









$$i'(x,y) = c(x,y) + i\tilde{(x,y)} * dH(x,y)$$

$$c(x,y) = i(x,y) * dL(x,y)$$

where  $\tilde{i}(x,y)$  and  $i'(x,y)$  denote the consecutive iterative estimations of the true image  $i(x,y)$  at generation  $k$  and  $k+1$ , respectively. At every iteration, the PSF,  $dL(x, y)$  is randomly generated and  $dH(x, y)$  is obtained.

### 5.6 Algorithm For PSF Generation:

1. Find the PSF size  $n*n$  where  $n$  should be odd number.
2. Randomly generate  $(n+1)/2$  values in the range  $(0,1)$ .
3. Sort the values generated in the ascending order.
4. Produce a vector  $d$ , of  $n$  elements, by flipping the values left to right provided the middle element is untouched.
5. Create  $d=d1*d1t$ . Normalise the  $d$ .

### 5.7 Evolutionary Algorithm:

#### 5.7.1 Algorithm Components:

EA have number of operators, components and procedures that must be specified clearly in order to define particular EA. Also, the initialisation and termination condition must also be well specified. The different components of EA are:- Definition of Individuals Fitness ,Function Population, Recombination, Mutation Survivor ,Selection Mechanism. Unlike other traditional optimization techniques, EA involve a search from set of possible solutions known as "population". Each iteration ends with a set of possible and feasible solutions, discarding the poor solutions based on some "fitness" criteria. The solutions with high fitness are then recombined with other solutions by interchanging parts of the solution with one another. These solutions are then again "mutated" generating new solution optimal to the given problem.

#### 5.7.2 Algorithm Steps

The major steps involved in this Evolutionary Algorithm are:-

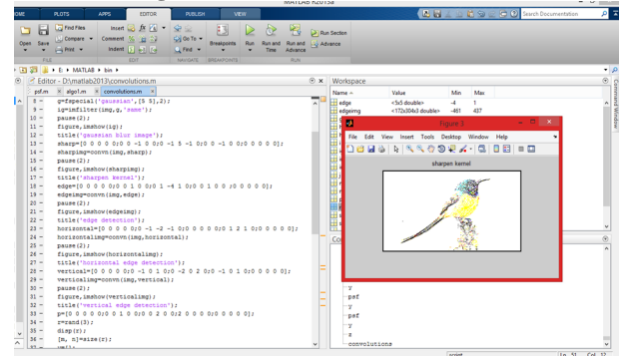
- **Mutation:** A set of random PSFs is generated in every generation. These PSFs are then used along with all individual images, obtained from the previous generation.
- **Selection:** The individuals in each generation individually undergo a selection procedure called feature vectors. Those individuals which have  $\rho$  value greater than the corresponding expectation value for the generation are excluded.
- **Clustering:** There exist only few individuals at each generation. The survivors are used in the next  $k + 1$ th generation.
- **Final Image Reconstruction:** There is set of possible estimated image obtained from each generation at the end. The best image is sort out by adopting fusion method pseudo-wigner distribution.

## 6. Experimental Results:

### Convolution: Original Image:



### Gaussian Image:



## 7. Conclusion

We have studied what exactly convolution is and the importance of deconvolution in deblurring an image in order to remove the noise. We have studied the role of PSF in Image Restoration techniques and how SNR best acted as fitness function. The image obtained is different from the blurred image which is proved by the signal-to- noise ratio.

## References

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