Ms. Shweta Tyagi, Hemant Amhia / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 2, March -April 2013, pp.579-584

Image Enhancement And Analysis Of Thermal Images Using Various Techniques Of Image Processing

***Ms. Shweta Tyagi **Hemant Amhia**
(M.E. student Deptt. of Electrical Engineering, JEC Jabalpur)
(Asstt.Professor, Deptt. of Electrical Engineering, JEC Jabalpur)

ABSTRACT:

Principle objective of Image enhancement is to process an image so that result is more suitable than original image for specific application. Thermal image enhancement used in Quality Control ,Problem Diagnostics,Research and Development,Insurance Risk Assessment,Risk Management Programme,Digital infrared thermal imaging in health care, Surveillance in security, law enforcement and defence. Various enhancement schemes are used for enhancing an image which includes gray scale manipulation, filtering and Histogram Equalization (HE),fast fourier transform.Image enhancement is the process of making images more useful. The reasons for doing this include, Highlighting interesting detail in images, Removing noise from images, Making images more visually appealing, edge enhancement and increase the contrast of the image.

KEYWORDS: Image enhancement , histogram equalisation, linear filtering, adaptive filtering , fast fourier transform, opening and closing.

I. INTRODUCTION:

The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. Digital image processing are used in various application in medicines medicine, space exploration, authentication, automated industry inspection and many more areas.

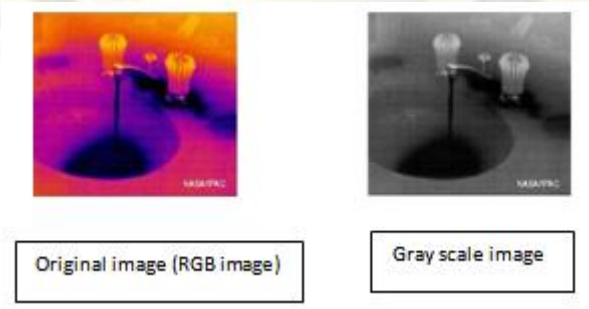
II. Image Enhancement And Analysis Techniques

Image enhancement is actually the class of image processing operations whose goal is to produce an output digital image that is visually more suitable as appearance for its visual examination by a human observer

- ⇔ The relevant features for the examination task are enhanced
- ⇔ The irrelevant features for the examination task are removed/reduced
- Specific to image enhancement:
  - input = digital image (grey scale or color)
  - output = digital image (grey scale or color)

2.1. Conversion of the RGB image into GRAYSCALE image:

In RGB images each pixel has a particular color; that color is described by the amount of red, green and blue in it. If each of these components has a range 0–255, this gives a total of 256^3 different possible colors. Such an image is a "stack" of three matrices; representing the red, green and blue values for each pixel. This means that for every pixel there correspond 3 values. Whereas in greyscale each pixel is a shade of gray, normally from 0 (black) to 255 (white). This range means that each pixel can be represented by eight bits, or exactly one byte. Other greyscale ranges are used, but generally they are a power of 2.so,we can say gray image takes less space in memory in comparison to RGB images.



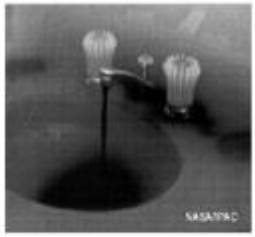
2.2 HISTOGRAM ,HISTOGRAM EQUALISATION AND CONTRAST ENHANCEMENT:

The histogram of an image shows us the distribution of grey levels in the image massively useful in image processing, especially in segmentation .The shape of the histogram of an image gives us useful information

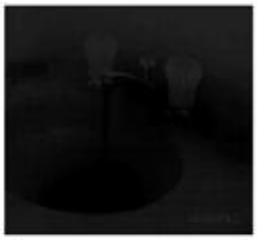
about the possibility for contrast enhancement. A histogram of a narrow shape indicates little dynamic range and thus corresponds to an image having low contrast.

Histogram equalization is used to enhance the contrast of the image it spreads the intensity values over full range. Histogram equalization involves finding a grey scale transformation function that creates an output image with a uniform histogram

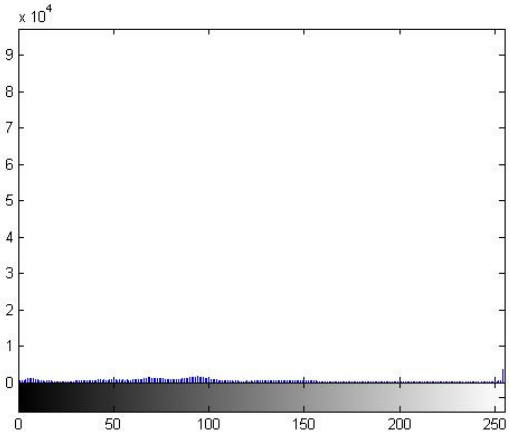
Under Contrast adjustment, overall lightness or darkness of the image is changed. Contrast enhancements improve the perceptibility of objects in the scene by enhancing the brightness difference between objects and their backgrounds A contrast stretch improves the brightness differences uniformly across the dynamic range of the image,



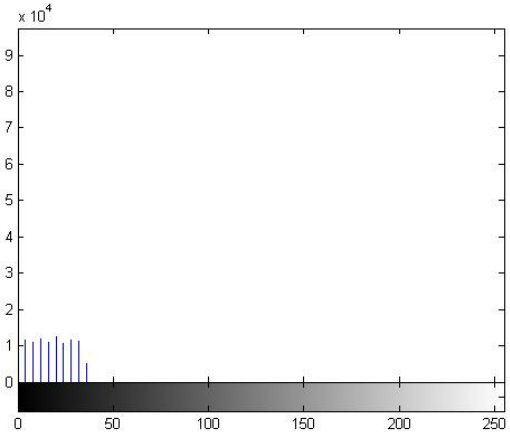
Gray scale image



Resulting image after Histogram equalisation image



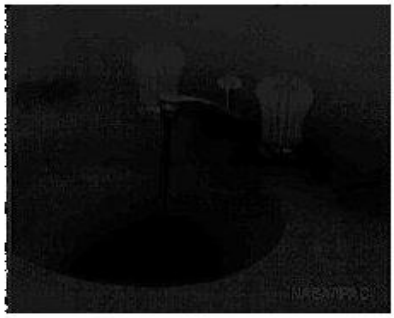
Gray scale image histogram



Resulting histogram after histogram equalisation

2.2.Linear filtering and noise removal image

Filtering is a technique for modifying or enhancing an image. For example, you can filter an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing, sharpening, and edge enhancement.Linear filtering is filtering in which the value of an output pixel is a linear combination of the values of the pixels in the input pixel's neighbourhood.The noise is removed by adaptive filtering approach, often produces better results than linear filtering. The adaptive filter is more selective than a comparable linear filter, preserving edges and other high-frequency parts of an image



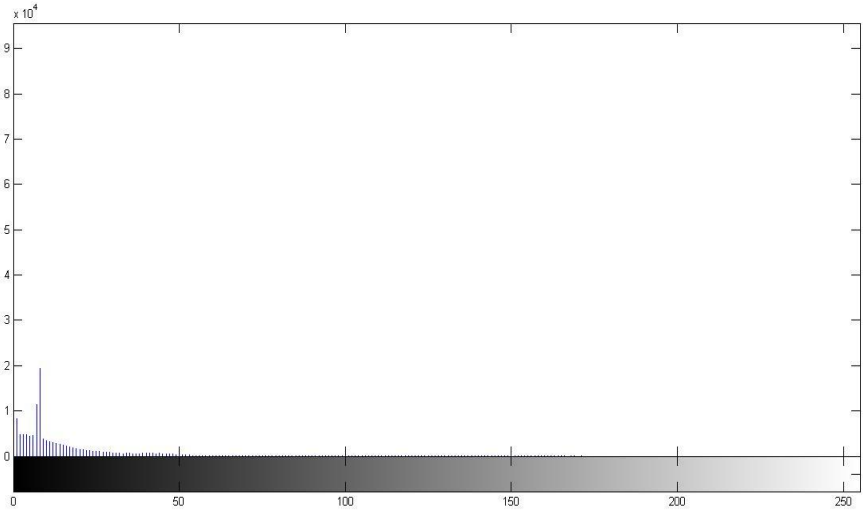
Filtered image after the histogram equalisation

Noise removal image by adaptive filtering

III. Morphology:

Morphological techniques typically probe an image with a small shape or template known as a **structuring element.** The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighborhood of pixels.Morphological operations differ in how they carry out this comparison. Mathematical morphology is based on geometry. The theoretical foundations of morphological image processing lies in set theory and the mathematical theory of order. The basic idea is to probe an image with a template shape, which is called structuring element, to quantify the manner in which the structuring element fits within a given image.

output = I – B, where output is the image obtained after the removal of non-uniform backround (B) from grayscale image (I) uniform background throughout the image



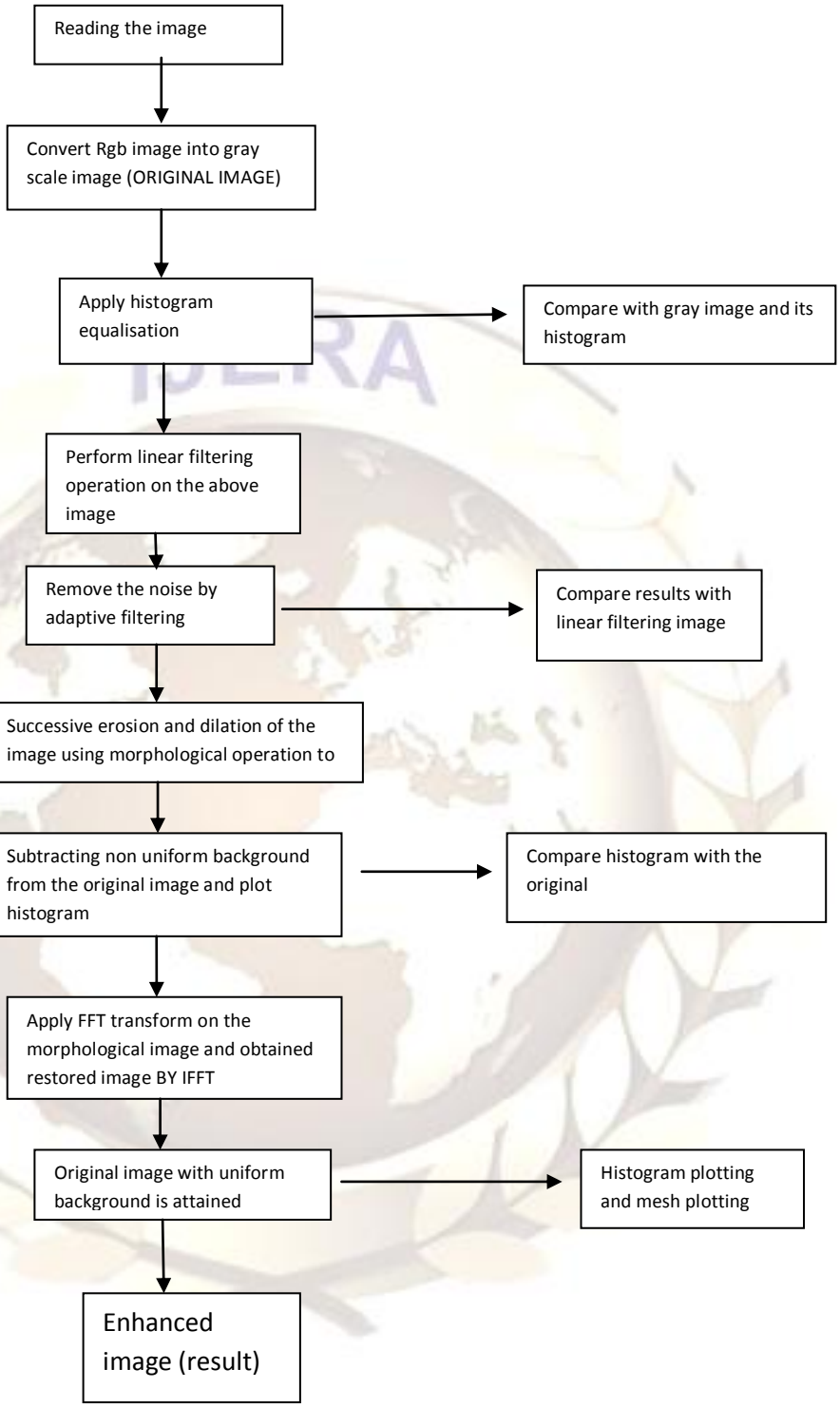
Output histogram of the above image

IV. FFT transform:

FFT function is an effective tool for computing the discrete Fourier transform of a signal.In fourier transform it actually change the domain of the image. In this we get the restored image after taking the inverse FFT. The FFT contains information between 0 and fs, however, we know that the sampling frequencymust be at least twice the highest frequency component. Therefore, the signal's spectrum should be entirly below fs/2 , the Nyquist frequency.

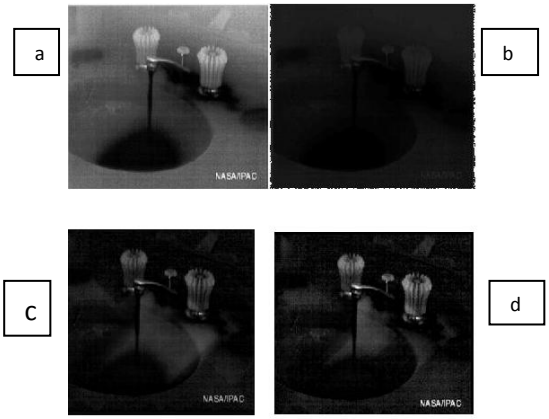
FFT image

5. *PROPOSED FLOW CHART*:

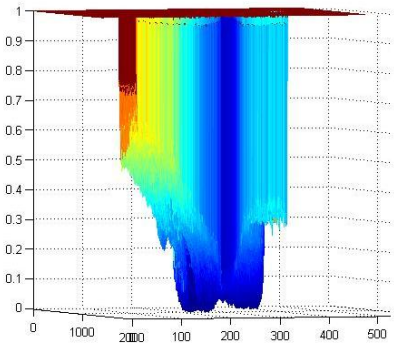


V. RESULTS:

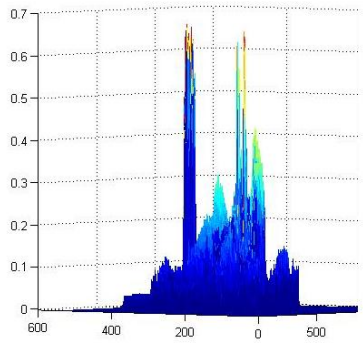
The result obtained from the enhancement of the thermal images is the improvement of the image in which we get the useful information. The histogram obtained from these images is also improved which shows that image is enhanced, the intensity range is also better . The mesh plot is also better in the morphology operation and the fft mesh plot is only change the domain.



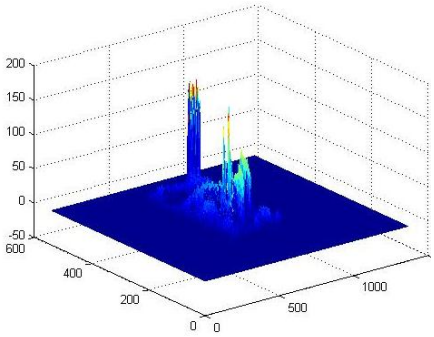
(a)gray scale image (b)resulting image after histogram equalisation (c)image after morphological operation (d) restored image after the fft tranform



Gray image mesh plot



Morphology mesh plot



Restored image after fft

VI. CONCLUSION:

The enhancement of thermal images is useful in quality control , problem diagnostics, research and development. The work indicates that histogram equalization technique can't be used for images suffering from non-uniform illumination in their backgrounds specifically for particle analysis purposes as this process only adds extra pixels to the light regions of the image and removes extra pixels from dark regions of the image resulting in a high dynamic range in the output image. The image obtained after the morphology operation is much clear than the other images,that will be helpful in problem diagnostics.FFT transform convert the domain of the image. So,it is necessary to enhance an image so that its information can be used that the image contain.

REFERENCES

1. Komal Vij,et al. "Enhancement of Images Using Histogram Processing Techniques Vol 2" , pp309-313, 2009.
2. Kevin Loquin,et al. "Convolution Filtering And Mathematical Morphology On An Image: A Unified View", pp1-4, 2010.
3. M. Kowalczyk,et al."Application of mathematical morphology operations for simplification and improvement of correlation of images in close-range photogrammetry",pp153-158, 2008.
4. J. Zimmerman, S. Pizer, E. Staab, E. Perry, W. McCartney,B. Brenton, "Evaluation of the effectiveness of adaptive histogram equalization for contrast enhancement," IEEE Transactions on Medical Imaging, pp. 304-312, 1988.
5. M. Abdullah-Al-Wadud, Md. Hasanul Kabir, M. Ali Akber Dewan, Oksam Chae, "A dynamic histogram equalization for image contrast enhancement", IEEE Transactions. Consumer Electron., vol. 53, no. 2, pp. 593- 600, May 2007.
6. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 2nd edition, Prentice Hall, 2002
7. A. K. Jain, "Fundamentals of Digital Image Processing". Englewood Cliffs, NJ: Prentice-Hall, 1991.
8. J. Alex Stark "Adaptive Image Contrast Enhancement Using Generalizations of Histogram Equalization", IEEE Transactions on Image Processing, Vol. 9, No. 5, May 2000.