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A NEW DEVELOPED FUZZY INFERENCE TECHNIQUE FOR IMAGE ENHANCEMENT

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ABSTRACT: - Image restoration is a process of improvement of corrupted or noisy image for obtaining a clean original image. Numbers of restoration methods were utilized for performing image enhancement process. In such works there is lack of analysis in selecting top similar local patches and Gaussian noisy images. The quality of the any 2-dimensional image is an important one for a reliable matching process. In this paper a heuristic image restoration technique is proposed to obtain the noise free images. This searching technique is composed of 2-steps, one is core processing and other is post processing. In core processing the local and global feature of each pixel of the noisy image are extracted and restored the noise free pixel value by exploiting the extracted feature of this method. The contrast of the image can be enhanced at the pre-processing stage of fingerprint matching. Contrast is the difference between two neighbouring pixels. In this paper we describe a fuzzy model in approach which may be used for reducing the noise and increasing the brightness of the ridges. Fuzzy filter values are analyzed for better results are produced in the image domain. The probabilities of gray values are determined from the position of the input image pixel. The result indicates the good performance of the proposed fuzzy histogram.

In this paper we proposed a new technique for detection and removal of impulse noise in grey scale digital images. Proposed method works in 2 steps, in its step we detect noisy pixels using fuzzy reasoning with lowest uncertainty and in 2nd step we replace noisy pixels with a heuristic median filter. Our heuristic median filter is combined with human knowledge for selecting best replacement. We analyze this method with PSNR metric values and visual comparison. The results of this method are efficient enough for noise reduction and image restoration in high level noisy image.

Human beings made decisions based on rules. All decisions are made based on computer if else then statements .Rules are associated with ideas or logic and related with each other. However the decisions and means of decisions are selected and replaced by fuzzy selectors and rules are replaced by fuzzy rules. Fuzzy rules operate using series of if else then statements.

Fuzzy rules define fuzzy patches membership functions which are key idea in fuzzy logic. A machine is made smart using a concept designed by Kosho called fuzzy approximation theorem (FAT) it states generally that a finite no of patches can cover a curve. If patches are large rules are slopy, if patches are small then rules are fine. So the rule implemented here is known as Fuzzy inference ruled by else action (A reasoning strategy) FIRE rule.

The FIRE rule is coupled with new pseudo fuzzy rule base that is represented by a set of simple logical operations. The FIRE mechanism is popular for study noise removal whereas pseudo fuzzy rule base simplifies the complicated computation and evaluation of a complex structured rule base in fuzzy filtering. In addition to the proposed filter were 2 inter related fuzzy membership functions to increase addictiveness towards local noise statistics which is true in compared restoration performance. Simulation results show effectiveness of proposed filter.

Keywords: - Impulse noise, pseudo fuzzy rule base fuzzy filter, nonlinear filter, image denoising restoration.

1. INTRODUCTION

The purpose of image enhancement is a prominent method for personal identification. The image enhancement algorithm can improve the clarity of images by degrading the pitfalls. The singular point region is the region where the ridge position is higher than normal structure. Like Gabor filter enhances the image on its orientation, but it is difficult to be accurate at the ridge position as we know it is used to remove blurriness. Filter estimation may be used to enhance the quality of the image. Linear filters are used for noise removal, edge detection, segmentation etc. Histogram processing is a non-linear contrast enhancement technique. The histogram of the original image is redistributed to produce a uniform population density of the image. The different filter masks are used in the enhancement algorithm, but the resultant image may not be smooth and the unwanted pixels are also present. In the fingerprint image system, Gaussian noises occur during finger pressure. The proposed algorithm reduces the noises and the ridges are extracted in a smooth manner. In the following sections, we describe in detail our enhancement algorithm. Section 2 addresses the fingerprint enhancement techniques with filter mask. Fuzzy statistics on digital image and its process is given in section 3. Experiment result of fingerprint images with Histogram Equalization and its PSNR (Peak Signal to Noise Ratio) values are given in section 4. Section 5 contains the summary of the fingerprint enhancement method.
(C D F) = Cumulative distribution function is associated with a random variable X is defined as the probability that the outcome of an experiment will be one of the outcome for which X<=x, where x is a given number.
Properties of CDF:-
Case 1:
1. The distribution function F(x) is bounded between the values 0 & 1.
2. F (-∞)=0. This property follows from the fact that F(-∞)includes no possible events due to this fact P(X≤ - ∞) will always be 0.
Case 2:

1. This property follows from the fact that F(∞) include all possible events due to this fact that P(X≤∞) will always be 1.
2. Cumulative distributive function F(X) is a monotonic non decreasing function of dummy variable x that is F(x1)≤F(x2), if x1<x2.
   What is Probability Density Function (PDF):
   The derivative of Cumulative distribution Function (CDF) with respect to some dummy variable is called probability Density Function (PDF).

2. IMAGE ENHANCEMENT TECHNIQUES

The objective of image enhancement technique is to process an input image I(x,y) and the result is more suitable for identification. The enhancement algorithm reduces the noises from the input image. The input image I(x,y) is defined as a M*N matrix, where $I_{i,j}$ represent the gray of the pixel at the ith row and jth column. The first step of the fingerprint processing is normalization. Normalization is used to remove the effect of sensor noise and finger pressure difference. The normalization $N_{i,j}$ for the image $I_{i,j}$ with mean m and variant V is given below [12],

Any function applied on 2D image can be defined as $I'_{x,y}$=f.($I_{x,y}$); F is applied as any intensity in very small scale on any image. I' is disturbed image is to be examined.

$$N(i,j) = \begin{cases} X + \frac{R(I(i,j)) - m^2}{V}, If\ I(i,j) > m \\ X - \frac{R(I(i,j)) - m^2}{V}, otherwise \end{cases} \quad (1)$$

$$m = \frac{1}{N^2} \sum_{i=0}^{N-1} \sum_{j=0}^{m-1} I(i,j) \quad (2)$$

$$V = \frac{1}{N^2} \sum_{i=0}^{N-1} \sum_{j=0}^{m-1} (I(i,j) - m(i,j)^2) \quad (3)$$

The parameters R and V are the desired mean and variant values. Filtering approach is a way of pursuing the pixel values from its surrounding locations. The mean and the standard deviations of such neighbourhood is used for contrast enhancement. Median filtering has been used for smooth image, with average weighted value depending on the neighbouring pixels. Frequency transformation decomposes an image from its spatial domain intensities into a frequency domain [2]. The frequency transformation shows the frequency of pixel brightness variations, pattern change and the amplitude of the signal waveform. Frequency domains are also performed for selective removal of noise patte from an input image.

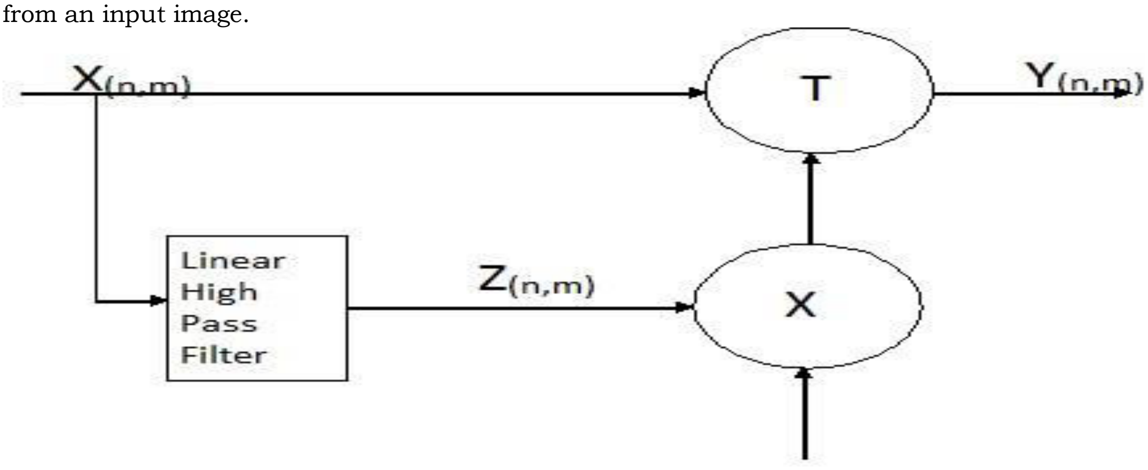


Fig-1: Linear masking for image enhancement

3. FUZZY STATISTICS ON 2-D IMAGE

Fuzzy sets are capable of representing the statistical value based on the theory of Fuzzy sets [15]. A gray scale transformation may succeed in preserving edges in one image and it may fail in another one. Fuzzy statistical values improve the quality of the input image by reducing noises and increasing the intensity slices. Fuzzy set A for digital images is defined in the ordered pairs

$(A \in \{ (x, A(x))\ x \square U \}$ ----------(4)

Where A(x) is called the membership function for the set of all values x in U. The membership values are permitted in the interval $0 \le X \le 1$, crisp set is consequently a special case of a Fuzzy set, with membership values restricted to $x \in \{0,1\}$. Fuzzy membership values are assigned from the following fuzzy Function. Where x and A(x) are the positive real values generated from the input histogram image. The Pseudo fuzzification means fuzzy rules are represented and evaluated by logical a operation which involves either 0 or 1 values which is based on fuzzy Reasoning method.

4. FUZZY BASED HISTOGRAM COMPUTATION-

If $X_{i,j} = \begin{cases} 1 \text{ it indicates that the pixel is bright }, \\ 0 \text{ it indicates that the pixel is dark }, \end{cases}$

The histogram of a digital image with gray levels in the range [0, L-1] is a discrete function with h[rk] = nk, where rk is the grey level value and nk is the number of pixels with gray level intensity k in the input image I(x,y)[6]. Histogram h[k] is occurrence probability (frequency) of grey level k in an image. Where n is the total number of pixels. Transforming intensities so as to obtain a desired (specified) shape of histogram of output image is called histogram mapping. $P_x(U)$ is the continuous Probability Density Function(PDF) for the given image and $P_z(U)$ is the specified(derived) PDF for output image. The equalization of the given image I(x,y) is.

Images are frequently contaminated by impulsive noise due to noisy sensors or channel transmission errors. Since high pass filters undergo masking scheme becomes high sensitive to noise. There are many types of impulsive noise such as random noise. If x(i,j) be grey level of an original image X at pixel location(i,j) and [n min, n max] bde dynamic range of X. Suppose Y(i,j)be the gray level of noisy image Y at pixel(i,j) and then random valued impulsive noise may be defined as

$$Y_{i,j} = \begin{cases} X_{i,j} \text{ with } 1-P, \\ R_{i,j} \text{ with } P \quad , \end{cases}$$

$R_{i,j} \in [n_{min} n_{max}]$, p is noise ratio, whereas for fixed valued impulsive noise better is salt and pepper noise $R_{i,j} \in [n_{min} n_{max}]$.It is usually seen that removal of salt and pepper is easier in compared to random valued impulsive noise. $Y_{i,j}$ can be any value from n_{min} to n_{max}.

5. PROPOSED METHOD FOR IMAGE ENHANCEMENT

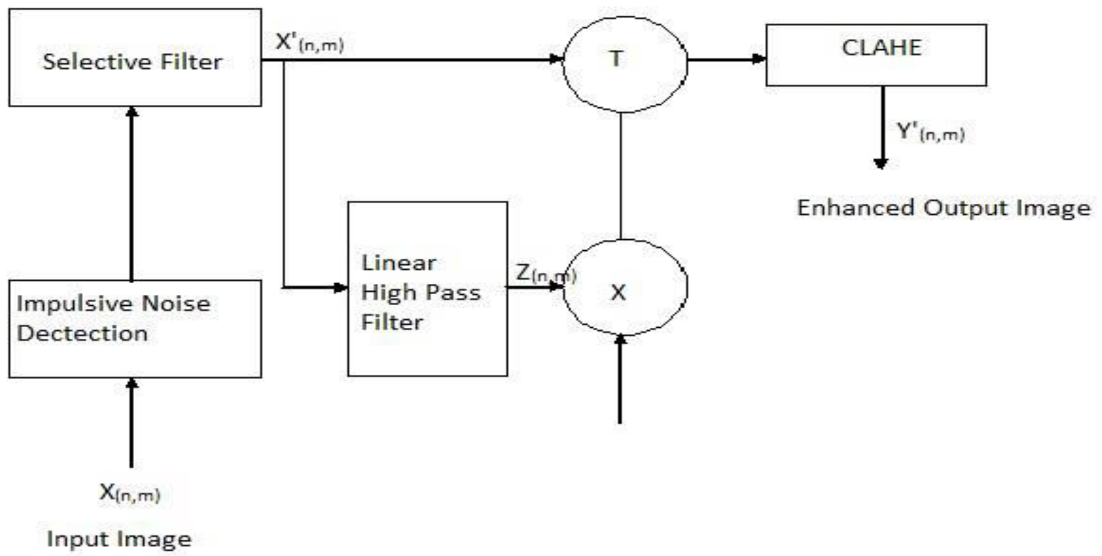


Fig-2: Proposed Model for Image Enhancement

The proposed algorithm consists of 3 steps as impulse detection, filtration and image contrast enhancement.

(a) Only those pixels that are classified as corrupted in detection phase that are subjected to filtration. It employs a second order difference based impulse detection mechanism at the location of the testing pixel. The mathematical formulation can be modelled as

$$Y'_{i,j} = \begin{cases} Y_{i,j} \;\; when\; d_{i,j} = 1, \\ Z_{i,j}\; when\; d_{i,j} \;= 0 \;\;, \end{cases}$$

If $d_{i,j}$ is zero then replace thr $I_{i,j}$ pixel with average or mean value of neighbourhood pixels otherwise remain as it is.Repeating above steps for 3×3 window matrix from top-left to bottom-right corner of corrupted image.

(b) i) The window Y^T is selected is of size 5×3 cantered at(i,j)of Y and sub window Y^w of size 3×3 centred at (i,j) of Y^T .

ii) The first and second order difference are calculated in vertical manner and decision parameter is determined, Compute the first order 3x4 difference matrix

$$fd_{i+k,j+l} = Y^T_{i+k,j+l} - Y^T_{i+k,j+l-1} \qquad \text{where, r= -1,0,1 and s= -1,0,1,2}$$

iii)Computer the second order 3x3 difference matrix sd from fd.

$$sd_{i+r,j+s} = fd_{i+r,j+s+1} - fd_{i+r,j+s} \qquad \text{where r=-1,0,1 and s= -1,0,1}$$

iv) Compute decision parameter‘d’

$$d_{i,j} = \begin{cases} 0 \;\; if\; |sd_{i,j}| > \theta \;, \\ \;\; 1\; otherwise \end{cases}$$

(c) The filtered image x’ is fed with high pass filter to segregate high frequency components of the image From smooth details of the image. Choosing a gain factor for intensifying the image. This can be modelled in form of

$Y_{(n,m)} = X'_{(n,m)} + \delta\, Z(n,m)$

$where\; z(n,m) is\; corrected\; signal\; computed\; as\; output.$

$Z_{(n,m)} = 4\, X'_{(n,m)} - X'_{(n-1,m)} - X'_{(n+1,m)} - X'_{(n,m-1)} - X'_{(n,m+1)}$

Followed by selective filtration similar to steps described earlier. The threshold values are assumed as θ . θ Values are taken by applying probability density functions. All the steps in 2^{nd} iteration is repeated for each test window column wise from top left to bottom right corner of the image obtained from (a) to obtain the final filtered image . After impulsive noise is removed the chance of noise amplification is minimised so now it is suitable for image enhancement using unsharp masking and contrast limited Adaptive histogram equalization technique(CLAHE).

$\delta\; is + ve\; scaling\; factor\; means\; controlling\; agent$, the filtered image X’ is applied with input for CLAHE to obtain the final enhanced output.The proposed scheme tries to prevent application of impulsive noise and tries to prevent amplification of impulsive noise and tries to provide better visual contrast about the image details. Pdf technique is used in pattern classification problems from a long time in the areas of computer vision, image processing, signal processing and various related fields. The proposed impulsive detector is shown in fig 3.

Fig 3

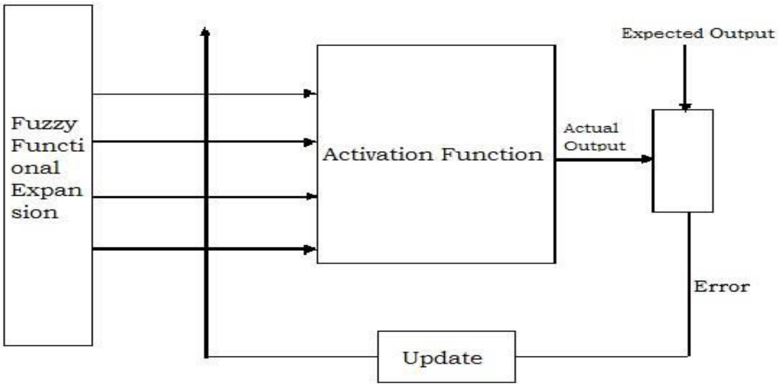
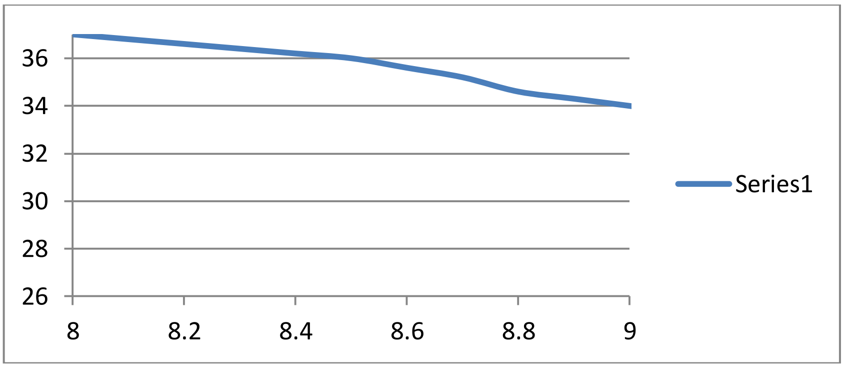


Fig-3: Fuzzy Structure for Adaptive Threshold Selection

The input image is covariance of noisy image. The input is functionally expanded for application. To determine error we compare actual output of network with desired output. As per error value we update θ *value.*
We take an image like black pepper that is corrupted with impulsive noise varying from .01 to .3 in a range.05. θ *value varies from* 0 *to* 1 *in a step of* .01 *and MSE value is calculated as MSE.*

So $MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left(X_{i,j} - Y_{i,j}\right)^2$

Where M×N is size of image $X_{i,j}$ & $Y_{i,j}$ which represents the pixel values at (i,j) th location of original image and restored image is produced. The min MSE & threshold optimum recorded. We use coefficient of variance which is ratio of standard deviation and mean which can be easily corrupted from noisy image available. Since we are not applying filtering to healthy pixels we avoid blurring effect which we expect for better enhancement. Then we can easily apply Histogram technique for edge protection. The amplification factor
δ dependes on application where we are and desired level of image details
For experimental use set $\delta = .5$.



6. SIMULATION & RESULTS

To demonstrate the performance of proposed image enhancement scheme simulation results is being discussed under 2 heads , one is impulsive removal and Image contrast enhancement.

6.1 Impulsive noise removal- The superiority of proposed impulsive detection method is demonstrated here is peak signal to Noise ratio (PSNR).

$$PSNR = 10\log_{10}\left(\frac{255^2}{MSE}\right) dB$$

In order to confirm high performance of proposed scheme we demonstrate some of the simulation results like lena image, contaminated noise ranging from .01 to .3.It is processed with varying filtering technique such as median filter, Two
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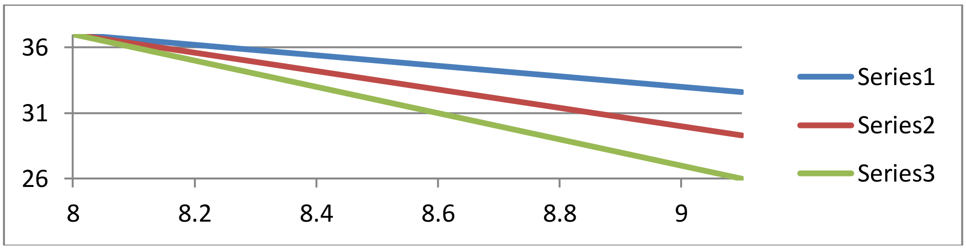
Output non linear filter, fuzzy filter, double derivative filter, non linear filter, median rational hybrid filter, FLANN based adaptive filter etc. Fig 5 shows PSNR comparison between the proposed scheme and existing scheme.

6.2-Image Contrast Enhancement

The performance of proposed algorithm is compared with Lena image and clown image. Performance of Lena image is shown below.as usual there is no loss of quantitative pixels in performance evaluation. No ideal image can be used a reference though perceptual quality evaluation is not a deterministic process

The image intensity is transformed with the specified Probability Density. To be specific we have to undergo objective measurements for comparing results for subjective tests. The proposed algorithm use contrast enhancements in controlled manner along with reduced chance of noise amplification Produced in the output domain.



7. DE FUZZIFICATION

De-fuzzification process is performed with the fuzzy statistical value for achieving the enhanced specification image. The following stages are performed during the fuzzy histogram process for the fingerprint enhancement. In the fuzzy maximization process, the discrete fuzzy gray intensity values are cumulated and the result is better than the classical Histogram Equalization (HE).

8. EXPERIMENTAL RESULT & SIMULATION

In this section, we demonstrate the experiment for removing the blur background pattern from the input fingerprint image. The original arch fingerprint image is in figure 3(a) and its histogram equalized image with PSNR = 38.1590 is in figure 3(b). Figure 3(c) gives the proposed fuzzy histogram fingerprint image with clear background (valleys)). The PSNR value for the proposed method is 34.4963. The fuzzy histogram graph is given in figure 3(d). Here the noises are suppressed and the ridges are clearly identified. Similarly in figure 4(a) the original whorl fingerprint image is given. The histogram equalization image with PSNR = 37.8282 is given in figure 4(b). Figure 4(c) shows the fuzzy histogram fingerprint image with PSNR value 30.7969 and its graph is in figure 4(d).

Enhanced Image Model

9. CONCLUSION

Our paper describes the concept of fuzzy histogram processing technique for the removal of impulse noise it is capable of suppressing high density impulse noise, at the same time preserving fine details edges and textures in the underlying image. A new pseudo Fuzzy inference mechanism filter that utilizes provides a different approach on histogram specification for image enhancement. The filtration is performed selecting only on detected pixels segregating noisy pixels from noise free pixels. Avoiding linear healthy pixels with mean value of neighbourhood pixels we preserve image details. Though exhaustive this fuzzy histogram generates intensity values, which may be used to improve the contrast of the input image. In the traditional filtering methods can not deal with the narrow intensity gray values. This method solves the problem of narrow and wide gray range images. it is observed that the proposed algorithm is practically useful for superior performance along with easier hardware implementation

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A New Improved Statistical Algorithm for Image Noise reduction

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Abstract: Many filtering algorithms have good noise reduction methods regardless the time complexity. This paper proposed a statistical algorithm which use correlation of the image to develop the filtering function. The correlating function applies filtering mask over the image to reduce the degradation. It can calculative resize the mask according to noise levels of the mask. The statistical histogram method is also introduced in the searching process of the median value. Experimental results show that the algorithm reduces the noise a much as possible and retains the detailed pixel value of the image. The complexity of the algorithm is decreased and efficiency of filtering function has been improved.

Introduction:1.Digital image is affected by noise resulting for image sensors or transmission of images.Image denoising is performed to remove the noise from the images..2.Linear and non linear filters are proposed for image denoising.3.Although non linear filters are more complex than linear filters they are more commonly used for image denoising because the reduce smoothing and edges are preserved.4.2-D spatial median filter is most commonly used non linear filter for image denoising.5.It is a non linear sorting based filter, it sorts the pixels in the given window 3×3 determining the median filter and replaces the pixel in the centre of given window with The noise is usually divided into Gaussian noise, the balanced noise and the impulse noise. The arisen impulse noises display as light and dark noise pixels under random distribution on the image. Basically they are also known as white and black pepper noise. This not only disturbs original value of the image, but also seriously corrupts the visual effects of the image. Therefore, the reduction of impulse noises has important significance to image processing and computer vision analysis. For an image corrupted by noises, we can use linear or nonlinear filter methods to reduce noises. In the frequency domain, the details are high-frequency components of the image, which easily confused with high-frequency noises. Therefore, how to keep the image details as usual effectively filter random noises is the key to image filtering processing. The median statistical filter is a nonlinear filter and it has widely used in digital image processing because of its good edge restoring characteristics and reducing impulse noise ability. The median filter is a rank-order filter. Its noise-reducing effects depend on the size and shape of the filtering mask which runs over the original image and its algorithm complexity mainly depends on how to get the median value. In order to improve the noise-reducing performance of the median filter, scholars proposed many improved methods to the conventional median filter [1-3].To improve the searching speed of the median value, people proposed some fast algorithms based on the dividing-conquering strategy, and simplified the algorithm complexity of the conventional median filter from O (N2) to O (n logn n) in references [4] and [5]. The subsequent work [6] of the paper further simplified complexity to O (n(1+logn n) /2). Based on the calculations study, this paper proposed two improvements to the median filtering algorithm:

(i) To improve the noise-reducing performance, the mask may be adaptively resized according to noise levels of the mask;

(ii) According to the median filtering theory, we only require quickly find the median value of the filtering mask, and not to rank all the pixels of the filtering mask. Therefore, the statistical histogram is introduced in the searching process of the median value to speed up the searching process.

Median Filtering Theory: It is totally based on statistics. It is non linear method used in signal processing as well as Image processing. here the noisy value of the digitized image is replaced by the median value of neighborhood pixels. The pixels of the image are ranked according to their gray levels and the median value og the group pixels is stored and replaced in place of noise value.the median filtering output is g(x,y)=med{f(x-I,y-j),i,jĺ€ W},where f(x,y),g(x,y) are the original image and output image respectively.W is the 2-dimensional mask, the mask size is m×m order and m is commonly odd like 3×3 and 5×5 etc, the mask shape may be linear, square, circular etc.

The Noise reducing performance of the median filter: as it is a non linear filter its mathematical analysis is relatively complex for the image with random noise.For an image with zero mean noise under normal distribution, the noise variance of the median filtering is approximately.

$$\sigma^2_{med}=1/4nf^2(n)= (\sigma_i^2/n+\pi /2-1).\ \pi/2 \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where σ_i^2 is the input noise power (the variance), n is the size of median filtering mask, f(n) is the function of noise densityand the noise variance of average filtering is $\sigma^2_0 = 1/n\ \sigma_i^2$ ………………………….(2)

Comparing (1) and (2) the statistical filtering method depends on two things; the size of the mask and the distribution of the image.The median filtering performance of random noise reduction is better than the average filterimh performance, but to the impulse noise especially narrow pixels are farther apart and the width is less than n/2, the mdian filter is very effective.the median filtering performance should be improved if median filtering is attached with average filtering or double derivative filtering algorithm, can resize the mask according to the noise density.Based on this an improved denoising algorithm(median filtering technique) is proposed.

3. Improved Median Filtering Algorithm

A. Improvement of the filtering mask The filtering mask is mainly on square mask or cross mask. Considering of the symmetry of the mask, n is commonly odd. The smaller the mask is, the better the image details are retained, the weaker the noise reduction performance is; the larger the mask is, the less the image details are retained, then stronger will be the noise reduction performance . To solve the contradiction, we introduce the adaptive filtering algorithm. In the filtering process, it can adaptively resize the mask according to noise levels of the mask. In the mask, max is the maximum value of gray levels, min is the minimum value of gray levels, average is the average value of gray levels, med is the median value of gray levels, jif),(is the central value of the mask, n is the size of the mask. The adaptive filtering requires two steps: Step 1: adaptively resizing the mask (1) Initialization: let n 3 ; (2) Computation: 1 medA min, 2 medA max (3) Judgment: if A ! 01 and A 02 , then turn to the step 2; if not, then enlarge the size of the mask, let n×n2 and turn to (2). Step 2: median filtering. B. Improvements of the median algorithm Because the average filter has better performance for filtering random noises, we combine the median filter with the average filter to certain size of the filtering mask. The improved method

Improved method:

For the natural image, neighboring pixels has strong correlation. The gray value of each pixel is quite close to neighboring pixels, and the edge pixels have the same property also. If the value of a pixel is greater or less than the value in the neighborhood, the pixel is contaminated by the noise; otherwise, the pixel is an available pixel. In the reducing-noise process, we sequentially check each pixel, if the value of a pixel is greater than the average value in the mask, then we judge that the pixel is contaminated by then noise and replace it with the median value of the mask; otherwise, we retain the original value of the pixel unchanged. This method not only reduces the computation time, but also retains the details of the image as far as possible. The original value of the pixel is replaced with the median value in the mask, and the next process of computation the average value may make full use of the new value of the pixel. This forms alternative process; it not only decreases the time complexity but improves noise reducing effect much better way.

e.g:reducing noise of the pixel(i,j) where moving window size is 3×3.

If f-average>0 then the median valueisf'(i,j).

If f'(i,j) <f(i,j),then f'(i,j) is the noise.By the conventional algorithm , the average and median value of pixel)I,j+1) arerespectively.

Average={f(i-1,j)+…f(i,j)+f(i,j+1)+…+f(i+1,j+2)}/9

Median={f(i-1,,j)+….+f'(I,j)+f(I,j+1)+…+f(i+1,j+2)}.

If f(I,j) is replaced by the factor of improved algorithm f(I,j) the average and median value are respectively.

Average=f(i-1,j)+…+f'(i,j)+f(i,j+1)…+f(i+1,j+2)}.

According to f'(I,j),f(I,j) average is less than average value.Thus the spatial extent of the noise reduction is increase and the time complexity of improved algorithm is less than conventional algorithm.Steps of improved algorithm are shown below.

1.The mask slides over the image , overlaps centre of the mask with the pixel on the image to serch the centre element f(i,j).

2.To read the values of the corresponding pixels of the mask.

3.To compute the average value of the mask.

4.to compare the value of the pixel with average, if value of each pixel is greater than average then searching median value and let f(i,j)=median value; otherwise original value of the pixel unchanged.

5.Repating step4 until i=j=n.

Fast computation of median value The complexity of the algorithm is mainly divided by the calculation of median value on above steps.This paper introduces histogram to improve searching speed of the median value.the method requires steps below.

1.To compute the gray histogram hist[i] (0<i<G where G=range of gray of n×n,find the median value med and record less than median value(ltmed) .Consider the pixel value which is less than median value.

2.To let the left row shift out of the histogram if value of shifting out pixels is less than median then ltmed-1.

3.To let the right now shift the histogram if the value of shifting out pixels is more than median then ltmed+1.

4.If ltmed<,N/2 then repeat med+1, ltmed+hist[ltmed] until ltmed=N/2.

(5) If ltmed>N/2,then repeat med-1,ltmed-hist[ltmed] until ltmed=N/2.

6.To return the median value.

The improved algorithm has two improvements compared to the conventional median filtering algorithm. One is to make the number of the compared pixels equal to N by using the historical information of the sliding mask and value of each pixel compares with original median value of mask.Another is to decrease the complexity of median algorithm.

C.Analysis of Complexity of Algorithm:

Suppose X = {Xi} (i=1, 2, ... , N) is the array to solve the median value, where 0 Mxi dd and i x is

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integer. By using the statistical histogram method to find the median value, the required maximum numberis N, and the complexity of the algorithm is approximately O (N).

Table 1. Comparison of the complexity of three algorithms:

Size Of Mask	**The standard median filtering algorithmN InN**	**The fast median filtering alg based on average N(1+In N)/2**	**The improved algorithm in the paper**
3×3	**20**	**7**	**7**
5×5	**84**	**50**	**26**
7×7	**192**	**129**	**48**
9×9	**356**	**221**	**80**
11×11	**577**	**351**	**120**

According to TABLE I, the computation complexity of the improved algorithm is obviously

4. Simulation Experiments

Experiment 1: comparative experiment among the standard median filtering algorithm, the fast medianfiltering algorithm based on average and the improved algorithm in the paper.10%, 35%, and 45% density impulse noises are respectively added to the original image of Lena. WithVC++6.0, results of the comparative experiment as shown in fig-1.

Figure:

Original lena image

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(a) (b)

Experiment 2: low signal to noise ratio experiment.60%, 70%, and 80% density impulse noises are respectively added to the original image of Lena.

Results of the improved algorithm in the paper are shown.

Performance estimation:

The effect of the image noise reduction may estimated by the subjective visual effect or the objectiveestimation method. The paper takes the peak signal to noise ratio (PSNR) and the signal to noise ratio (SNR)as the performance estimation standard.Suppose an original image is jif),(and its size is u NM , the processed image is jif),(OUT and its size is u NM , where ,...,2,1,,...,2,1 NjMi , then we have

MSE=(1/M×N) summation i=1 to m summation j=1 to n(fout-f(i,j)^2

PSNR= 10 log(a^{2}max/MSE)(dB)

SUM=summation i-1 to m summation j=1 to n=3 f(i,j)^2 /summation i=1 to m summation j=1 to n(fout(I,j)-f(I,j)^2

$$\text{sum} = \frac{\sum_{i=1}^{M} \sum_{j=1}^{N} f(i,j)^2}{\sum_{i=1}^{M} \sum_{j=1}^{N} (fout(i,j)-f(i,j)^2)}$$

snr =10 log (sum)(dB)

Where $a_{max}=2^k-1$, k denotes the number of pixel binary bit. If k=8 then $a_{max}=255$.The results of two experiments are shown below in table II.

Experimental results show that the performance of this algorithm is better than standard median filtering algorithm and fast median filtering algorithm is based on average.Specially with low SNR(signal to noise ratio) this improved algorithm has more advantages.

Table II: Comaparison of 3 algorithms.

Noise Density	The standard median filtering algorithm PSNR(dB) SNR(dB)	The first median filtering algorithm based on average	The improved algorithm in the paper PSNR(dB) SNR(dB)
10%	31.2439 25.5618	31.3804 25.6983	32.1180 26.1059
35%	28.7432 22.0611	28.8262 22.1441	31.8541 25.1720
45%	16.9419 11.2598	17.3371 11.6550	30.5521 23.8699
60%	---- __	__ __	28.5861 21.6371
70%	---- __	__ __	27.2651 20.3307
80%	---- __	__ __	26.1206 19.1103

5.Conclusion: The paper proposed an improved median filtering algorithm for image noise reduction. It can adaptively resize the mask according to noise levels of the mask. Combined the median filtering with the average filtering, the improved algorithm can reduce the noise and retain the image details better. The statistical histogram is introduced to improve the searching speed of the median value and the correlationof image has been fully used. Thus, the complexity of the improved algorithm is decreased to O (N).Experimental results show that the improved algorithm can well do with the relationship between the effect of the noise reduction and the time complexity of algorithm.Thats why it has a good application prospect in Digital Image processing as well as signal processing.

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ERP and its Successful Implementation

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Abstract – *The world has become more digitized. Businesses are depending on technology to help them enhance their business processes. Companies are looking for an information system that can handle massive workloads. This is where Enterprise Resource Planning (ERP) systems come into play. An ERP integrates different subsystems into one huge system that shares one database. It enhances productivity and brings more profit to companies. The purpose of this paper is to address the effects of ERP systems on organizations. The paper will discuss these issues and present a scheme to overcome them. Research was carried out with articles, as well as books, to gather the suitable resources that will help us in discussing the factors that contribute to ERP systems. Many of the articles are from IEEE journals. A large volume of data was collected that represents millions of users. Analyzing the collected data will give researchers insight into the effects brought about by ERP systems. In addition, the paper will explore these issues and their impacts on organizations. Our aim is to produce an Effective ERP Solution for continuous delivery of positive output for the company. Its stream lines accelerate the business process providing a competitive edge to company.*

Key Words: SAP, CRM, Success Scheme (SS), Microsoft Dynamics NAV, PeopleSoft, Oracle Financials

1. INTRODUCTION

Enterprise Resource Planning, or ERP, is a large-scale software program designed for modern businesses, both large and small. A simple definition is that ERP systems aid the flow of internal business processes and allow for communication between a business's departments and its internal functions and data. ERP, or Enterprise Resource Planning, refers to creating a more efficient, leaner, better-automated and integrated business through sophisticated technology solutions. Enterprise resource planning (ERP) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources. A simple definition is that ERP systems aid the flow of internal business processes and allow for communication between a business's departments and its internal functions and data. Examples of ERP system modules include: product lifecycle management, supply chain management (for example purchasing, manufacturing and distribution), warehouse management, customer relationship management (CRM), sales order processing, online sales, financials, human resources, and decision support system. There are following types of ERP Systems:

- SAP R/3
- SAP B1
- Microsoft Dynamics AX
- Microsoft Dynamics NAV
- JD Edwards
- Oracle Financials
- PeopleSoft

1.1 Difference between ERP and CRM

Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) are similar in many ways, as they are both used to increase the overall profitability of a business. These systems overlap in some areas, and can be completely integrated in others.

1.2 ERP Integrates Processes across Business Functions

ERP is an acronym for Enterprise Resource Planning, but even its full name doesn't shed much light on what ERP is or what it does. For that, you need to take a step back and think about all of the various processes that are essential to running a business, including inventory and order management, accounting, human resources, customer relationship management (CRM), and beyond. At its most basic level, ERP software integrates these various functions into one complete system to streamline processes and information across the entire organization. The central feature of all ERP systems is a shared database that supports multiple functions used by different business units. ERP Synchronizes Reporting and Automation.

1.3 The Business Value of ERP

At its core, ERP helps employees do their jobs more efficiently by breaking down barriers between business units. More specifically, an ERP solution:

- Gives a global, real-time view of data that can enable companies to address concerns proactively and drive improvements.
- Improves financial compliance with regulatory standards and reduces risk.

- Automates core business operations such as lead-to cash, order-to-fulfilment, and procure-to-pay processes.
- Enhances customer service by providing one source for billing and relationship tracking.

2. RELATED WORK

In order to make an ERP implementation a success, we need a good scheme. The key success factors are:

- Project Startup
- Management Commitment
- Project Scope
- Project Team
- Change Management, Communication and Training
- Customization / Modifications
- Budget
- Project Closure

There are many factors involved in making the ERP project a success.

3. CASE STUDY

According to Issues in implementing ERP, Educational Organization decided to change their old system because of many failures. After a long search for a solution, the ERP solution was introduced in late 1997. They decided to go with the SAP vendor. They followed the ERP implementation life cycle; they started in 1997 and finished in 1999. During that time, many training sessions were set up for more than 1000 employee. These training sessions are really good for change control. Everything was going just fine, so they decided to use a sequential deployment whereby each part of the system is brought to life in a sequence. After the first system was deployed, the problems started to appear. Moreover, they still had to launch the other subsystems because it was a sequential deployment. The system was shutting down a lot. This small problem of transferring data from the old system to the ERP system has caused many problems for the Water Corporation.

First, they had to pay a lot more money to fix these problems. The data was not available, many solutions were proposed, and by the end, the problem was eventually solved, but only after a long time of suffering.

The company paid a lot of money to contractors to fix this problem. The employees were suffering because they could not do their jobs. Management was affected badly because the company was in financial crisis. The whole company was facing a disaster, and some employees were laid off. In conclusion, there are many people who have proposed strategies for a successful ERP implementation, but only a few who have written about handling these effects after the ERP disaster occurs.

4. ERP ISSUES

The ERP system could improve organizations immensely, but only when it is implemented correctly. When the system is not implemented correctly, it could affect organizations very badly. It could destroy companies. The effects are operational and managerial. Each of these effects could damage organizations severely. These effects bring many issues to organizations. They will be discussed individually under these three categories.

5. OPERATIONAL EFFECTS

In order for a system to operate effectively, it has to be implemented very well. The most important factor in the success of the project is the implementation phase. As we have seen in the case study, a technical problem in transferring the data from the old system to the new system, also the data was simply not available in generated reports. A scheme will be proposed to overcome these issues. The scheme is called Solve Scheme:

- As we have seen, the effects of managerial problems are:
    - Wastes of Time
    - Wastes of Money

  The causes can be grouped into three main categories:

    - Poor management skills
    - Hasty management acts
    - Poor decision-making skills

- As we have seen, the effects of operational problems are:
-
    - Business process shutdown
    - Technical problems

The causes are under three main categories:

- Poor consultant vendor
- Poor transfer of data
- Do not apply government standards

6. SUCCESS SCHEME

The figure below is the proposed scheme for overcoming the managerial and operational effects. In order to overcome this disaster, we need to have a good start. The following Figure:

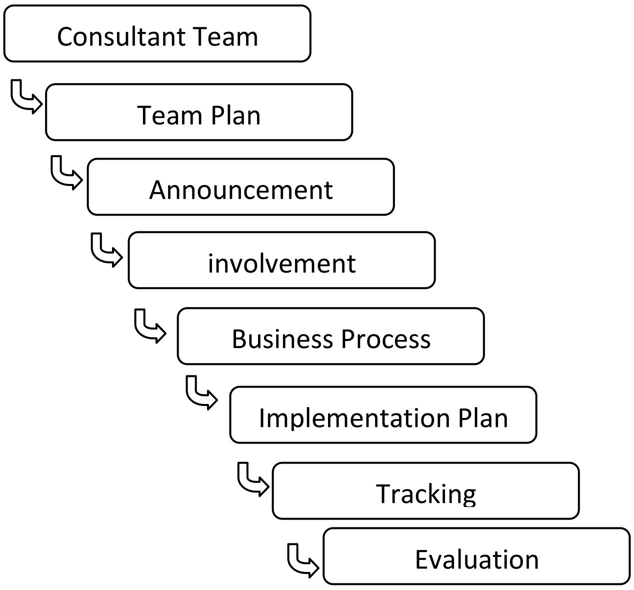

Chart-1: SUCCESS SCHEME

- First Phase: Consultant Team
  In this phase, the top management will form a consultant team from the organization. This team should include experts in three areas: ERP system, business process, and information system. The team should also include consultants from outside of the organization who are experts in ERP products.
- Second Phase: Team Plan
  In this phase, the team should design a main plan. This plan should specify the phases that they should go through in the project. They are of the following: Specify issues in the current information system; Set up goals; Review proposals; Choose ERP product; Choose integration partner; Implementation; Training; and System Testing.
- Third Phase: Announcement
  In this phase, the scheme should be announced to all of the employees in the organization. This phase is critical because the involvement of the employees is very important.
- Fourth Phase: Involvement
  In this phase, the employees will be told how they will be involved in this project. The involvement of the employees will reduce the user resistance. They will also have higher self-esteem toward this project.
- Fifth Phase: Business Process Mapping
  In this phase, the integration partner will first meet with the consultant team to discuss the main processes of the system. Then they have to go to each department and understand how each business process is carried out.
- Sixth Phase: Implementation Plan
  In this phase, the integration partner will build the implementation plan. Moreover, they need to discuss this plan with the consultant team and get their approval.
- Seventh Phase: Tracking
  In this phase, the consultant team will need to track the progress of the implementation with the implementation team. They should track the progress every week and evaluate the progress.
- Eighth Phase: Evaluation
  In this phase, the consultant team should evaluate the project after it has been done. They should see if it has met the goals that they set.

7. RESULT AND EXPERIMENT

Specifically built for higher education, our ERP systems enable us to:

- Automate admissions- Eliminate manual processes and save significant faculty time by enabling prospective students to apply online through a self-service portal.
- Provide one-stop student access. - Allow students to enroll, register, and pay for courses through the portal. Only students can access it to check their attendance status, examination details, test evaluated marks etc.
- Simplify records management-With a single system for all your data needs—and a single digital record for each student—any department on campus can find the student information they need
- Engage faculty- Give faculty the means to enter and update grades, and have personalized access to timely, accurate, and institution-wide information for updation of organization.
- Manage resources more powerful- Manage personnel, funds and processes more transparently.
- Strengthen decision-making optimization techniques Track the metrics you need to guide day-to-day operations, meet reporting requirements, and engage your organization.

8. CONCLUSIONS

In conclusion, the paper has discussed several effects of the ERP system. The effects are managerial and operational. The paper has proposed the Success Scheme (SS). This consists of eight phases. The scheme was presented and discussed in a graduate-level class, and a questionnaire was conducted. After the analysis of the survey, some modifications on the scheme were made. The work can be further enhanced. Implementing the scheme in an actual project to test its effectiveness can enhance the scheme, as well as improving the Success Scheme to involve more certain aspects of the ERP project, such as customization.

Recommendation Strategies for further enhancement of ERP Implementation:

- Prepare the business strategy
- Prepare the IT strategy
- Prepare the ERP strategy
- Prepare the project scope
- Prepare the organization for process changes and the new system by applying the proper change management strategies and techniques
- Direct implementation of ERP without understanding the customer requirement will lead to downfall of application of ERP.
- As timely solutions are not found that creates a hurdle for smooth and complete application of ERP.
- we must keep an eye to smooth functioning of ERP so that unexpected problems should not arise from customer side.
- Payment related issues from resource side should be minimized.
- Modules and programming code should be flexible to adopt new changes in ERP.

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