Lab 13

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Aim: Write a program to demonstrate Image Steganography operations: Embed and Extract Hide 2 bits per pixel. Hide 3 bits per pixel. Compute MSE (Mean Squared Error) and PSNR (Peak Signal to Noise Ratio) values.

Code:

```
#include<bits/stdc++.h>
using namespace std;
#define BITS 2 //hide bits per pixel
#define DIMS 4 //image dimensions
#define MSG DIMS*DIMS*BITS //input number size(in bits)

vector<vector<int>> lsb_embed(vector<vector<int>>
img,bitset<MSG> num)
{
    for(int i=0,k=0;i<DIMS;i++)
    {
        for(int j=0;j<DIMS;j++)
        {
            bitset<8> t(img[i][j]);//convert decimal to
binary
            for(int l=BITS-1;l>=0;l--,k++)
            {
                t[l]=num[MSG-1-k];
            }
```

```
            string t1=t.to_string();

            img[i][j]=stoi(t1,0,2);//convert binary to
decimal
        }
    }

    return img;
}
float MSE(vector<vector<int>> img,vector<vector<int>>
stegoImg)
{
    float sum=0;
    for(int i=0;i<DIMS;i++)
    {
        for(int j=0;j<DIMS;j++)
        {
            sum+=pow(img[i][j]-stegoImg[i][j],2);
        }
    }
    return (sum/(DIMS*DIMS));
}
float PSNR(float mse)
{
    float temp=pow(255,2)/mse;
    return (10*log10(temp));
}
long long extract(vector<vector<int>> stegoImg)
{
    string msg="";
    for(int i=0;i<DIMS;i++)
```

```
    {
        for(int j=0;j<DIMS;j++)
        {
            bitset<8> t(stegoImg[i][j]);
            for(int l=BITS-1;l>=0;l--)
            msg+=to_string(t[l]);
        }
    }
    return stoll(msg,0,2);
}
int main()
{
    long long n;
    cout<<"Enter number in decimal:";
    cin>>n;
    bitset<MSG> num(n);
    cout<<"Enter cover Image:\n";
    auto img=vector<vector<int>>(DIMS,vector<int>(DIMS));
    for(int i=0;i<DIMS;i++)
        for(int j=0;j<DIMS;j++)
            cin>>img[i][j];

    vector<vector<int>> stegoImg=lsb_embed(img,num);
    cout<<"\nStego Image:\n";
    for(vector<int> vect1D:stegoImg)
    {
        for(int pix:vect1D)
        {
            cout<<pix<<" ";
        }
        cout<<endl;
```

```
    }
    cout<<"\nMSE:";
    float mse=MSE(img,stegoImg);
    cout<<mse;
    cout<<"\nPSNR:";
    cout<<PSNR(mse);
    cout<<"\nextracted From Stego Image:";
    cout<<extract(stegoImg);
}
```

Testcase:

➔ **Hide 2 bits per pixel:**

```
D:\document\NIS\Lab\lab 13>cd "d:\doc
ument\NIS\Lab\lab 13\"image_steganogr
Enter number in decimal:12351525
Enter cover Image:
50 25 49 79
78 23 78 80
49 52 90 201
100 59 70 75

Stego Image:
48 24 48 76
78 23 79 80
49 55 90 200
100 58 69 73

MSE:2
PSNR:45.1205
extracted From Stego Image:12351525
```

➔ **Hide 3 bits per pixel:**
Changed In Code:

```
#include<bits/stdc++.h>
using namespace std;
#define BITS 3 //hide bits per pixel
#define DIMS 4 //image dimensions
#define MSG DIMS*DIMS*BITS //input number size(in bits)
```

```
D:\document\NIS\Lab\lab 13>cd "d:\docum
ument\NIS\Lab\lab 13\"image_steganograp
Enter number in decimal:12351525
Enter cover Image:
50 25 49 79
78 23 78 80
49 52 90 201
100 59 70 75

Stego Image:
48 24 48 72
72 16 72 80
53 55 88 207
100 56 68 77

MSE:16.125
PSNR:36.0558
extracted From Stego Image:12351525
```