Step 1: Take a Colour input image and extract out the red, green and blue pixel matrixes from it.

Step 2: Obtain the histograms, hi[n], an un-normalised discrete probability mass function of pixel intensities for each matrix.

Step 3: Set the parameters, lambda, the quantity for positioning the amount of contrast on a scale of 0-20, and gamma, the amount of detail in the image to be retained, on a scale from 1 – 109 . Usually, lambda is around 4 and gamma is 50000.

Step 4: Construct a Difference matrix, D, with backward-difference of histogram, i.e h[i]-h[i-1], required for histogram smoothening. The Difference matrix D € R255\*256 is bi-diagonal.

Step 5: For each pixel matrix, obtain the optimised histogram, ho[n], from the cuckoo search optimization algorithm. Cuckoo Search will take arguments as number of nests, input histogram, hi[n], lambda, gamma and the difference matrix,D.

Step 6: Obtain the normalised histograms, p[n], from the optimised histograms. It gives an approximate probability distribution function of the pixel intensities.

p[i] = ho[i]/number\_of\_pixels;

Step 7: Then, the Approximate Cumulative distribution Function (CDF), c[n], is obtained from p[n].

c[i] = sum(p[1:i]);

Step 8: After the CDF is obtained, a modified discrete mapping function T[n] is used to map back to spatial domain(pixels).

T[n] = ( lambda + 1) × { (2β-1) × ( sum(p[1:n]) + 0.5)}

Where β is the number of bits used to represent the pixel values and n € [0, 2β-1] and p[n] is the probability density function.

Step 9: Finally the Image is obtained from this mapping. After this,the required performance metrics are calculated like PSNR, SSIM, FSIM, Computational Time etc.

FLOWCHART (On Next page):

Extract 3 pixel matrixes from Input image

Obtain the histograms, hi[n], an un-normalised discrete probability mass function of pixel intensities

Set the parameters, lambda as 4 and gamma as 50000

Construct the bi-diagonal Difference matrix, D € R255\*256

Obtain optimised histogram ho[n] using cuckoo search with arguments number of nests as 15, hi[n], D, lambda and gamma

Final Output Image, Calculation performance metrics like PSNR, SSIM, FSIM, Computational Time etc.

Modified discrete mapping function T[n] to map back to spatial domain.

Obtain Approximate Cumulative distribution Function (CDF), c[n] from p[n]

Obtain approximate probability distribution, p[n] using ho[n]; p[i] = ho[i]/number\_of\_pixels;