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Image Processing Using Dominating Technique

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ABSTRACT

In this paper, Digital image processing refers processing of two dimensional picture by a digital computer. Digital image is composed of a finite number of elements are called picture elements or pixels. These image are generally degraded by noise. Noise occurs during image capture, transmission or processing. Some of these noises are salt and pepper noise, gaussian noise and uniform noise.

These noises can be removed by two kinds of filters either linear or nonlinear filters. The nonlinear filters which we use for filtering operation are median, midpoint and trimmed.

The aim of the paper is to remove the pepper noise by using median filter and also there is possibility to change image matrix value in to connected graph and find the dominating set and dominating number for the image matrix value for better result with help of dominating technique in graph theory.

The equivalent two dimensional matrix representation having picture for the image is generated using MATLAB- programming and the program for median filter process are simulated using VHDL and in this paper we try to include the dominating methods in image processing. In the graph theory, domanatin set a for a connected graph G = (V, E) is a subset S of V such that every vertex not in S is adjacent to at least one vertices of S . The domination number $\gamma(G)$ is the number of vertices in a dominating set of G.

KEYWORDS : MatLab, Content analysis, Image Processing, Representing digital images, Image Enhancement,Connected graph ,Dominating Set and Dominating Number.

INTRODUCTION

Digital image processing refers to processing of two dimensional picture by a digital computer. An image is a two dimensional function $f(x,y)$. Where X and Y are spatial co-ordinates and the intensity or gray level of the image at that point. Digital image is composed of a finite number of elements are called picture elements, image elements, peels and pixels. The image may be in the form of slide, photograph or chart. Digital image processing operation can be broadly grouped into five fundamental classes.

- Image enhancement
- Image restoration
- Image analysis
- Image compression
- Image synthesis

IMAGE ENHANCEMENT

Image enhancement operation improves the quality of an image. They can be used to improve an images contrast and brightness characteristics (except color), reduce its noise content or sharpen its details.

Image enhancement technique may be grouped as either subjective enhancement or objective enhancement.

Subject enhancement technique may be repeatedly applied in various forms until the observer feels that the image yields the detail necessary for particular application.

Objective image enhancement correct an image for know degradations. Here distortions are known degradations. Here distortions are know and enhancement is not applied arbitrarily. This enhancement is not repeatedly but applied once based on the measurements taken form the system.

NOISE

The principal sources of noise in digital images arise during image acquisition or transmission.

Consider a noisy image $F(x,y)$ formed by the addition of noise $f_x(x,y)$ to an original image $f_y(x,y)$.By mathematically in two dimensional random variable we write if x and y are independent then we write

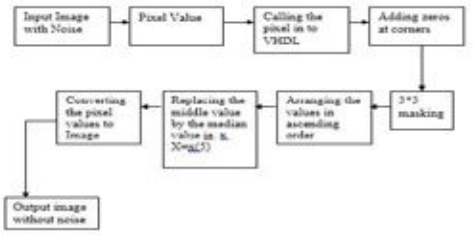
$$F(x,y) = f_x(x,y) * f_y(x,y)$$

The objective is to reduce the noice content. Some of the important noises are

- Gaussian noise
- Rayleigh noise
- Erlang noise
- Exponential noise
- Uniform noise
- Impulse noise (Salt and pepper noise)

The image corrupted by impulse noise is the only one that is visually indicative. It appears as white and black dots which resembles salt and pepper granules and hence the terms impulse or salt and pepper noise. To filter these noises we go for spatial filtering.

BLOCK DIAGRAM



SOFTWARE DESCRIPTION

MATLAB

MATLAB is a high performance language for technical computing. It integrates computation, visualization, and programming in an easy -to- use environment problems and solutions are expressed in familiar mathematical notation typical uses include math and computation

- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non language such as *C* or *FORTRAN*.

The name *MATLAB* stands for matrix laboratory. *MATLAB* was originally written to provide easy access to matrix software developed by the *LINPACK* and*EISPACK* projects. Today, *MATLAB* uses software developed by the *LAPACK* and *ARPACK* projects, which together represent the state- of-the-art in software for matrix computation.

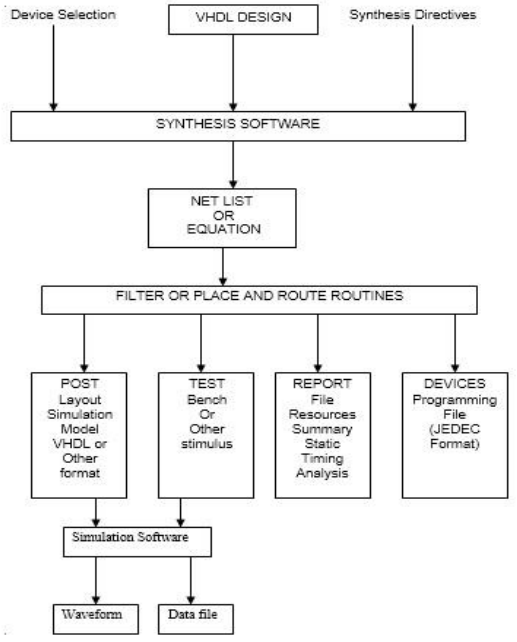
MATLAB has evolved over a period of years with input from many users. In industry, *MATLAB* is the tool of choice for high -productivity research, development, and analysis.

VHDL DESIGN PROCESS

The design process in *VHDL* consist of the following steps .

- Formulate the design
- Code the design
- Simulate the source code
- Synthesize, optimize and fit design

FLOW DIAGRAM



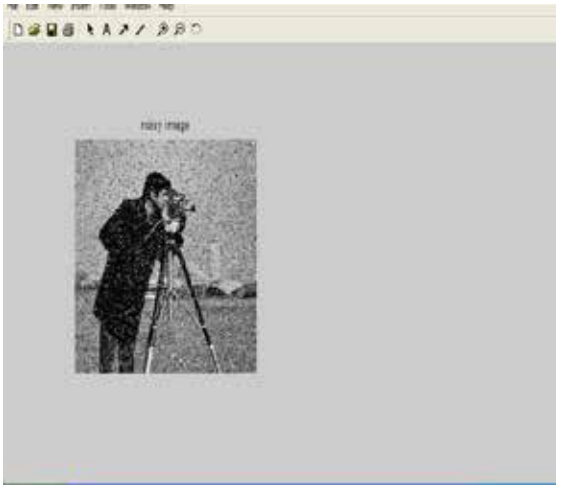
IMPLEMENTATION

Implementation is the final step of a system design. It means converting a new design into operation. This involves installing hardware terminals and training the operating staff. In this phase, user training is critical for minimizing resistance to change and giving the new system a chance to prove its worth. Major steps involved in the implementation of the system are:

- Installation of the new hardware, if required. Installation of the newly developed software into the hardware at the work site.
- Training to be given for the users.

- ❖ All the Users/Operators should be briefed on how to use the system.
- ❖ Operating manual to be prepared and distributed.

FILTERING APPLICATION



DOMINATING SET

In graph theory, a **dominating set** for a graph $G = (V, E)$ is a subset S of V such that every vertex not in S is adjacent to at least one member of S. The **domination number** $\gamma(G)$ is the number of vertices in a smallest dominating set for G.

The **dominating set problem** concerns testing whether $\gamma(G) \leq K$ for a given graph G and input K; it is a classical NP-complete decision problem in computational complexity theory (Garey& Johnson 1979). Therefore it is believed that there is no efficient algorithm that finds a smallest dominating set for a given graph.

Let us consider an image of M*N **strings** with 8 connectivity where the pixels are

Weighted with the (DRAW) For example let the image be

$$I=\begin{bmatrix} I_{11} I_{12} & \cdots & I_{1n} \\ \vdots & \ddots & \vdots \\ I_{m1} I_{m2} & \cdots & I_{mn} \end{bmatrix}$$

Figure 1.1

Let the pixels weight be 0.8 obtained from DRAW method and the weight pixel are shown as below figure

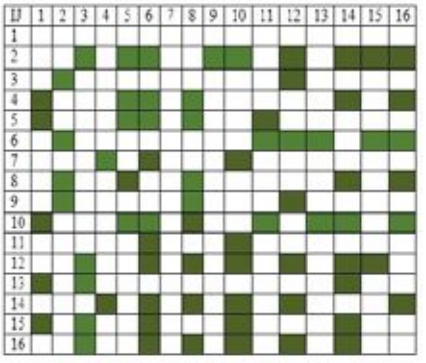


Figure 1.2

For simplicity, let us assume $16 * 16$ matrix split in to four 8*8 matrix for easy Explanation a nd understanding the concept of the dominating set and aslo to find easily the dominating number for the Graph. So that we take is as the following weight block of $8 * 8$ be shown as by the below Figure

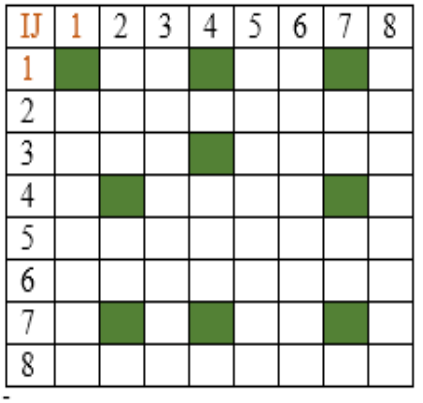


Figure 1.3

Let the shaded square represent the weighted pixels are (1,1) (1,4) (1,7) (3,4) (4,2)(4,7)(7,2)(7,4) and (7,7) take it as a node of the graph and if the two nodes are joined by a line take that line as a edge of a connected graph G.Let us assume the connected graph i s plotted for $8 * 8$ matrix said above is drawn below for our reference.Let V_1 , V_2 , ……..V_9 are the vertices of the connected graph and E_1 , E_2 , ……..E_9 be the edges of the connected graph G.

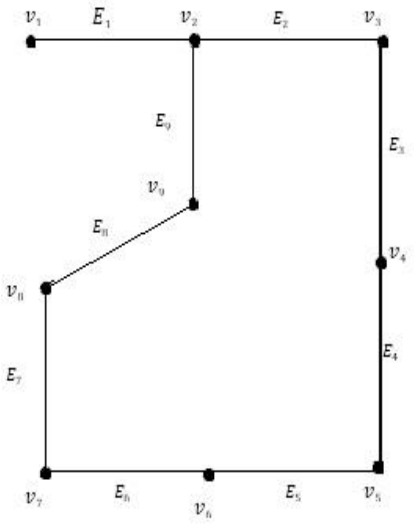


Figure 1.4

From the above graph the dominating set $S_1 = \{v_2, v_5, v_7\}$ and $S_2 = \{v_2, v_5, v_8\}$ are the two dominating sets for the above connecting graph G and the dominating number is $\gamma(G)$=3. So it conclude ,every weighted pixel from Figure 1.3 can be formed as node and vertices with dominating number 3.so this proposed mathematical solution identifies the best pixels which can be proved by filtering the multiexposure images with minim um number of pixel which enables the maximum resolution after filtering .

DOMINATING SET APPLIED FOR THE IMAGE CORRECTION.

Normal pixel value of the noise image is given below

PIXEL VALUE BEFOR FILTERING

153	166	153	166	159	155	159	159	161	156	151	154	160
	148	155	156	154	149	151	150	155	157	151	149	152
	154	167	161	165	157	154	149	153	152	157	152	153
	148	154	162	155	157	154	164	144	156	155	164	154
	160	164	157	159	169	161	168	161	159	159	161	160
156	160	156	160	156	155	156	159	158	155	154	152	157
	151	156	157	154	151	153	152	154	155	151	150	153
	154	162	158	161	158	154	152	154	159	159	155	156
	152	155	160	157	157	155	160	153	158	159	162	157
	160	162	159	160	165	161	165	161	160	159	161	161
	159	159	159	159	159	162	165	163	161	162	161	163
	166	162	164	164	160	163	164	162	161	161	165	164
	161	159	160	159	163	160	166	164	162	158	157	158
	160	158	161	160	157	161	157	162	161	160	159	158
	157	161	163	159	155	164	162	161	165	158	157	162
	160	164	161	163	159	163	164	162	162	164	164	163
	163	164	162	159	164	162	159	157	161	161	162	158
	146	127	122	116	113	110	110	107	107	106	110	133
	126	95	95	82	69	70	64	66	80	113	110	86
	117	98	88	96	103	101	114	105	95	114	130	145
	140	133	140	134	140	144	142	141	136	135	137	132
	131	124	130	117	135	135	129	123	120	132	135	141
	157	148	150	140	155	110	120	141	126	117	114	119
	120	101	147	125	110	133	114	130	119	126	124	116
	133	111	119	119	100	117	132	147	118	126	117	125
	107	129	142	133	145	81	106	137	145	114	98	127
159	154	159	154	153	155	153	159	155	154	157	150	153
	154	157	158	154	155	155	154	157	153	151	151	154
	154	157	155	157	159	154	155	155	158	158	158	159
	156	156	158	156	157	156	156	159	160	163	160	160
	160	160	161	161	161	162	161	161	159	161	162	162
	160	161	160	160	163	161	164	163	159	162	165	163
	165	163	167	160	163	161	163	162	160	163	166	166
	162	162	162	162	163	163	165	162	161	157	160	159
	161	160	161	156	159	159	160	160	158	155	159	159
	157	159	161	160	161	161	158	162	162	162	161	161
	162	164	159	165	160	161	164	165	164	165	166	160
	161	161	162	162	162	164	160	161	161	164	163	160

The above image is represent to the pixcel value of noice image.That image is convert in the matrix format using dominating set methods and we have finish the entire process than we get the final value of the normal pixcel without noise.

The img 1.1 is represent to the normal pixcel value of the noiceless image.The key role of the matrix value is get from the substract value of noice pixcel value to noiseless pixcel value.

PIXEL VALUE AFTER FILTERING

	0	156	154	154	154	153	155	155	155	154	152	152	151	153	154
154	153	153	157	153	153	151	151	151	151	154	154	157	157	154	154
154	154	155	155	156	155	155	155	156	157	156	156	155	156	159	159
159	160	160	160	160	160	161	161	161	161	159	159	159	160	159	159
159	159	159	161	162	161	161	161	162	163	163	162	162	160	160	161
161	161	161	161	163	161	161	160	159	160	160	163	165	165	159	157
157	158	158	160	156	157	157	157	159	158	158	158	158	157	157	157
159	159	159	158	161	161	161	158	158	160	161	160	161	159	160	160
162	162	162	163	163	161	161	161	161	162	162	160	159	159	161	161
160	146	127	122	118	113	109	109	109	107	107	106	104	104	109	95
85	69	68	66	66	66	66	80	88	89	89	94	84	84	101	103	104	95	93
95	116	133	133	133	133	134	134	140	140	136	135	131	131	131	131
130	124	126	126	132	127	123	123	120	135	135	137	124	124	124	122
120	120	126	123	114	114	109	108	108	119	119	119	110	114	110	114
121	120	120	111	111	106	106	106	117	119	128	126	118	125	117	120
120	129	128	106	106	106	116	116	114	114	114	116	121	0		
156	158	157	156	155	155	156	157	157	157	155	155	154	156	157	157
156	154	153	154	154	154	153	151	154	154	155	157	158	158	155	155
155	157	158	157	156	156	156	157	157	157	157	156	159	159	160	160
160	160	160	161	161	161	162	161	161	161	160	161	161	161	160	160
160	161	163	163	163	162	162	162	163	163	163	164	164	163	163	163
163	162	163	164	164	162	162	162	162	163	162	162	161	160	158	
159	159	160	160	160	160	160	160	160	159	159	159	159	159	161	
161	160	160	161	162	162	162	161	161	162	161	163	161	162	162	163
163	163	164	164	163	163	162	162	162	162	162	161	161	161	162	162
160	146	127	122	118	110	109	108	108	107	106	104	110	133	126	95
82	69	66	66	66	80	110	112	117	117	117	103	106	106	114	108	114
114	119	136	136	136	136	134	140	141	142	141	136	135	135	132	135
131	131	130	132	133	133	132	129	132	137	137	137	137	137	140	135
132	129	129	128	126	123	120	119	119	120	125	125	122	120	120	120
124	124	123	124	118	122	111	118	118	119	128	132	146	140	136	120
133	129	133	133	119	119	119	121	119	116	116	116	124	126	121	
155	158	157	157	155	155	156	156	157	157	157	155	155	156	157	157
157	154	154	155	155	155	154	154	154	155	155	157	157	157	156	155
155	157	158	157	157	156	156	156	157	157	157	158	159	160	160	160
160	160	161	161	161	161	161	161	161	161	161	159	161	162	161	161
160	161	161	161	161	161	162	161	161	161	161	164	165	164	164	163	164	164
165	163	163	165	165	165	163	163	163	165	163	161	161	161	160	159
160	160	160	159	159	159	160	161	160	158	158	159	159	159	161	161
161	161	161	161	162	162	162	162	162	162	162	163	162	162		

IMAGE AFTER FILTER APPLICATION

FUTURE DEVELOPMENT

In this paper we use only Bit map files*BMP images has been processed. But in future, other extension files including joint photographic expert's group (ipeg) images can also be processed. Color images can also be processed.

CONCLUSION

The implementation of Median filter is reviewed in this project. The behavior an performance is analyzed using dominating methods. Based on the threshold value of the median filtering algorithm have been developed and summarized here. The optimization goal is to minimize the absolute error, resulting these filter will attenuate noise maximally while preserving certain desired.

By using this filtering and dominating technique the edges images can be preserved, while reducing the noise to its maximum capability.

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