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Complimentary Image Processing Techniques: Critical Review with C#

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Abstract
Image Enhancement is one of the most essential and laborious techniques in image researches. The scheme of image enhancement is to improve the visual semblance of an image, or to afford a "correct transform representation for future automated image processing. Many images like medical images, satellite images, aerial images and even real life photographs suffer from indigent contrast and noise. It is necessary to enhance the contrast and remove the noise to enhance image quality. One of the most significant stages in medical images detection and analysis is Image Enhancement techniques which improves the quality (clearness) of images for human look, removing blurring and noise, increasing contrast, and unveil details are examples of enhancement operations. The enhancement technique varies from one field to another according to its objective. The existent techniques of image enhancement can be classified into two categories: Spatial Domain and Frequency domain enhancement. In this research, we present an overview of image enhancement projection techniques in spatial domain. More specifically, we categorise processing methods based typical techniques of Image enhancement. Thus the contribution of this paper is to arrange and review image enhancement procedure techniques, attempt an evaluation of shortcomings and universal needs in this field of active research and in last we will stage out promising directions on research for image enhancement for prospective research.
Keywords: Frequency based domain enhancement, Image Enhancement, Spatial based domain enhancement, Histogram Equalization.

I. INTRODUCTION

Image enhancement proposition can be developed as follows: granted an input low quality image and also the output high quality image for precise applications [1]. It is well-known that image enhancement as an energetic subject in medical imaging has hold much attention in modern years. The aim is to boost the visual semblance of the image, or to afford a "better" rework illustration for future automatic image processing, like analysis, detection, segmentation and recognition. Moreover, it assists analyses background intelligence that's essential to grasp object behaviour while not requiring expensive human visual investigation [2]. Completing image improvement or enhancement perception underneath quality image is a difficult drawaback attribute to these to these reasons. Attribute of low contrast, cannot clearly extract motive from the dark background. Most colour supported strategies can lack on this concern if the colour of the objects which of the background area unit undiversified. The review of obtainable techniques is supported on the present techniques of image enhancement, which may be various, into two intensive categories: Spatial based domain image enhancement and Frequency based domain image enhancement [3]. Spatial based domain image enhancement effect directly on pixels. The main benefit of spatial based domain technique is that they conceptually simple to learn and the complexity of this technique are low which favours real time implementations. But these techniques commonly lacks in providing sufficient robustness and imperceptibility requirements. Frequency based domain image enhancement is a expression used to describe the analysis of mathematical performance or signals with regard to frequency and operate openly on the transform coefficients of the image, such as Fourier transform, discrete wavelet transform (DWT), and discrete cosine transform (DCT). The basic idea in second-hand this technique is to intensify the image by handle the transform coefficients. The superiority of frequency based image enhancement includes low intricacy of computations, ease of viewing and manipulating the frequency consistency of the image and the easy applicability of special transformed domain properties. The fundamental limitations including are it cannot simultaneously intensify all parts of image very well and it is also laborious to automate the image enhancement operation [4]. In this paper agreeing to if enhanced image embed high quality groundwork information, the existing techniques of image enhancement like spatial domain methods can again be classified into two comprehensive categories: Point Processing function and Spatial filter operations.

II. Related Work

Image enhancement process consists of a gathering of techniques that solicit that solicit to reform the visual looks of a picture or convert the image to a kind higher set for analysis by individual or machine. The principal objective of image enhancement is to switch characteristic of an image add national form it additional compactable for a given task a and a definite observer. Throughout this method, one or additional characteristic of the image area

unit changed. One or additional characteristic of the image are modified. Digital Image enhancement techniques contribute a assembly of decisions for rising the visual nature of images. Applicable decision of such techniques is well influenced by the imaging modality, task at ability and viewing conditions [5]. A well-recognised sample of enhancement is in which when we increase the contrast of an image and filters it to remove the noise "it looks reform". It is vital to stay in belief that distinction of an image and filters it does get rid of the noise.

The work done by many researchers for Image Enhancement are examine here, Madhu[1],[6] inspire that the Adaptive histogram equalization produced a ameliorate result, but the image is still not free from washed out look. The sharpness is poor and also the background information because the traverse continues to be opaque and meager in contrast. Alpha maturation yield the complete image in a dark tone. Even the sketch of the clouds that was perceptible in just case of histogram equalization is lost [2],[7]. Again insinuate that the common no transform-based improvement technique is global histogram equalization, which exertion to alter the spatial histogram of an image to closely correspond a uniform arrangement. Bar graph suffers from the proposition of being poorly dress for hire local detail due to its global treatment of the image. It is also habitual that the equalization will over enhance the image, effect in an undesired loss of visual data, of quality and of intensity scale [3],[7]. Tang refers to global histogram equalization, which set right the intensity bar graph to proximate uniform distribution. The global histogram equalization is that the global image properties may not be properly applied in a local context. In deed, global histogram modifications entreat all regions of the image alike and, thus, often render poor local performance in boundary of detail preservation. Therefore, several local image enhancement algorithms have been induced to improve enhancement.

III. Spatial Domain Methods

Spatial domain techniques directly converse with the image pixels. The pixel worth is manipulated to accomplish desired enhancement. Spatial domain techniques resembling the logarithmic transforms, power law transforms, histogram equalization are supported on the straightforward manipulation of the pixels in the image. Spatial techniques are distinctly useful for directly altering the gray level values of distinctive pixels and hence the overall contrast of the interior image. But they generally enhance the whole image in a uniform appearance which in many cases propagates undesirable results. It is not likely to selectively enhance edges or other prescribes information effectively. Techniques like histogram equalization are powerful in many images [8]. The approaches can be classified into two categories: Point Processing operation (Intensity transformation function) and Spatial filter operations. An overview of some of the well given methods is examine here. Point processing operations (Intensity transformation function) is the simplest spatial domain operation as operations are performed on separate pixel only. Pixel values of the processed image impend on pixel values of original image. It can be granted by the expression $g(x,y) = T[f(x,y)]$, where T is gray level transformation in point processing. The Point processing approaches can be assorted into four categories as Image Negatives in which gray level values of the pixels in an image are reversed to get its negative image. Consider a 8 bit digital image of size M x N, then each pixel value from original image is deducted from 255 as $g(x, y)=255- f(x, y)$ for $0 \leq x < M$ and $0 \leq x < N$. In a normalized gray scale, $s = 1.0 – r$. Negative images are valuable for enhancing white or gray detail fixed in dark regions of an image.

Fig.1 shows an example of an image negative.

Tone mapping: is another technique of contrast distinction techniques. During this procedure if the output high dynamic range (HDR) image on analysis paper or on a show. Somehow may be convert the wide intensity target in the image to the lower range based by the display. This technique used in image processing and computer graphics in C# programming environment to map a group of colours to different , typically approximate the appearance the looks of high dynamic vary images format in media with a more districted dynamic range. Tone mapping is finished within the luminance channel solely and in scale of measurement and adopt to changes. It's accustomed convert floating purpose radiance map into 8-bit representation for rendering applications. The two main aims and objectives of tone mapping algorithm: Protective image details and providing enough absolute brightness data in low dynamic range tone mapped image format. Strength or grey level slicing or scalability is another technique of Piecewise linear transformation during which the gray or strength slicing high lights bound vary of gray levels within the pure image [8]. These transformations enable segmentation segment o bound grey regions from the remainder of the image. This technique is needful when different characteristics features of an image are contained in different gray levels. Bit plane Slicing is another form of Piecewise transformation techniques which highlights the contribution made to total image view by specific bits used for pixel gray levels and determines the adequacy and corresponding number of bits used to quantize each pixel in image compression. Spatial Filter Operations are performed and applied on a pixel along with its immediate neighbours; this is also called as neighbourhood operations. In spectacular, supported type of operations performed on the pixels spatial filters are classified into two categories: Linear and Nonlinear spatial filters. Linear spatial filter process entails convolving a mask with an image i.e. passing a weighted mask over the entire image. Mask is also knowned as

window, template, or kernel. Non linear spatial filter are those filters in which enhanced pair image is not linearly related to pixels in the neighbourhood of original image. Max filter is used to locate the brightest point in an image processing. It is a 100th percentile filter and removes salt noise whereas Min filter is used to locate the darkest point in an image block. Moreso, It is a 0th percentile filter and removes pepper noise and Median filter is a statistical filter used to locate the median value of the pixels. It removes salt and pepper noise. This filter segment provides less blur but rounds corners.

IV. Frequency Domain Techniques

Frequency domain techniques are based on the manipulation of the orthogonal transform of the image rather than the image itself. Frequency domain techniques are suited for processing the image according to the frequency content. The principle behind the frequency domain methods of image enhancement consists of computing a 2-D discrete unitary transform of the image, for instance the 2-D DFT, manipulating the transform coefficients by an operator M, and then performing the inverse transform. The orthogonal transform of the image has two components magnitude and phase.

The magnitude consists of the frequency content of the image. The phase is used to restore the image back to the spatial domain [9]. The usual orthogonal transforms are discrete cosine transform, discrete Fourier transform, Hartley Transform etc. The transform domain enables operation on the frequency content of the image, and therefore high frequency content such as edges and other subtle information can easily be enhanced. Frequency domain which operate on the Fourier transform of an image.

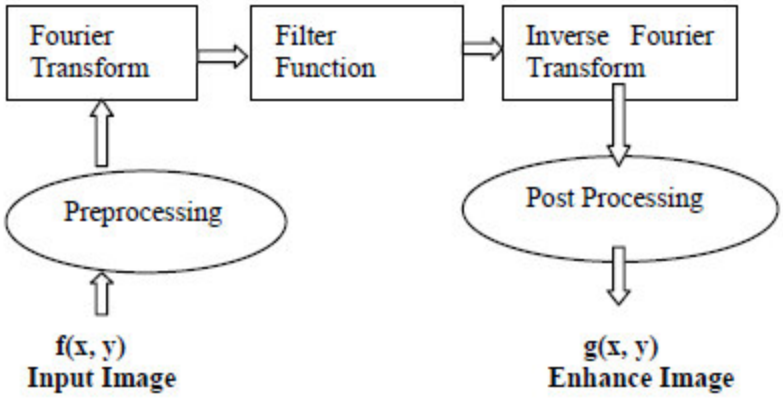
Edges and sharp transitions (e.g. noise) in an image contribute significantly to high frequency content of Fourier transform [12],[13] ,[14].

Low frequency contents in the Fourier transform are responsible to the general appearance of the image over smooth areas.

The concept of filtering is easier to visualize in the frequency domain.

Therefore, enhancement of image f(x, y) can be done in the frequency domain based on DFT. This is particularly useful in convolution if the spatial extent of the point spread sequence h(x, y) is large then convolution theory [15].

g(x, y)= h(x, y)f(x, y) where g(x, y) is enhanced image. **f(x, y) g(x, y)**



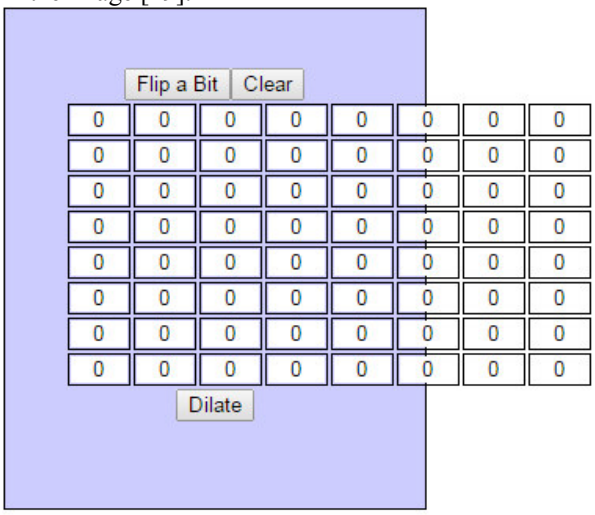
V. Applications

Image enhancement is used for enhancing a quality of images [16]. The applications of image enhancement are Aerial imaging, Satellite imaging, Medical imaging, Digital camera application, Remote sensing, Image Enhancement techniques used in many areas such as forensics, Astrophotography, Fingerprint matching, etc. The better result for Image enhancement has also used in real time enhancement of neuro evolution of augmenting. IE techniques when applied to pictures and videos help the visually impaired in reading small print, using computers and television, and face recognition. Color contrast enhancement, sharpening and brightening are just some of the techniques used to make the images vivid. In the field of e-learning, IE is used to clarify the contents of chalkboard as viewed on streamed video; it improves the content readability. Medical imaging uses this for reducing noise and sharpening details to improve the visual representation of the image [17]. This makes IE a necessary aiding tool for reviewing anatomic areas in MRI, ultrasound and x-rays to name a few. In forensics IE is used for identification, evidence gathering and surveillance. Images obtained from fingerprint detection, security videos analysis and crime scene investigations are enhanced to help in identification of culprits and protection of victims [18].

Design Efficiently Implementing Dilate and Erode Image Functions

Dilate is a function that allow a black and white image. It is also known by the names "grow", "bolden", and "expand". It turns on pixels which were near or close pixels that were on originally, thereby thickening the items

in the image [19].



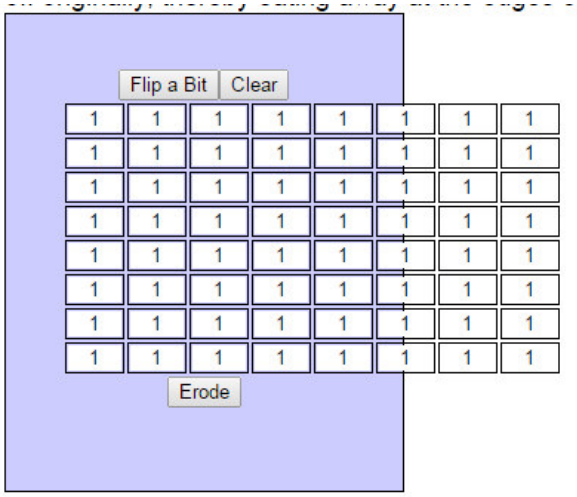


Figure 1: Erode **Figure 2: Detecting image show**

Erode is an associate function to dilate. It is also known by the name "shrink". It turns off pixels which were close pixels that were off originally, thereby eating away at the edges of the items in the image region.

VI. Observations, Discussion and Results

The point processing methods are most primitive, yet essential image processing operations and are used primarily for contrast enhancement. Image Negative is suited for enhancing white detail embedded in dark regions and has applications in medical imaging. Power-law transformations are useful for general purpose contrast manipulation. For a dark image, an expansion of gray levels is accomplished using a power-law transformation with a fractional exponent. Log Transformation is useful for enhancing details in the darker regions of the image at the expense of detail in the brighter regions the higher-level values. For an image having a washed-out appearance, a compression of gray levels is obtained using a power law transformation with γ greater than 1. The histogram of an image (i.e., a plot of the gray level frequencies) provides important information regarding the contrast of an image. Histogram equalization is a transformation that stretches the contrast by redistributing the gray-level values uniformly.

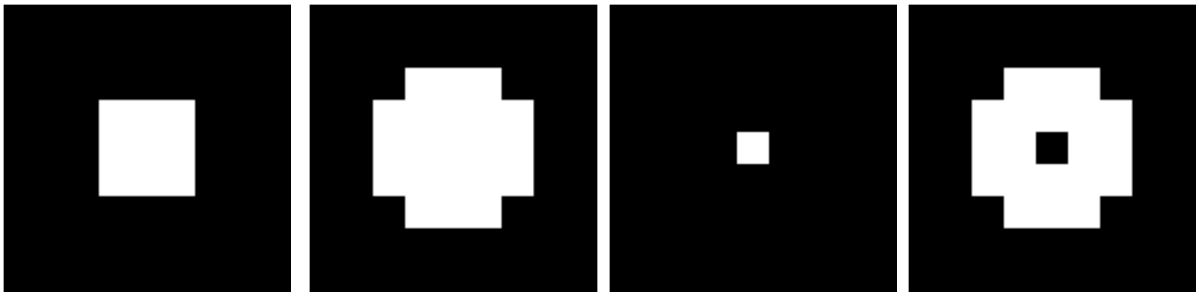


Fig3 a: Input image b: Dilation c: Erosion d: Subtraction


Figure 4: a: Original Face Image b: Skin Color Segmentation

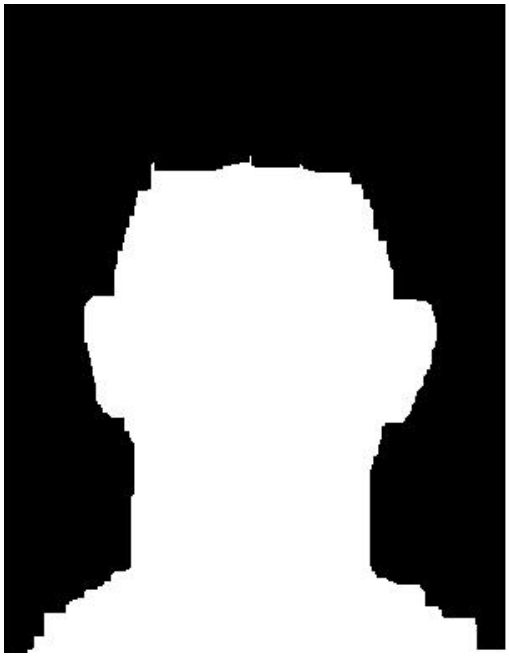
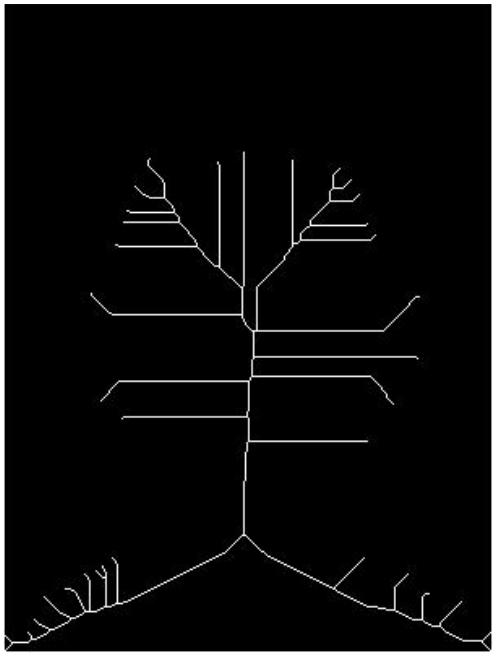



Figure4a: After Dilation & Erosion b: Skeleton of the image

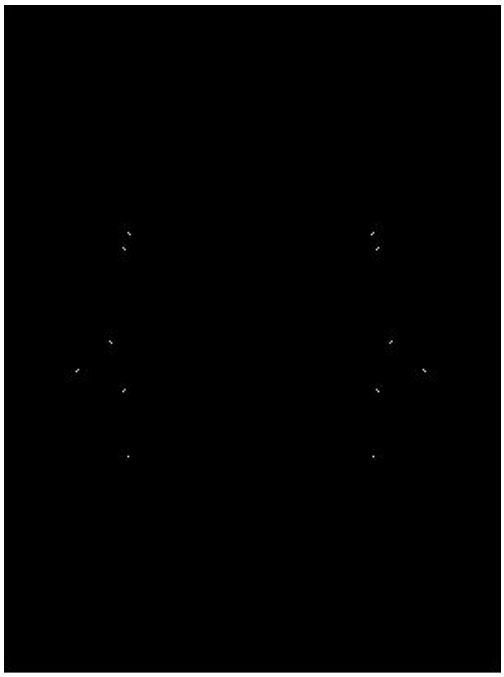


Figure 5: Gamma Correlation

Fiureg 5 Contour points

Figure6: After applying Brightness enhancement

Figure 7 Using Sepia Method

Figure 8 Edge Detection with homogeneity

Figure 9: Morphology Dilation Close

Figure *10: Morphology Dilation Open*

Figure 11 Grey Scale

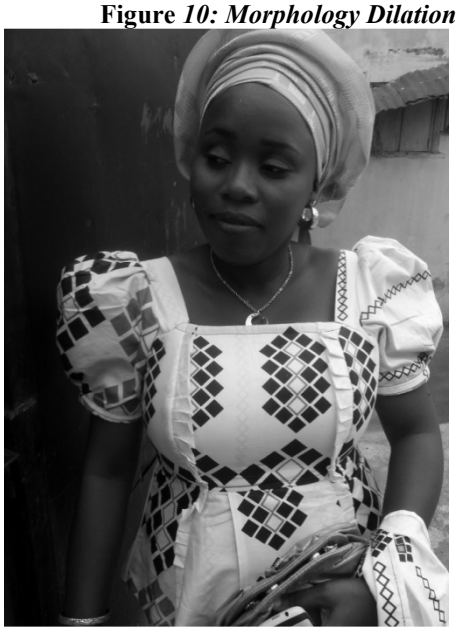


Figure 12 Invert method

Fig 13: Two Source Filter Intercept **Conclusion and Recommendation**

The experimental design for the research (Image processing) was successfully replicate the results found by Viola and Jones and even arrive at the same feature set even though our training set was different. This further shows the robustness of the algorithm. Although processing is quite easier and take neon second to complete whole process with the experimental output. Algorithm is fast and can be used to scan large images quickly. Using 10 best features is not sufficient for processing images with low false positive rates in the general case, but on the other hand a small set of 10 features can be used successfully if the image within the image are relatively large and an approximate bound can be placed on their size and get perfect output.

References

[1] Arun R, Madhu S. Nair, R. Vrinthavani and Rao Tatavarti. "An Alpha Rooting Based Hybrid Technique for Image Enhancement". Online publication in IAENG, 24th August 2011.
[2] Agaian, SOS S., Blair Silver, Karen A. Panetta, "Transform Coefficient Histogram-Based Image Enhancement Algorithms Using Contrast Entropy", IEEE Transaction on Image Processing, Vol. 16, No. 3, March 2007
[3] Jinshan Tang Eli Peli, and Scott Acton, "Image Enhancement Using a Contrast Measure in the Compressed Domain", IEEE Signal processing Letters , Vol. 10, NO. 10, October 2003
[4] R. Mantiuk, S. Daly and L. Kerofsky, "Display adaptive tone mapping", *ACM Trans. Graphics*, vol.27, no. 3, pp. 681-690, 2008.
[5] R. P. Kovaleski and M. M. Oliveira, "High-quality brightness enhancement functions for real-time reverse tone mapping", *Visual Computer*, vol. 25, no. 5, pp. 539-547, 2009.
[6] T. Jinno, M. Okuda and N. Adami, "Acquisition and encoding of high dynamic range images using inverse tone mapping", Proc. of IEEE
International Conference on Image Processing, vol. 4, pp.181-184, 2007.
[7] S. S. Agaian, S. Blair and K. A. Panetta, "Transform coefficient histogram-based image enhancement algorithms using contrast entropy",
IEEE Trans. Image Processing, vol. 16, no. 3, pp. 741-758, 2007.
[8] H. Hu, "Video enhancement: content classification and model selection",Ph. D. Thesis, Technique Universities Eindhoven, Eindhoven, Netherlands, 2010.
[9] YunBo Rao and Leiting Chen, "An efficient contourlet transform-based algorithm for video enhancement", *Journal of Information Hiding and Multimedia Signal Processing*, vol. 2, no. 3, pp. 282-293, 2011.
[10] S. Lee, "An efficient content-based image enhancement in the compressed domain using Retinex theory", *IEEE Trans. Circuits and Systems for Video Technology*, vol. 17, no. 2, pp. 199-213, 2007.
[11] V. A. Nguyen, Y. P. Tan and Z. H. Chen, "On the method of multicopy video enhancement in transform domain", *Proc. of the 16th IEEEInternational Conference on Image Processing*, pp. 2777- 2780, 2009

[12] R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, New Jersey, 2008.
[13] X. Dong, Y. Pang and J.Wen, "Fast efficient algorithm for enhancement of low lighting video", Proc. Of the 37th International Conference and Exhibition on Computer Graphics and Interactive Techniques,2010.
[14] A. A. Wadud, M. Kabir, M. H. Dewan and M. C. Oksam, "A dynamic histogram equalization for image contrast enhancement", IEEE Trans. Consumer Electronic, vol. 53, no. 2, pp. 593-600, 2007.
[15] S. S. Agaian, S. Blair and K. A. Panetta, "Transform coefficient histogram-based image enhancement algorithms using contrast entropy", IEEE Trans. Image Processing, vol. 16, no. 3, pp. 741-758, 2007.
[16] A. O. Boudraa and E. H. S. Diop, "Image contrast enhancement based on 2D teager-kaiser operator", Proc. of the IEEE International Conference on Image Processing , pp. 3180-3183, 2008.
[17] S. Hashemi, S. Kiani, N. Noroozi and M. E. Moghaddam, "An image contrast enhancement method based on genetic algorithm", Pattern Recognition Letters, vol. 31, no. 13, pp. 1816-1824, 2010.
[18] D. G. Toderici and J. Yagnik, "Automatic, efficient, temporallycoherent video enhancement for large scale applications", Proc. of the 17th ACM International Conference on Multimedia, pp. 609-612, 2009.
[19] I. Jafar and H. Ying, A new method for image contrast enhancement based on automatic specification of local histograms, International Journal of Computer Science and Network Security , vol. 7, no. 7, pp. 1-10, 2007