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Traditional and Soft Computing Techniques for Image Enhancement

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Abstract: ***Now-a-days, there is a growing demand for image processing. The target of image enhancement is to find details present in images having low luminance for better image quality. Enhancement is required to improve the picture quality. In this process, we can enhance an image, by applying the suitable technique. In enhancement, there is a conversion in image contrast, quality, color vision, brightness, clarity etc. So we need image enhancement. A comparative survey is carried out in this paper, explaining traditional and soft computing techniques. This paper clarifies a study of traditional such as edge detection of an image and fuzzy logic based soft computing for improvement of an image. In the result section output of image is shown as edges using traditional as well as fuzzy. A small description is also study for picture improvement using different soft computing and optimization techniques such as Neural network, Convolution Neural Network, Ant Bee Colony, Particle Swarm Optimization etc. in literature survey and in comparative table. It is concluded that Image enhancement can be done by traditional method, soft computing and optimization method. Image enhancement has found various vision applications that have the ability to enhance the visibility of images. To enhance an image it is very important that image should be clear, so before using the enhancement techniques we should need to learn about the enhancement. So this paper described a survey of image enhancement with different techniques. In future scope of this paper we can find out different type of parameters like PSNR, MSE and execution time, also we can use optimization technique. We are also showing a comparison table of image enhancement based on traditional, soft computing and optimization techniques with its open scope.***

Keywords : Discrete wavelet transform, Image enhancement, Soft Computing, Fuzzy logic, Particle Swarm Optimization, Ant Bee Colony, Ant Colony Optimization, Histogram equalization, convolution neural networks, Edge detection.

I. INTRODUCTION

Advanced picture preparing is extending in all the field of our life. In various fields of interest such as medical imaging systems, digital photography, satellite imaging, underwater visibility imaging, vision and face recognition, video surveillance systems, radar image processing, virtual restoration of ancient Chinese painting, digital photography and sonar image Processing and so on.

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Nowadays, mobile phones for capturing pictures is mostly seen, but due to hardware limitation observed in mobile phones for digital photography, the image quality can vary based on its resolution, focus, light intensity, a sudden bright light change or a shadow effect *etc.*, leading to poor image contrast with distortions and high noise levels. It might be remote detecting, safeguard, aviation, bio-restorative field, and therapeutic field. Today picture quality preparing is becoming very quick. Enhanced picture handling is dependably a fascinating zone, and it gives better pictorial or picture data. Picture preparing is the strategy to improve Pictures got from camera/sensor. Essentially we can state that picture preparing is indirect way to the handling of the computerized picture. Picture handling is utilized as a part of different applications, for example, biomedical, remote detecting zone, material, military and so on. Picture pressure is a portrayal of the picture in a computerized frame. Enhancement is very important in image processing it is used for the better visual quality of the image, so it is called enhancement. It is the process of balancing the digital image. Enhancement gives more efficient result of edge detection, negative image, and image threshold [3]. Image Enhancements helps in boosting the visual quality of the image as perceived by a human eye. In computer vision the image graded of a digitally stored picture by using a suitable software. By utilizing a specific calculation and apparatus it is quite simple to make a picture lighter or darker/increment or abatement differentiate. For make a proper picture upgrade programming bolster numerous kind of channels. Picture upgrade is utilized for enhancing the nature of a picture. It is the way of modifying advanced picture by this we get a more appropriate outcome. In picture upgrade there are different technique utilized, for example, edges, contrast, sharpening and so on [7]. There is two segments of advanced picture handling: picture improvement and data extraction. Upgrade techniques are extensively separated into two types: Frequency domain and spatial domain. Spatial domain straight forwardly manages the pixels of a picture. The estimations of pixels are required to accomplish wanted upgrade. There are two categories used in the spatial domain these are: intensity transformation and spatial filtering. Frequency domain image firstly transferred into frequency i.e. Fourier transforms of image computed first. Enhancement used in various field i.e. remote sensing, the image obtained by satellites have higher quality, to obtain this higher quality we need image enhancement such as contrast, edges colors vision etc. [18]. Several methods required for obtaining high quality i.e. histogram equalization, bi-histogram equalization, Recursive Mean square histogram. Some Enhancement techniques are histogram equalization, transformation, and contrast stretching etc.

Picture improvement is a procedure primarily centers around handling a picture such that the prepared picture is more appropriate than the first one for the particular application. "Specific" has essentialness.

It provides some insight that the consequences of such an activity are exceedingly application subordinate. At the end of the day, a picture improvement strategy that functions admirably for X-beam topographic pictures may not function admirably for MR pictures. The upgraded method separated in two classes based on the space they are connected on. These are the recurrence and spatial areas. The recurrence area techniques work with the Fourier Transforms of the picture. The term spatial space alludes to the entire of pixels of which a picture is made out of. Spatial area techniques are systems that work specifically on the pixels. The procedure can be communicated as:

$$g(x, y) = T[f(x, y)] \quad (1)$$

Where f(x, y) is the info picture, g(x, y) is the handled picture, and T is an administrator on f characterized over some area of (x, y). Various upgrade procedures exist in the spatial area. There are two types of computing are used i.e. soft computing and hard computing. We use soft computing to solve the complex problems; it is a set or collection of a different algorithm. The aim of soft computing is to obtain a better solution at a reasonable cost. Soft computing based on learning programming such as fuzzy logic, neural nets, probabilistic reasoning [52] 4. Soft computing is a set of or a collection of an algorithm that is employed to solve the complex problem. The objective of soft computing is obtaining a robust solution at a reasonable cost. When we talk about cost it is how much time and space consume to a run the algorithm [40]. When we talk about the advantages of soft computing, it is used for solving the nonlinear problem in which the mathematical model is

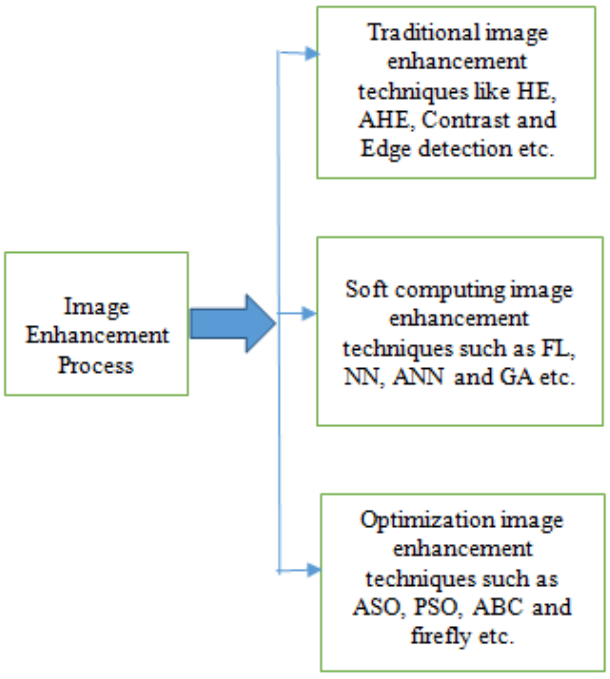

Fig. 1. Work flow of image enhancement process

not possible or available. It introduces human knowledge such as cognition, recognition, learning etc. [28] 6. Fig. 1 is here showing a image enhancement process, in this process we can do the image enhancement by various methods such as tradition, soft computing based and using optimization. In this paper we stress on enhancement by traditional and soft computing. In traditional we have to do enhancement by edge detection, histogram so on and in soft computing our stress is on fuzzy logic. The classification of soft computing techniques are such as intelligent system, Neural Networks, Fuzzy Logic, Evolutionary algorithm: Genetic algorithm, Artificial Intelligence enhancement, how an image goes through different categories of traditional and soft computing. Three types of phase of image enhancement are mentioned in this fig. such as preprocessing, standard image enhancement, soft computing based processing. The first phase of this figure is preprocessing phase. In this firstly image convert into gray and check noise then get output image of phase one preprocessing step. In phase two apply the image histogram, contrast and edges of the image, if there is any noise then apply filter to remove the noise and get output of phase two after apply these techniques. In phase three we will apply the soft computing technique such as fuzzy logic, convolution neural networks, neural network and artificial neural network so on.

The remainder of this research is ordered as follow: I introduction, section II is showing literature survey of Image enhancement. Section III demonstrates the image enhancement techniques with the help of a comparison table. Section IV is showing the proposed work through a flow chart result section. Section V is showing the result and discussion with the help of output implemented in MATLAB. Section VI is the telling about the conclusion and future scope of the paper. At the beginning of each section, we define and review about all the sections.

II. LITERATURE REVIEW

G.Saravanan et.al. [1] Presented a real time implementation. The tech is used in this paper is image enhancement using DWT (2016). In this paper author focus on to reduce the distortion and luminance enhancement achieve by GMF (geometric mean filter) The main work of this paper is enhance the color of an image. By converting RGB to HSV, author focus on enhance a color image. Author concluded some parameters such as enhanced luminance, reduction of noise, better visual quality, increase the PSNR value and also decrease the MSE. According to author there is an open scope of soft computing technique.

Gouri B.et.al. [2] Presented an image enhancement tech on brain MRI. In this paper author expressed an algorithm for image enhancement (2015). In this paper GUI is used that band or connect /interface MATLAB and XSG, this provide a simplicity and easier to implement on hardware. In this research author focus on image processing in term of pixel and develop a new algorithm. The image pixels are available in image and reconstructed picture. The enhancement of MRI image can be done at minimum delay. Open scope for this paper is any other disease can be detected related to brain.

Dr Usha Rani Nelakuditi, et.al. [3] Presented an implementation of different detection method, parameters on FPGA (2015). This algorithm based on VLSI implementation and MATLAB using XSG. In this paper these techniques are implemented on FPGA.

It can be observed by this paper that XSG is a tool for implementation of a hardware and software co-simulation in the field of image processing application. Complexity exist also very less.

Mohammad Alarequi et.al. [4] Presented a image enhancement technique and provide a better transform and make a better appearance using FPGA because FPGA is better option for real time (2017). In this paper author focus on different enhancement method use in biomedical applications such as hand image with veins, as result vein of hands can be appear to be clear. This paper also present an enhancement algorithm the of image processing.

Hasan Demirel et.al. [5] Presented a real time enhancement technique based on DWT (2011). In this paper low resolution image enhance by Wavelet Zero Padding (WZP) and Cycle Spinning (CS). According to author these techniques are sharper than other techniques and give a better result, experimental result has been done on MATLAB in this paper.

Zoltan German Sallo et.al. [6] Presented a filtering process and implement it on FPGA (2014). Authors focus on clean the error signal on FPGA for analysis.XSG environment will be used for simulation. There is a co-simulation used for hardware and software. In this paper various parameters are find out that is PSNR, MSE and compared these parameter are at different noise level using discrete wavelet transform.

Jerry Chan Ting Hai et.al. [7] Presented feature extraction only eyes, height for moving image using HDL and FPGA (2015). In this paper creators display an elective approach of planning a structure, in light of HDL coder, vision tool kit and MATLAB for outlining a moving picture and video arrangement. The fundamental goal of this paper is to decrease the specialized multifaceted nature and furthermore lessen the advancement time of conventional FPGA outline. In open scope authors suggest other moving object tracking i.e. nose, lips etc.

Adesh Kumar et.al. [8] Presented a text and character extraction using Haar and DWT techniques (2015). In this paper authors contribution is text / character extraction by using Haar dwt technique. Various parameters are observed in this paper i.e. minimum time delay, max frequency, memory storage, extract character and textual information horizontally and vertically using Xilinx and FPGA vertex 5. Open scope of this review is integration of DWT with extraction special character.

Jose-Luisani et.al. [9] expressed an algorithm on contrast enhancement; various parameters are tested on satellite images (2016). In this paper creator display two benchmarks which tried the execution of the condition of-craftsmanship differentiate upgrade and furthermore connected a tone mapping calculations connected onto satellite pictures. The primary benchmark allowed to fix the system and determination of test pictures for second. The second benchmark is select a best calculation and furthermore included more rivals in tone mapping class.

Jiahang Liu et.al. [10] focus on contrast enhancement because remote sensing mostly suffers low contrast (2017). In this paper a adaptive histogram compacting transform based contrast image enhancement method is used for remote sensing images. In this a local remapping algorithm is implementing for grey extended with linear stretch. Comparison and experimental results indicate that proposed methods found the improved result than state-of-the-art method.

Codruta o.Ancuti et.al. [11] Presented an enhancement algorithm for underwater image and video with high accuracy (2018). In this paper this proposed approach for enhancement of underwater video and images, their approach is suitable for enhance a wide range of underwater images with high accuracy.

Xinghao Ding et.al [13] presented enhancement algorithm for human visualization. This algorithm is classified into three parts such as luminance find out and images background, restoration and adaptive adjustment (2010). This algorithm provide a better visuality results such as clear and natural color.

B.D Jadhav et.al [14] presented an image enhancement approach using interpolation of high frequency sub band using DWT for the satellite image (2015). They proposed DWT and IDWT on low resolution image and get a high resolution image.

Avinash S et.al [15] Present a enhancement technique based on DWT in predict a lung cancer. In this paper a new approach is proposed to overcome drawback of image enhancement Gabor filter, DWT, AEA (auto enhancement algorithm) (2017). In this article, X-ray lung images has been taken, and this new approach using GFT for image enhancement for immediate detection of cancerous cell. These result also verified the result of real time images. So this approach (GFT) is highly suitable.

Milos klima et.al [16] used an image enhancement technique by reducing noise and improve the quality of a security image (2006). This article present a subjective image quality evaluation, author present two techniques edge detection and denoising in operator, these techniques have been tested on security scenes.

Samiul Azam et.al [17] presented a resolution enhancement technique using DWT , Discrete wavelet transform is used to decompose the low resolution image into frequency band, by this author find the PSNR, RMSE, Entropy, universal quality index (2014).

Rohit kempanna Atyali et.al [18] presented a DWT and PCA technique to detect a cancer tissue through image fusion (2016). In this paper author found that PCA and DWT give a better result of fused image with less noise.

Ahire Rina B et.al [19] focus on SWT, DWT and interpolation based image enhancement technique. Discrete wavelet transform and SWT have high resolution (2013). In this paper author has been concluded that by the compare the two image resolution enhancement technique shown image is more enhance and sharper.

Vasieios Syrris et.al [20] expressed an approach for low resolution and give a superior resolution (2015). Author focus on the study to find out the sensitivity of textural measurement and morphological characteristics based on contrast of image that are used for f high resolution satellite image. A brief study is presented for test a blend operations of image enhancement such as linear stretching and decorrelation stretching. Next step for this paper can be included the test images with adaptive histogram adjustment, using different layers.

He Deng et.al [21] expressed their views on image enhancement those images have weak edges (2016). This technique applied on MRI brain, Mammogram, Small target infrared images.

By this proposed method author found a good performance of enhancement, In future can be improve the flexibility.

Patrick Schuch et.al [22] presented a survey on image enhancement of fingerprint. In this survey author focus on image enhancement techniques using in biometric performance (2017). The performance also varies depending on feature extraction algorithm. In this paper author found that wiener filter gives the best performance result.

Shilpa Suresh et.al. [23] Presented a cuckoo search enhancement algorithm of robust and adaptive for various satellite images (2017). In this algorithm initializing phase, an adaptive strategy of Levy flight that helps in rising the convergence rate of algorithm. Performance evaluation algorithm of experimental work was conducted by differentiating it with literature review work of Meta heuristic algorithm. This algorithm tested on wide range of satellite images. Author also mentions various merits of these algorithms in this paper.

Kirti Khatkara, et.al. [24] presented an enhancement technique, this technique based on discrete wavelet transform (DWT).Author focus on enhancement in biomedical images (2015).

Liang Zhang et.al. [25] Proposed an algorithm that has dehazing and noise reduction (2016). In this paper stress on find the estimate the values of initial parameter of hazy image model with the help of dehazing techniques. Secondly they correct the parameters of hazy image model alternately with the iterative joint bilateral filter. The proposed model also gives comparative study on with current common image enhancement and noise reduction algorithm.

Amit Mehto et.al. [26] Presented a watermarking algorithm that provides an image security or privacy of patient (2016). In this paper value of PSNR for proposed work with original image is 40-45 db i.e. enough to visualization the image.

Guang Yang et.al.[27] provide a technique to identify brain tumor using DWT technique, author tested brain tumor both in whole spectral and sub spectral analysis. Author concluded that sub spectral is gives a better or sufficient result to identify brain tumor by using windowed key (2015). Author concluded in this review that feature extraction using DWT and hierarchal clustering produces promising brain tumor classification that has potential for analysis of larger multicenter database.

Kaur, Taranbir et.al [29] describe an image enhancement technique like histogram equalization and fuzzy enhancement techniques (2016). The aim of this paper is to find out the effectiveness of histogram based and fuzzy based enhancement for different type of images. In this paper author used different optimized techniques like ACO, PSO, and ABC. It has been analyzed that result obtained from PSO technique are more efficient than others.

Avinash, S.et.al. [30] In this paper author stress on implementation and comparison of different image enhancement techniques for the
lung cancer detection (2017). In this survey a modified approach is proposed to overcome the disadvantages for enhancement for
image. For this author used Gabor filter, DWT, auto enhancement algorithm. In this paper, X-ray of lung images has been taken. A new GFT approach is proposed, because author found that GFT I highly suitable in enhancement and lung cancer can be predict at earlier stage.

Sharma, Neha, et.al [31] proposed a comparative study of various image enhancement approaches. It gives a different parameters performance (2015). By this comparative analysis modified CLAHE shows the better result. This entire algorithm has been implemented on MATLAB. But the limitation of modified CLAHE is it has larger execution time.

Mahashwari, et.al [32] presented a fuzzy based image enhancement logic also implemented on MATLAB, algorithm based on fuzzy rules, image enhancement has been spread, implemented. The conclusion is that, if pixel intensity is bright then output will be bright, if intensity is gray then output will be gray, if pixel intensity is dark then output is also dark (2013) .

Malik et.al [33] presented a comparative study of enhancement algorithm and these techniques based on spatial domain, so the result has been obtained that advance image enhancement investigation approach must be forward that can operate almost in every domain (2014).

Saenko et.al [34] author focus on various type of edge detection techniques, these approaches depend upon search, fuzzy logic, zero crossing, (2012). This enhancement done in the field of optical measurement parameters.

Taneja et.al [35] author focus on analyze the execution of algorithm for image segmentation, the segmentation is based on intensity and texture based (2015). According to author want to state that both intensity and texture provide a better result. Various investigation of performance parameters such as confusion matrix parameters, accuracy, Kappa coefficient on traditional method. Saxena et.al [36] this paper focus on image enhancement techniques based on fuzzy method (2015). Experimental results are also preserve the brightness, edge, contrast of images that are based on soft computing enhancement method which gives the better results as compared of state of art enhancement method. In this paper a block wise two step fuzzy technique is proposed.

SS Bedi et.al [37] presented a survey on various enhancements a techniques; image enhancement is used for showing better visualaity or provides a better transform representation. Author also gave a brief survey of histogram enhancement (2013). This paper focus on image enhancement categories that are spatial domain and frequency domain depend on enhancement and also discuss the advantages and disadvantages of image enhancement algorithm. Future scope of this survey is development of adaptive algorithm for image enhancement based on soft computing.

Pinky Agrawal et.al [38] described the different enhancement techniques in spatial domain as well as in frequency domain (2014). In this paper image enhancement algorithm provide a wide range approaches to acquire images by modifying images according to specific task, viewing condition, characteristics of observer and image content. In this review author found that global histogram can be done automatically. In future there is a scope of to enhance images by the implementing a neural networks and wavelet transform.

Aporva kumari et.al. [39] author focus on a new approach to remove haze. In this paper for this work authors used FFT technique based on MATLAB (2015).

By using FFT it gives a better visuality and also authors focus on to reduce the complexity. In open challenges author suggest we can continue this work further on hardware.

TABLE 1: LITERATURE REVIEW OF ENHANCEMENT TECHNIQUES

The table has been shown below a comparison literature review about the traditional and soft computing based upon image enhancement according to authors, year, techniques, author contribution and their open issues and future scopes also. In this table a comparative analysis between traditional based image enhancement, soft computing based image enhancement and optimization based enhancement has been done.

Refer./Author	Year	Techniques	Contribution	Open issues
Traditional techniques of image enhancement				
H.Demirel [5]	2011	DWT enhancement	Resolution enhancement on satellite image.	Resolution can be measured on other real-time images.
G.Saravanan [1]	2016	Image enhancement based on DWT	-Achieve luminance enhancement -resource utilization i.e. H/W component -avoid distortion	Soft computing
M. Alareqi [4]	2017	Image enhancement	Image enhancement applied to a biomedical application such as a vein of hand, the vein can detect easily by this technique	Can be applied to other medical images.
Avinash S [15]	2017	DWT GFT AEA	To overcome the limitation of image enhancement an advanced technique is proposed.	Can develop a new approach for increase the computing speed and efficiency
Klima M [16]	2006	Edge detection	used an image enhancement technique by reducing noise and improve the quality of a security image	Can measure other parameters with a suitable tool and algorithm.
Schuch [22]	2017	Enhancement, Wiener filter	Survey on image enhancement of fingerprint	Can a particular algorithm with a suitable tool.
Zhang.L [25]	2016	Dehazing enhancement technique	Comparative study on with current common image enhancement and noise reduction algorithm.	Can also measure other parameters.
Sharma.N [31]	2015	Different enhancement techniques	Comparative study of image enhancement algorithms. Modified CLAHE shows the better result. But M-CLAHE has large execution time.	In open scope, we can create a new technique of Modified CLAHE which takes less time complexity.
Malik [33]	2014	Image processing technique	These techniques based on the spatial domain.	Can also create a new approach in every domain.
Apurva K [39]	2015	FFT(MATLAB)	Complexities reduce better visualization.	Focus on hardware.
Zohair Al-Ameen [42]	2018	Image Enhancement	Proposed an algorithm for low complexity.	Focus on find other parameters.
V.Magudeeswaran [43]	2013	Histogram Equalization	Histogram equalization algorithm is proposed for contrast enhancement.	Can use in real world applications.
Senthilkumaran N [44]	2014	HE, GHE, AHE, LHE,BPDHE	Different enhancement techniques are used for enhance MRI brain images.	Can apply these techniques on other real time applications.
Saruchi [45]	2012	HE,CS ,smoothing	Author gave a comparison in different enhancement techniques.	Analysis the parameters.
Soft computing techniques of image enhancement				
Gagandeep Kaur [40]	2018	Genetic, fuzzy, neural network and optimization techniques.	Comparison between the status of currently used image enhancement using soft computing approaches.	The algorithm is complex to make it simple, very few techniques are used for enhancement, the existing algorithm require more memory space
Kaur, Taranbir [29]	2016	ACO, PSO, ABC	Histogram and fuzzy based image enhancement & has been doing performance analysis such as MSE, PSNR, CII, Execution time, based on MATLAB	In open issues, we can evaluate this work on FPGA and get a comparative evaluation.
Saenko [34]	2012	Edge detection	A comparative study based on edge detection i.e. search, zero crossing, fuzzy logic.	Can apply in another field also.

Kumud S [41]	2014	State of art , Fuzzy	Proposed a two step fuzzy enhancement which gives superior result as compared to another state of art method.	Can also use other soft computing and optimization techniques.
D.Teodorovic [48]	2006	BCO, BS, FBS	In this paper author explore the utilization of collective bee intelligence in solving combinational problems charecterized by uncertainity.	In future can work on advantages and disadvantages
M.Braik [49]	2007	PSO	Maximize an objective fitness functionfor contrast enhancement.	Also used in real-time application.
Q.bai [50]	2010	PSO	Measure parameters.	Real-Time applications.
S.J. preethi [51]	2013	Fuzzy Logic	Introduce membership function and modify membership function for image enhancement.	In future there is a scope of applying algorithm to enhance video images.
T.Mahashwari [52]	2013	Fuzzy Techniques	Fuzzy technique is used for image enhancement.	For more accurate result can be used another method.
Tao [52]	2017	LLCNN	Convolution neural network for improve low light and increase the brightness. In this author has been evaluate various parametrs like PSNR,SSIM,LOE and SNM.	We can decrease the speed-up time for this evaluation.
Katyani Singh [56]	2019	CNN	Study literature of CNN for improve denoising, resolution.	These Performance parameters can apply in real time processing.

III. PROPOSED WORK

After the study of complete literature survey, we have to propose a work flow for image enhancement. In this we are doing a step by step image processing shown in fig.2. In this figure the structure complete in three phase are as follows:

a. Phase : 1 (Preprocessing)
b. Phase : 2 (Image enhancement)
c. Phase : 3 (Soft computing based IE)

In this figure phase 1 is showing a preprocessing step. In it we are taking an image as input and convert it into gray image, in this no operation like enhancement is applied, we are only preprocess the input image and saw its output.

In the second phase that is enhancement, in it we are apply the enhancement techniques like histogram, edge detection, contrast to improve the visual appearance. The last i.e. phase 3, soft computing techniques. This is used for more accurate results.

There are many types of soft computing techniques like fuzzy, NN, ANN and genetic. The output of these images are also shown in the result part of this paper. This part is showing the output image after every phase of these techniques. After this we can also apply the optimization technique for more accurate result, but in this we are doing only these three phase: preprocessing, enhancement and soft computing based enhancement.

In this process we are showing the histogram equalization of an image, edge detection of image, conversion in gray and in the soft computing we are using fuzzy logic i.e. we are applying a fuzzy logic technique after the enhancement.

This work has been already done by different authors but we are studying and talk about the literature survey of image enhancement, so we are only check our output images, no evaluation parameters found in this paper.

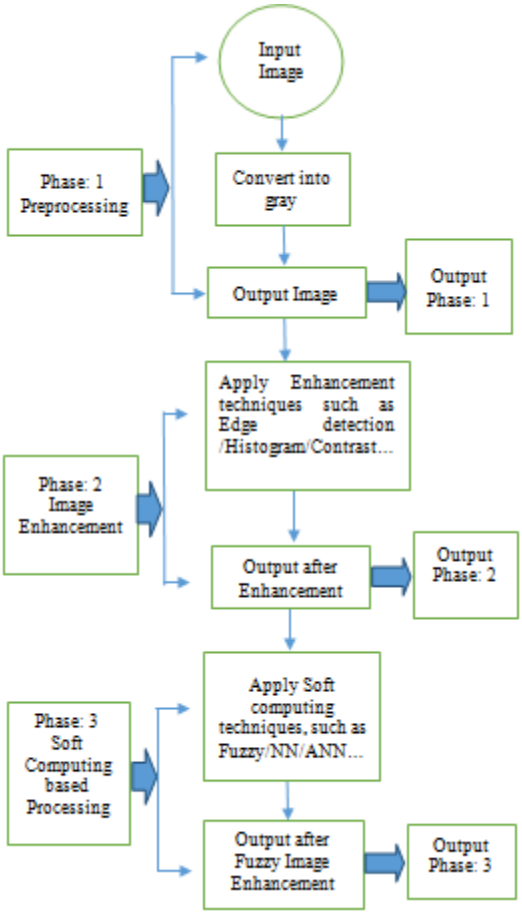

Fig. 2 Proposed work for the image enhancement [51]

IV. RESULT AND DISCUSSION

In the overall discussion there is given a work flow of enhancement and also shown the enhanced results in section V.

These results are implemented in MATLAB. Comparison table.1 is a concluded enhancement survey. In this various enhancement techniques and algorithms are used with traditional and soft computing method, and also give the comparative study. Different types of enhancement can be done with these techniques like contrast, brightness, atmospheric color. Open scope for this survey is this work has some limitation of for the suitable algorithms and tool such as software as well as hardware based. So we can continue this work at another tool, algorithm and improve different parameters such as complexity, another medical image, reduce noise more, use another tool, also focus on hardware implementation i.e. in real-time processing discussed in the table I. The figure 3 is showing here different types of outputs according to the proposed work shown in figure 2. Here the input image is shown in figure 3(a) which is a color image. According to phase 1 firstly we are taking an input image then convert it into gray image because the intensity of colored image is very high so need to it convert in gray. Fig (b) is showing here gray image. The original color image is converted into gray, because color image has intensity so need to convert into gray. The fig (c) is showing the enhanced output after convert an image into gray. In fig (d) here is showing edge detection of phase 1. At last fig 3 (e) is showing the enhanced output image when we are applying the fuzzy logic on it. After apply fuzzy logic in MATLAB we got more accurate, visual appearance. The all the images are shown their individual results. In MATLAB we can implement these in MATLAB code as well as we can create a Simulink model. In Simulink we can also write code in MATLAB function block. After a complete survey we have to conclude that fuzzy gives the more accurate results. All the three phases of this work has their own operation. They are doing individually works. For the implementation we are taking a desert image, this image is taken as input image. All the functions like edge detection, enhancement, fuzzy are apply on this image. Results of this image are shown below.

Fig.3 (a) Input Image (b) Convert into gray(c) Enhanced Image (d) Edge detection (e) Enhanced after fuzzy

V. CONCLUSION AND FUTURE SCOPE

Image enhancement plays a very important role in digital image processing. A complete survey of image enhancement based on traditional and soft computing based technique. In this paper, we give a complete review of image enhancement by a complete literature survey and giving a comparison table. A workflow is given in this paper and also implemented the results in MATLAB. In the conclusion part we have to take an image then on this we put different techniques like edge, conversion, fuzzy and found the results. Future scope of this survey is that we can measure different type of parameters like PSNR, ET, MSE and SSIM. In future we can also apply optimization techniques for more suitable results. The different techniques has a different limitation in the form of tool used, the algorithm used, a technique used so in open scope we focus on that we choose a suitable technique with suitable algorithm and tool of enhancement which has less limitation and give a better result, we also focus in processing of image enhancement in real-time. In this paper, a comparative survey is carried out describing various Direct and In-Direct Contrast Image enhancement techniques with their advantages and disadvantages.

REFERENCES

1. Saravanan, G., and G. Yamuna. "Real Time Implementation of Image Enhancement Based on 2D-DWT." *Procedia Computer Science* 87 (2016): 105-110.
2. Deshpande, Gouri B., and K. Ramesha. "MRI Brain Image Enhancement Using XILINX System Generator and DWT." *Bonfring International Journal of Advances in Image Processing* 5, no. 2 (2015): 16.
3. Nelakuditi, Usha Rani, M. Naresh Babu, and T. Narayana Bhagirath. "Efficient real time hardware co-simulation for image enhancement applications." In *Electronics and Communication Systems (ICECS), 2015 2nd International Conference on*, pp. 1580-1583. IEEE, 2015.
4. Alareqi, Mohammed, R. Elgouri, M. Tarhda, K. Mateur, A. Zemmouri, A. Mezouari, and L. Hlou. "Design and FPGA implementation of Real-Time Hardware Co-Simulation for image enhancemen in biomedical applications." In *Wireless Technologies, Embedded and Intelligent Systems (WITS), 2017 International Conference on*, pp. 1-6. IEEE, 2017.
5. Demirel, Hasan, and Gholamreza Anbarjafari. "Discrete wavelet transform-based satellite image resolution enhancement." *IEEE transactions on geoscience and remote sensing* 49, no. 6 (2011): 1997-2004.
6. German-Sallo, Zoltan. "Signal processing using FPGA structures." *Procedia Technology* 12 (2014): 112-118.
7. Hai, Jerry Chan Ting, Ooi Chee Pun, and Tan Wooi Haw. "Accelerating video and image processing design for FPGA using HDL coder and simulink." In *Sustainable Utilization And Development In Engineering and Technology (CSUDET), 2015 IEEE Conference on*, pp. 1-5. IEEE, 2015.
8. Kumar, Adesh, Prakshi Rastogi, and Pragyan Srivastava. "Design and FPGA Implementation of DWT, Image Text Extraction Technique." *Procedia Computer Science* 57 (2015): 1015-1025.
9. Lisani, Jose-Luis, Julien Michel, Jean-Michel Morel, Ana Belén Petro, and Catalina Sbert. "An inquiry on contrast enhancement methods for satellite images." *IEEE Transactions on Geoscience and Remote Sensing* 54, no. 12 (2016): 7044-7054.

10. Liu, Jiahang, Chenghu Zhou, Peng Chen, and Chaomeng Kang. "An efficient contrast enhancement method for remote sensing images." *IEEE Geoscience and Remote Sensing Letters* 14, no. 10 (2017): 1715-1719.
11. Ancuti, Codruta O., Cosmin Ancuti, Christophe De Vleeschouwer, and Philippe Bekaert. "Color balance and fusion for underwater image enhancement." *IEEE Transactions on Image Processing* 27, no. 1 (2018): 379-393.
12. Asmare, Melkamu Hunegnaw, Vijanth Sagayan Asirvadam, and Lila Iznita. "Color space selection for color image enhancement applications." In *Signal Acquisition and Processing, 2009. ICSAP 2009. International Conference on*, pp. 208-212. IEEE, 2009.
13. Ding, Xinghao, Xinxin Wang, and Quan Xiao. "Color image enhancement with a human visual system based adaptive filter." In *Image Analysis and Signal Processing (IASP), 2010 International Conference on*, pp. 79-82. IEEE, 2010.
14. Jadhav, B. D., and P. M. Patil. "An effective method for satellite image enhancement." In *Computing, Communication & Automation (ICCCA), 2015 International Conference on*, pp. 1171-1175. IEEE, 2015.
15. Avinash, S., K. Manjunath, and S. Senthilkumar. "Analysis and comparison of image enhancement techniques for the prediction of lung cancer." In *Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017 2nd IEEE International Conference on*, pp. 1535-1539. IEEE, 2017.
16. Klima, Milos, Karel Fliegel, and Jan Svihlik. "Quality Enhancement in Security Image Information." In *Carnahan Conferences Security Technology, Proceedings 2006 40th Annual IEEE International*, pp. 60-67. IEEE, 2006.
17. Azam, Samiul, Fatema Tuz Zohra, and Md Monirul Islam. "Image spatial resolution enhancement: A novel wavelet approach." In *Computer and Information Technology (ICCIT), 2014 17th International Conference on*, pp. 362-367. IEEE, 2014.
18. Atyali, Rohit Kempanna, and Shivchandra R. Khot. "An enhancement in detection of brain cancer through image fusion." In *Advances in Electronics, Communication and Computer Technology (ICAECCT), 2016 IEEE International Conference on*, pp. 438-442. IEEE, 2016.
19. Ahire, Rina B., and V. S. Patil. "Overview of satellite image resolution enhancement techniques." In *Wireless and Optical Communications Networks (WOCN), 2013 Tenth International Conference on*, pp. 1-4. IEEE, 2013.
20. Syrris, Vasileios, Stefano Ferri, Daniele Ehrlich, and Martino Pesaresi. "Image enhancement and feature extraction based on low-resolution satellite data." *Ieee Journal Of Selected Topics In Applied Earth Observations And Remote Sensing* 8, no. 5 (2015): 1986-1995.
21. Deng, He, Xianping Sun, Maili Liu, Chaohui Ye, and Xin Zhou. "Image enhancement based on intuitionistic fuzzy sets theory." *IET Image Processing* 10, no. 10 (2016): 701-709.
22. Schuch, Patrick, Simon Schulz, and Christoph Busch. "Survey on the impact of fingerprint image enhancement." *IET Biometrics* (2017).
23. Suresh, Shilpa, Shyam Lal, Chintala Sudhakar Reddy, and Mustafa Servet Kiran. "A novel adaptive cuckoo search algorithm for contrast enhancement of satellite images." *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 10, no. 8 (2017): 3665-3676.
24. Khatkar, Kirti, and Dinesh Kumar. "Biomedical image enhancement using wavelets." *Procedia Computer Science* 48 (2015): 513-517.
25. Zhang, Liang, Peiyi Shen, Xilu Peng, Guangming Zhu, Juan Song, Wei Wei, and Houbing Song. "Simultaneous enhancement and noise reduction of a single low-light image." *IET Image Processing* 10, no. 11 (2016): 840-847.
26. Mehto, Amit, and Neelesh Mehra. "Adaptive lossless medical image watermarking algorithm based on DCT & DWT." *Procedia Computer Science* 78 (2016): 88-94.
27. Yang, Guang, Tahir Nawaz, Thomas R. Barrick, Franklyn A. Howe, and Greg Slabaugh. "Discrete wavelet transform-based whole-spectral and subspectral analysis for improved brain tumor clustering using single voxel mr spectroscopy." *IEEE Transactions on Biomedical Engineering* 62, no. 12 (2015): 2860-2866.
28. Chiuchisan, Iuliana. "An approach to the Verilog-based system for medical image enhancement." In *E-Health and Bioengineering Conference (EHB), 2015*, pp. 1-4. IEEE, 2015.
29. Kaur, Taranbir, and Ravneet Kaur Sidhu. "Optimized Adaptive Fuzzy based Image Enhancement Techniques." *vol* 9 (2016): 11-20.
30. Avinash, S., K. Manjunath, and S. Senthilkumar. "Analysis and comparison of image enhancement techniques for the prediction of lung cancer." In *Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017 2nd IEEE International Conference on*, pp. 1535-1539. IEEE, 2017.
31. Sharma, Neha, Sumeet Saurav, Sanjay Singh, Ravi Saini, and Anil K. Saini. "A comparative analysis of various image enhancement techniques for facial images." In *Advances in Computing, Communications and Informatics (ICACCI), 2015 International Conference on*, pp. 2279-2284. IEEE, 2015.
32. Mahashwari, Tarun, and Amit Asthana. "Image enhancement using fuzzy technique." *International Journal of Research in Engineering Science and Technology* 2, no. 2 (2013): 1-4.
33. Malik, Showkat Hassan, and Tariq Ahmad Lone. "Comparative study of digital image enhancement approaches." In *Computer Communication and Informatics (ICCCI), 2014 International Conference on*, pp. 1-5. IEEE, 2014.
34. Saenko, Alexey, Galina Polte, and Victor Musalimov. "Image enhancement and image quality analysis using fuzzy logic techniques." In *Communications (COMM), 2012 9th International Conference on*, pp. 95-98. IEEE, 2012.
35. Taneja, Arti, Priya Ranjan, and Amit Ujjlayan. "A performance study of image segmentation techniques." In *Reliability, Infocom Technologies and Optimization (ICRITO)(Trends and Future Directions), 2015 4th International Conference on*, pp. 1-6. IEEE, 2015.
36. Saxena, Kumud, Avinash Pokhriyal, and Sushma Lehri. "SCIENCE: Soft Computing Based Image Enhancement for Contrast Enhancement." *International Journal of Advanced Computing, ISSN*: 2051-0845.
37. Bedi, S. S., and Rati Khandelwal. "Various image enhancement techniques-a critical review." *International Journal of Advanced Research in Computer and Communication Engineering* 2, no. 3 (2013).
38. Agrawal, Pinki, Vishakha Chourasia, Ravikanta Kapoor, and Sanjay Agrawal. "A Comprehensive Study of the Image Enhancement Techniques." *International Journal of Advance Foundation and Research in Computer (IJAFRC)* 1 (2014): 85-89.
39. Real Time Visibility Enhancement for Single Image Haze Removal Apurva Kumari∗ and S. K. Sahoo
40. Gagandeep kaur, Nishant Bhardwaj, Pardeep kumar singh"An analytic review on image enhancement technique based on soft computing Approach." *International Journal of Advance in intelligence system and computing, Springer* (2018): 85-89.
41. Saxena, Kumud, Avinash Pokhriyal, and Sushma Lehri. "SCIENCE: Soft Computing Based Image Enhancement for Contrast Enhancement." *International Journal of Advanced Computing, ISSN*: 2051-0845.
42. Al-Ameen, Zohair, and Awni Hasan Zaman. "A Low-Complexity Algorithm for Contrast Enhancement of Digital Images." *International Journal of Image, Graphics and Signal Processing* 10, no. 2 (2018): 60.
43. Magudeeswaran, V., and M. Krishnamurthy. "Low-complexity Histogram Modification Algorithm for Contrast Enhancement." (2013).
44. Senthilkumaran, N., and J. Thimmiaraja. "Histogram equalization for image enhancement using MRI brain images." In *Computing and Communication Technologies (WCCCT), 2014 World Congress on*, pp. 80-83. IEEE, 2014.
45. Garg, Saruchi, and Madan Lal. "Comparative Study of Different Image Enhancement Techniques." *International Journal of Computers & Technology* 2, no. 3c (2012): 131-133.
46. H. Zimmermann, "Fuzzy set theory and its applications", Springer Science & Business Media, **(2001)**.
47. Verma, Om Prakash, Puneet Kumar, Madasu Hanmandlu, and Sidharth Chhabra. "High dynamic range optimal fuzzy color image enhancement using artificial ant colony system." *Applied Soft Computing* 12, no. 1 (2012): 394-404.
48. Teodorovic, Dusan, Panta Lucic, Goran Markovic, and Mauro Dell'Orco. "Bee colony optimization: principles and applications." In *Neural Network Applications in Electrical Engineering, 2006. NEUREL 2006. 8th Seminar on*, pp. 151-156. IEEE, 2006.
49. Braik, Malik, Alaa F. Sheta, and Aladdin Ayesh. "Image Enhancement Using Particle Swarm Optimization." In *World congress on engineering*, vol. 1, pp. 978-988. 2007.
50. Bai, Qinghai. "Analysis of particle swarm optimization algorithm." *Computer and information science* 3, no. 1 (2010): 180.
51. SJ, Mrs Preethi, and Mrs K. Rajeswari. "Membership Function modification for Image Enhancement using fuzzy logic." (2013).
52. Mahashwari, Tarun, and Amit Asthana. "Image enhancement using fuzzy technique." *International Journal of Research in Engineering Science and Technology* 2, no. 2 (2013): 1-4.

53. Tao, Li, Chuang Zhu, Guoqing Xiang, Yuan Li, Huizhu Jia, and Xiaodong Xie. "LLCNN: A convolutional neural network for low-light image enhancement." In *2017 IEEE Visual Communications and Image Processing (VCIP)*, pp. 1-4. IEEE, 2017.
54. Singh, Katyani, Avi Seth, Harshit Singh Sandhu, and Krishna Samdani. "A Comprehensive Review of Convolutional Neural Network based Image Enhancement Techniques." In *2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN)*, pp. 1-6. IEEE, 2019.
55. Hayfron-Acquah, J. B., J. K. Panford, and Y. Poakwah Gyimah. "Enhancing Quality of Images using Fuzzy Logic and Singleton Parameters." *International Journal of Computer Applications* 165, no. 13 (2017).
56. Singh, K., Seth, A., Sandhu, H.S. and Samdani, K., 2019, March. A Comprehensive Review of Convolutional Neural Network based Image Enhancement Techniques. In *2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN)* (pp. 1-6). IEEE.

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