]

1.1 Histogram shifting based reversible data hiding

Kar Pearson was a pioneering author who introduced histogram method of accurate representation of the data in the number form. There is a sharp difference between the bar graph and histogram. The bar has two variables and the histogram represents one variable. The entire range is converted into bins that are a container. The frequency of the data falling in the range constitutes a histogram. The bin means the division of the image on the basis of the same size which is adjacent and non-overlapping. The size of these containers is same.

The bins are equal sized intervals of the frequency. The histogram represents the size of the bin. The width of these bins is maintained to be the same size. The area is directly related to the frequency of the data in the particular range. It shows the frequency density. There in neither any gap nor overlapping between two adjacent bins. The density being represented by the histogram is normalized to one [9].

The histogram represents the smooth distribution of the variable. In case of histogram each bin is represented individually otherwise this mathematical projection is difficult to represent graphically [10]

Image noise

The unwanted information is referred to as the noise. The digital noise gets added at the different stages of the image processing like image capture. The shady camera leads to the addition of blue. The device and operational condition are not perfect and finally results into noise. The carrier image when transmitted over public channel can set some noise added to it.

There are many types of noise like:

1 Salt and pepper Noise,

2 Gaussian Noise,

3 3 Speckle Noise

Salt and Pepper Noise

The data transmission errors are referred to as salt and pepper noise [11]. The sudden intensity changes lead to black or white point. The salt and pepper noise can be due to error in camera sensors or errors in memory. The Poisson noise is error created by the sensor's fault. The intensity of light is the main cause of such as error [3] [12].

Gaussian Noise

This type of noise is distributed over a signal. The noise is not co-related to the intensity of the pixel at each point. The main reason of noise is the image capturing system. Sensor adds noise when the illumination on lower side [3].

Speckle Noise

Like the salt & pepper noise and Gaussian noise the speckle noise multiplicative. This noise is commonly present in the data captured [4].

2. LITERATURE REVIEW

[1] Zhi-Hui Wanga et.al [5] has designed Histogram shifting limited method is used in this design. The peak point is modified to point to another pixel value but in the same segment and this location is chosen to hide the data. This way we get multilevel data hiding. The hardware requirement is low to due to less complex method and varies high security.

[2] J.Jayaseelan and B.Kruthika [6] have designed a steganographic system by hiding the secret message under the security cover of salt and pepper noise. The proposed approach is based on LSB reversible data hiding. The salt and pepper is deliberately added to the cover image in varying levels of intensity. This image is called the reference image. The noise addition makes the changes in high and low bits position. The secret message is added to cover image and the embedding is controlled by reference image. The simulation results yield stego image of PSNR values of the order 50 dB.

[3] Sukhjinder Kaur [7] has discussed the addition of the channel noise to the stego image. The author has also thorougerly discussed. The different type of noise models like Gaussian, salt & pepper noise and speckle noise etc. The different noise removal methods are discussed. These techniques are called filters, linear, nonlinear filter are briefly discussed.

3. PROPOSED WORK

In this work, we have designed a better RDH method. The entire work is divided into two cases.

3.1 CASE1: (With segments)

3.1.1 First step

The first step is deliberately adding the noise to the cover image. The salt & paper noise is chosen in varying intensity viz. 0.01, 0.02 and 0.04. The data set consists of 4 standard images of 256x256 sizes.

3.1.2 Second step

The second step is to test the image by PkDp Frame work. The embedding is based on histogram- and embedding capacity is recorded. The detailed algorithm is described below. See flow diagram fig 3.1 and fig 3.2.

The second step is to test the image by PkDp Frame work. The data is hidden by using HS imitated based RDH scheme. The present methodology is driven the idea of dividing the intensity range of the pixels in the no-overlapping containers of the frequency. Each bin represents a particular range of the intensity of the pixels which visually compose the image. The peak pixel values are chosen to hide the secret data. But the first peak is left for the strategic help during the reverse process of the secret data recovery. The k-bit data is hidden in the segment peak. The location map LMi is correlated to the i^{th} segment is bit map and 1 show that it is the

segment peak. This bit map can also be compressed by JPEG1 format. PSNR and the embedding capacity are found out. S.

3.2 CASE2: (Without segment)

3.2.1 First step

The first step is deliberately adding the noise to the cover image. The salt & paper noise is chosen in varying intensity viz. 0.01, 0.02 and 0.04. The data set consists of 4 standard images of 256x256 sizes.

3.2.2 Second step

In **t**his case, reversible data hiding is done without dividing the image into the segments. The histogram peaks are found in the entire image. Only the maximum pixel values are embedded except for the first peak. Each embedding highest point can carry k- bit data when 2k is size of the image. All non-summit values are non-embeddable. A location map LMi corresponding to ith location in the image 1 indicates. That pixel is the histogram Peak 0 indicates the other position. The bit map can compress using JPEG1 format. The matlab based implementation is used to load the cover image and further the PSNR and embedding capacity are recovered. The detailed algorithm is described below [5] [8]. See flow diagram fig 3.3 and fig 3.4.

PkDp Algorithm (WITH SEGMENT) Hiding Algorithm

Input: hiding Image I and a hidden information SM

Output: Stego image S

1 Add pepper Noise (noise level 0.01, 0.02 and 0.04).

2 group the pixel value set PV for color image I into N Piece, All the same and equal sized.

3 Determine the maximum pixel value of the frequency distribution for each segment and call it a summit-peak.

4 The cover image is scanned in a zig-zag way I, Extract the K bit data Sd to an embedding pixel using the pixel shifting strategy.

5 The flag bit is marked the bit corresponding to position (x, y). If the current processing pixel is a segment peak, then the indicator bit is '1' else indicator bit is '0'.

6 Continue steps 4 and 5 until all secret data in SM are hidden.

7 the output is the stego-image S [5].

Decryption Algorithm

Input: Stego image S

Output: Cover image I and secret data SM

1 Obtain PV of the stego image.

2 Divide PV into N piece and get S_m, 1≤m≤N.

3 Get SP_m in each S_m by using place map $L_{i,j}$.

4 Obtained secret information S_m from SP_m by

PkDP and get the cover Image I [8].

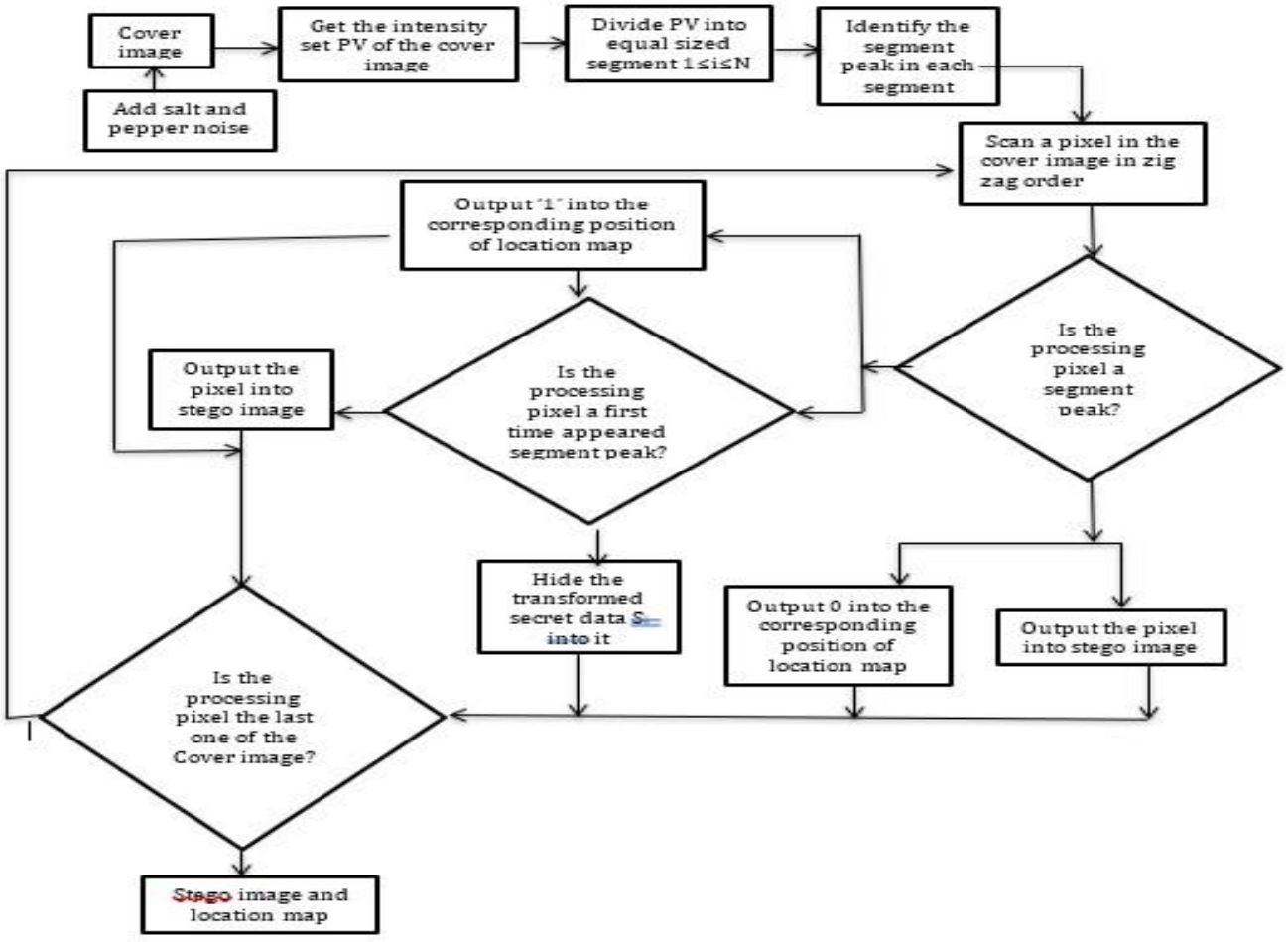

Fig -3.1: Flow Diagram of PkDp (Secret Data Embedding)

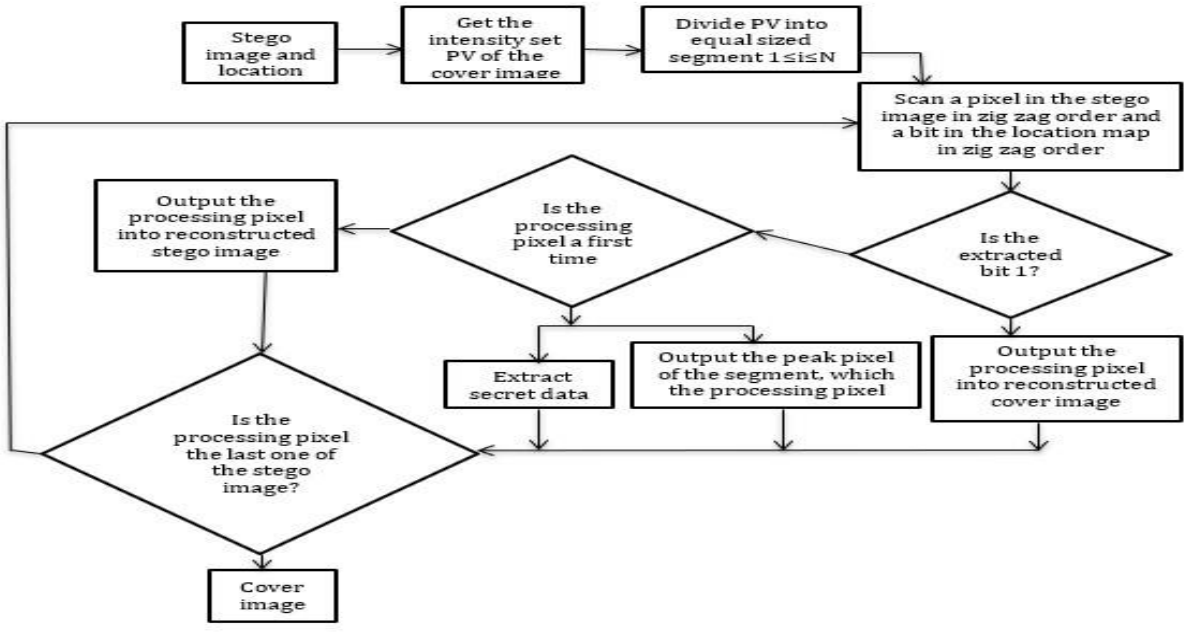

Fig -3.2: Flow Diagram of PkDp (Secret Data Retrieval)

PkDp Algorithm (Without Segment) Hiding Algorithm:

Input: The target I and a hidden message SM Output: Stego image S

1 Add pepper Noise (noise level 0.01, 0.02 and 0. .04)

2 find the frequency peak for entire image

3 In a Zig-Zag scanning order to process the cover image I, Extract the K bit data Sd to an embedding pixel using the pixel shifting strategy

4 Mark an indicator bit at the location map corresponding to position (x,y). If the current processing pixel is peak, then the indicator bit is '1' else indicator bit is '0'.

5 Continue steps 3 and 4 until all secret data in SM are hidden.

6 Output the stego image S.

Decryption Algorithm

Input: Stego image S

Output: Cover image I and secret data SM

1 Obtain PV of the encrypted image.

2 Get Peak value in stego image by using place map Li, *j.*

3. Obtained secret information ʃ�� from Peak value in stego image by PkDP and get the cover Image.

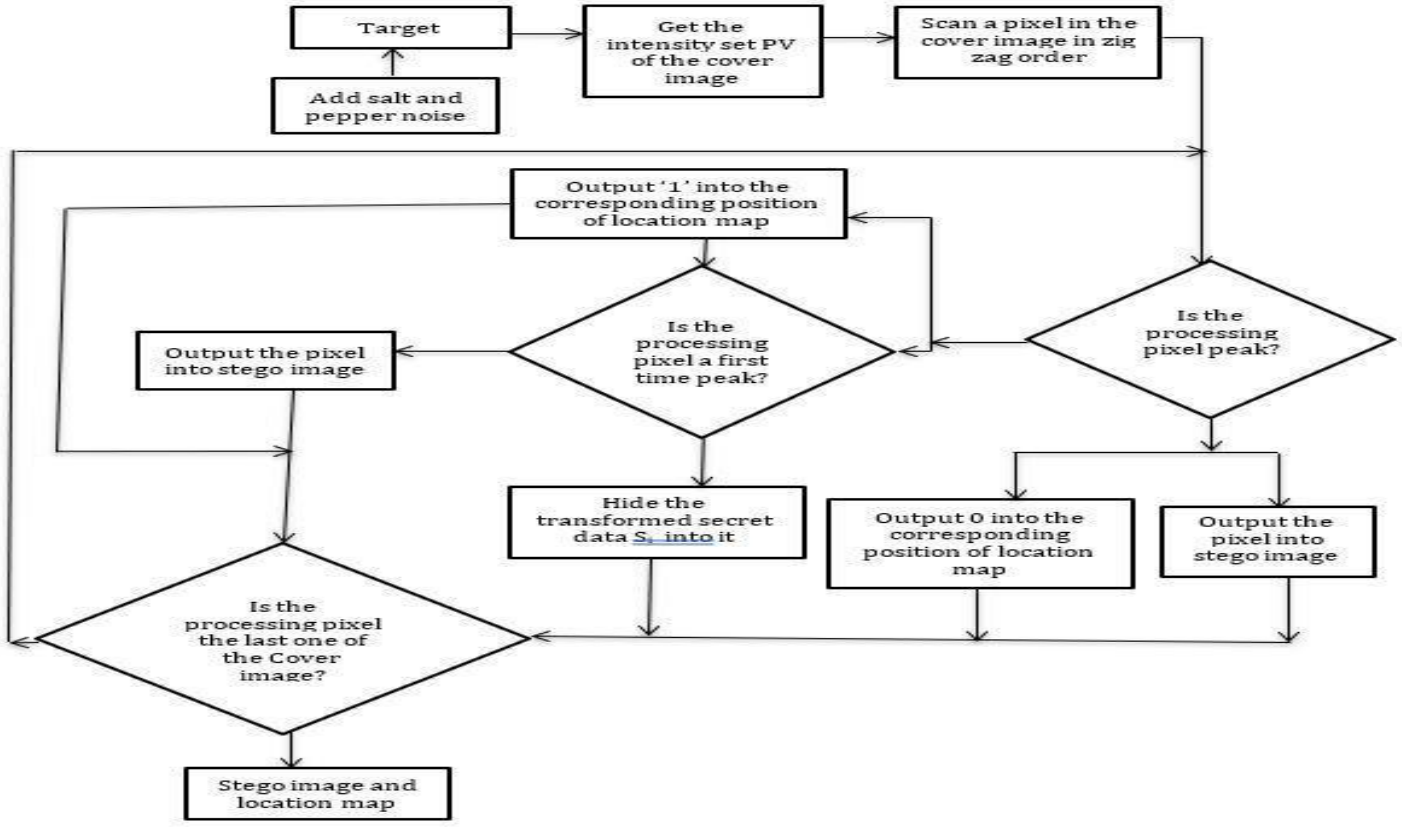

Fig -3.3: Flow Diagram of PkDp (Secret Data Embedding)

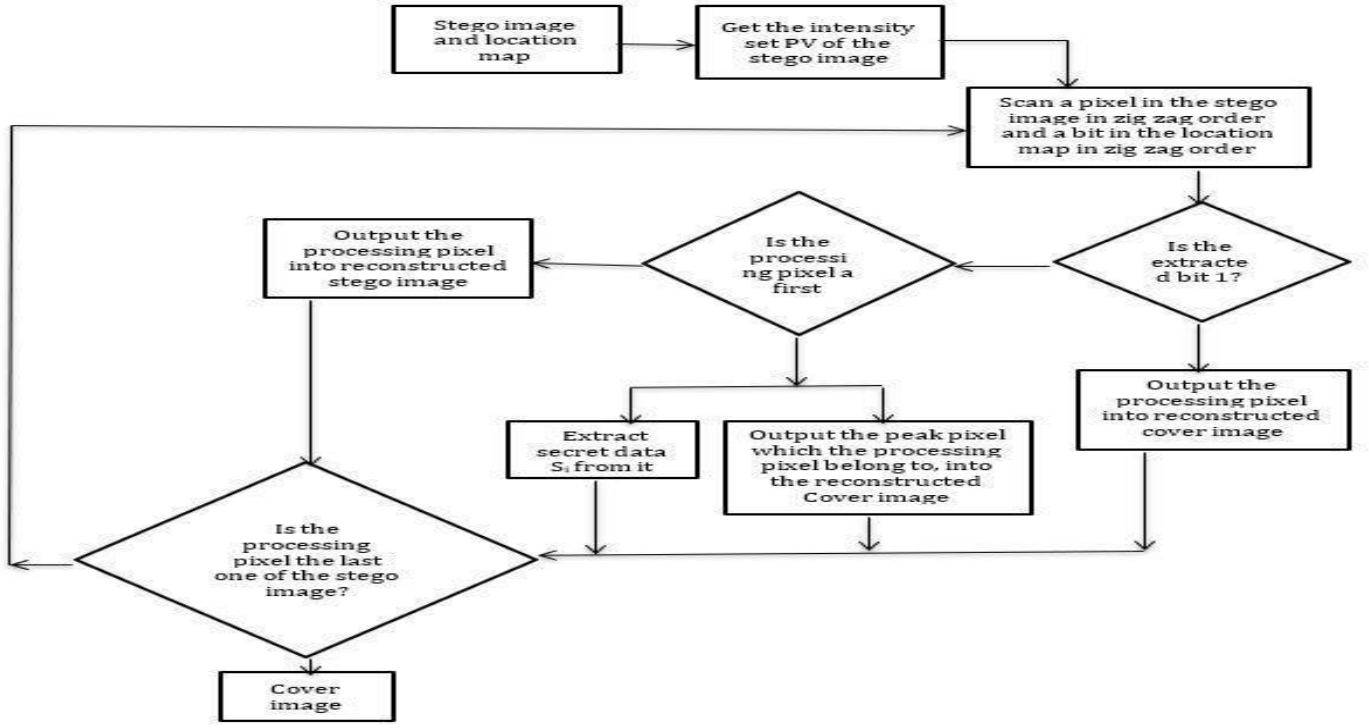

Fig -3.3: Flow Diagram of PkDp (Secret Data Retrieval)

3. SIMULATIONS AND RESULTS

The proposed methodology is simulated using MATLAB.

Case1

The cover image is divided into the segments of equal size i.e.

6 segments of 8 bit each. The noise is added prior to segmentation, in the same way as in case1. The results are tabulated as under in table.

Case2

The cover image is not divided into the segments. The salt and pepper noise is purposely added to the standard image in varying noise levels 0.01, 0.02 and 0.04. The simulation results for PSNR and embedding capacity are tabulated.

The salt and pepper noise are added at different noise level(0.01, 0.02, and 0.04). The authors have not used standard image; therefore, we cannot compare the results with this work. But we have kept rest of the conditions same like image size (256*256) and noise level(0.01, 0.02, and 0.04) with varying intensities. The proposed results are encouraging and shows in Table-1 and Table-2. The PSNR values without segmentation are above 40 dB and close to 50 dB. This ensures the good quality image. The result outperforms the base values for 64 sized segments. The PSNR values for all the standard images Lena, football, baboon and airplane are above 62 dB. This proves that the proposed technique is better. This also ensures the robustness of the scheme. The human eyes cannot perceive the data hidden in the stego image.

Table -1: PSNR Values for Different Noise Level (Lina Image)

Noise level	2	4	8	16	32
0.01	45.51	44.351	41.047	40.482	48.2669

0.02	46.20	44.745	41.598	40.731	48.5009
0.04	**48.11**	**45.09**	**41.72**	**40.66**	**48.2692**

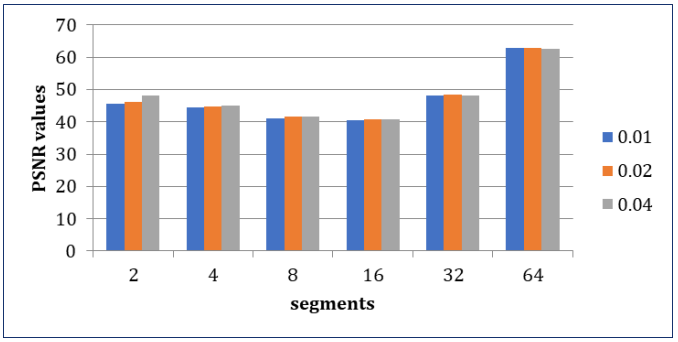

Chart -1: PSNR values v/s no of segments (Lena image)**Without Segment (result and graph)**

Table -2: PSNR Values for Different Noise Level (Lina Image)

noise	Red	Green	Blue
0.01	46.882	45.4861	**42.3698**
0.02	47.9507	45.7319	**42.9752**
0.04	**41.6398**	**40.6739**	**40.7372**

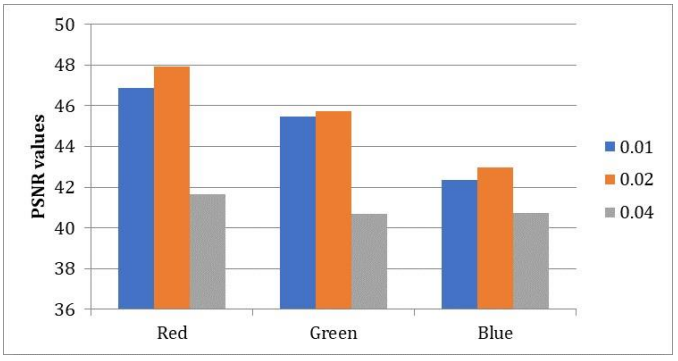

Chart -2: PSNR values for different noise level (Lena image)

4. CONCLUSION

In this work, the proposed results are encouraging. The PSNR values without segmentation are above 40 dB and close to 50 dB this ensures the good quality image. The result outperforms the base values for 64 sized segments. The PSNR value for all the standard image Lena, football, baboon and airplane are above 62 dB this proves that the proposed technique is better. This also ensures the robustness of the scheme. The human eyes cannot perceive the data hidden in the stego image.

5. FUTURE WORK

This work is limited to only the test of two different noise i.e. Gaussian and Salt & pepper. The experiment can be extended to other type of noise. The image steganography can also be enhanced by applying DWT method for embedding. The extra security features like double encryption and secret key can also be applied.

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