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GENERATION THE REGULAR PICTURES AND IRREGULAR PICTURES FROM THE SOUND BY USING EFFECT MATRIX $\hat{E}(\Re, p_n, q_n)$

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Abstract. In this paper we introduce regular pictures and irregular pictures, where these pictures are generated from random sounds by using effect matrix $\hat{E}(\Re, p_n, q_n)$. Moreover, the comparison between two different sounds under the same effect matrix can be studied and explained its applications.

Key word: irresolute operation, effect matrix, wavelength, frequency, effect product.

1. Introduction

In this work we deal with sound waves and colors. Waves are the key to sound and color. Mobile phone signals, microwave ovens all use energy carried by waves. Earthquakes and tsunamis are destructive waves of energy. Waves affect our everyday lives in many ways. There are many studies are introduced by a number of researchers, where they are using the colors in an important different applications like new methods of meat quality evaluation which the world of meat faces a permanent need for these methods [1]. Recent advances in the area of computer and video processing have created new ways to monitor quality in the food industry. The formulation of Genetic Snakes is extended in two ways, by exploring additional internal and external energy terms and by applying them to color images. A modified version of the image energy is employed which considers the gradient of the three color RGB (red, green and blue) components

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(see [3] and [5]). In this paper for any sound (one dimension) we can generate a picture (two dimensions) by using effect matrix $\hat{E}(\Re, p_n, q_n)$. If the mathematical operations in effect matrix are changed, then another picture can be generated from the same sound. Therefore the picture generated from random sound it is not unique. Moreover, in this work two special cases of the pictures are introduced, these are regular picture and irregular picture, where each case of the pictures consists of (n^2) squares, where the area of all squares are equal and each square is called cell and has a special color, where these colors for each cell depends on the operator $\wedge$ and the properties of the mathematical operations p_i, q_i (decreasing, increasing, or irresolute). Let μ be the number of colors in a given problem and c_{ij}, for all $(1 \le i \le n)$ be elements in $\hat{E}(\Re, p_m, q_n)$. Then for each color given, there is a semi open set $[\frac{(2\mu-3)\lambda}{2}, \infty)$ or $[\frac{(2r-3)\lambda}{2}, \frac{(2r-1)\lambda}{2})$ or an open set $(-\infty, \frac{\lambda}{2})$ in real numbers R, where $(2 \le r \le \mu - 1)$ and $\lambda = \frac{Max(c_{ij}) - Min(c_{ij})}{\mu}$, it is represent the level of this color. Moreover, in this paper we consider regular picture if for each color A appear in considering picture there is a single path of type $p(A)$ and we consider irregular picture if at least there are two paths of the same type $p(A)$. In another direction by this new method we can study many of the arising sounds from the nature and animals and then make comparison between them under the same effect matrix $\hat{E}(\Re, p_n, q_n)$ to help us in our everyday lives in many ways for instance we can predict disaster before it happened.

2. Definitions and Preliminaries

2.1 Sound Wave Properties: ([5] and [6])

Each wave has some properties and notations. The most important ones for this work are shown here:

2.1.1 Definition: (wavelength).

The distance between any point on a wave and the equivalent point on the next phase. Literally, the length of the wave.

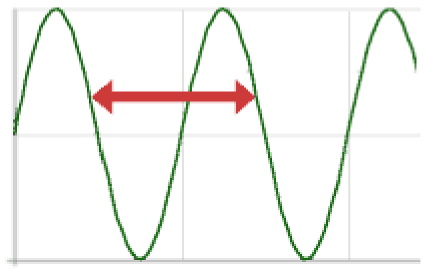


Figure (1)

2.1.2 Definition: (frequency).

The number of times the wavelength occurs in one second. Measured in kilohertz (Khz), or cycles per second. The faster the sound source vibrates, the higher the frequency.

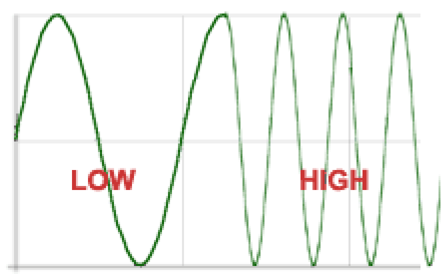


Figure (2)

2.1.3 Remark:

Higher frequencies are interpreted as a higher pitch. For example, when you sing in a high-pitched voice you are forcing your vocal chords to vibrate quickly.

2.2 Effect graph: [4]

Let $\Re = \{y_i / i = 1,2,3,...,I\}$ where $I \in N$ be collection of sets, Assume that there exists some finite positive number m of mathematical operations; $p_1, p_2, p_3, ..., p_m$, which can be applied on $\Re$ in the form $p_j(y_i)$, where $j = 1,2,3,...,m \leq I$. Assume that there exist another finite positive number n of other mathematical operations; $q_1, q_2, q_3, ..., q_n$, which can be also applied on $\Re$ in the form of $q_k(y_i)$, where $k = 1,2,3,...,n \leq I$. Assume also that the operations $p_j(j = 1,2,3,...,m)$ and $q_k(k = 1,2,3,...,n)$ are arranged in rectangular (matrix) form such that the operations p_j represent the rows of the matrix while the operations q_k represent its columns as shown in the following arrangement.

No. of columns = n

$$\text{No. of rows} = m \qquad \begin{array}{c|cccccccc} & q_1 & q_2 & q_3 & . & . & . & q_n \\ \hline p_1 & y_{11} & y_{12} & y_{13} & . & . & . & y_{1n} \\ p_2 & y_{21} & y_{22} & y_{23} & . & . & . & y_{2n} \\ p_3 & y_{31} & y_{32} & y_{33} & . & . & . & y_{3n} \\ . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . \\ p_m & y_{m1} & y_{m2} & y_{m3} & . & . & . & y_{mn} \end{array} \qquad \ldots(1)$$

Where $y_{jk} = (y_j, y_k)$; $j = 1, 2, 3, ..., m$; $k = 1, 2, 3, ..., n$. Then next step is to imagine, that there exists some graph formed from that two sets of operations p_j and q_k such operator p_j is connected with each q_k. This oriented connection between p_j to q_k $[(p_j, q_k)]$, This effect is oriented and the corresponding rectangular graph of effects is called the " effect graph " it's convenient to symbolize effect between p_j and q_k. By the notation $(p_j \hat{,} q_k)$, where the symbol $\wedge$ refers to the presence of the effect. Therefore, the above arrangement can be represented as follows:

$$
\begin{array}{c|cccccc}
 & q_1 & q_2 & q_3 & \cdot\ \cdot\ \cdot & q_n \\
\hline
p_1 & (p_1 \overset{\wedge}{,} q_1) & (p_1 \overset{\wedge}{,} q_2) & (p_1 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_1 \overset{\wedge}{,} q_n) \\
p_2 & (p_2 \overset{\wedge}{,} q_1) & (p_2 \overset{\wedge}{,} q_2) & (p_2 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_2 \overset{\wedge}{,} q_n) \\
p_3 & (p_3 \overset{\wedge}{,} q_1) & (p_3 \overset{\wedge}{,} q_2) & (p_3 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_3 \overset{\wedge}{,} q_n) \\
\cdot & \cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
p_m & (p_m \overset{\wedge}{,} q_1) & (p_m \overset{\wedge}{,} q_2) & (p_m \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_m \overset{\wedge}{,} q_n)
\end{array}
\quad \ldots\ldots (2)
$$

Assume that there exists a rectangular matrix of coefficients in the following form:

$$
E = \begin{bmatrix}
y_{11} & y_{12} & y_{13} & \cdot & \cdot & \cdot & y_{1n} \\
y_{21} & y_{22} & y_{23} & \cdot & \cdot & \cdot & y_{2n} \\
y_{31} & y_{32} & y_{33} & \cdot & \cdot & \cdot & y_{3n} \\
\cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
y_{m1} & y_{m2} & y_{m3} & \cdot & \cdot & \cdot & y_{mn}
\end{bmatrix}
$$

Let us symbolize the effect graph by the symbol $\hat{E}$ i.e,

$$
\hat{E} = \begin{bmatrix}
(p_1 \overset{\wedge}{,} q_1) & (p_1 \overset{\wedge}{,} q_2) & (p_1 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_1 \overset{\wedge}{,} q_n) \\
(p_2 \overset{\wedge}{,} q_1) & (p_2 \overset{\wedge}{,} q_2) & (p_2 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_2 \overset{\wedge}{,} q_n) \\
(p_3 \overset{\wedge}{,} q_1) & (p_3 \overset{\wedge}{,} q_2) & (p_3 \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_3 \overset{\wedge}{,} q_n) \\
\cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot\ \cdot\ \cdot & \cdot \\
(p_m \overset{\wedge}{,} q_1) & (p_m \overset{\wedge}{,} q_2) & (p_m \overset{\wedge}{,} q_3) & \cdot\ \cdot\ \cdot & (p_m \overset{\wedge}{,} q_n)
\end{bmatrix}
\ldots\ldots (3)
$$

Where $\hat{E}$ is an effect graph .if the oriented effect (p_j, q_k) could be interpreted, mathematically, as some oriented mathematical operation, $\wedge$, originating at p_j and ending at q_k (i.e., from p_j to q_k), $(p_j \hat{,} q_k) \to [p_j] \wedge [q_k]$ ....(4)

This operator $\wedge$ may refer to addition, subtraction, multiplication, inner product… etc.). The quantity $[p_j]$ $\wedge$ $[q_k]$ may be scaled (or normalized), simply, by multiplication with the corresponding scaled (normalization) coefficient, y_{jk} : that is,

$(p_j \hat{,} q_k) \to y_{jk}([p_j] \wedge [q_k]) = [p_j(y_j)] \wedge [q_k(y_k)]$..............(5)

Forming the matrix of (5), yields

$$y_{jk}(\,[p_j] \wedge [q_k]) \;;\; \begin{pmatrix} j = 1,2,3,\ldots,m \\ k = 1,2,3,\ldots,n \end{pmatrix} \to E \bullet \hat{E} \text{...........(6)}$$

2.2.1 Definition:

The symbol $(\bullet)$ refers to a special type of matrix multiplication in which each element of the matrix E is multiplied with the corresponding element in the matrix $\hat{E}$ and this special type of the multiplication matrix is called "Effect product " .

2.2.2 Definition:

The special type of the quantity $E \bullet \hat{E}$ is a matrix and its called "Effect matrix of $\Re$ " and denoted by $\hat{E}(\Re, p_m, q_n)$.

2.2.3 Remarks:

1. The mathematical operations $\{p_k\}_{k=1}^n$ is called an increasing on the set $\Re = \{y_k\}_{k=1}^n$, if for each $y_i > y_j$ such that $p_i(y_i) > p_j(y_j)$.
2. The mathematical operations $\{p_k\}_{k=1}^n$ is called a decreasing on the set $\Re = \{y_k\}_{k=1}^n$, if for each $y_i > y_j$ such that $p_i(y_i) < p_j(y_j)$.

3. The mathematical operations $\{p_k\}_{k=1}^{n}$ is called an irresolute on the set $\Re = \{y_k\}_{k=1}^{n}$, if there exist $y_i > y_j$ and $y_a > y_b$ such that $p_i(y_i) > p_j(y_j)$ and $p_a(y_a) < p_b(y_b)$.

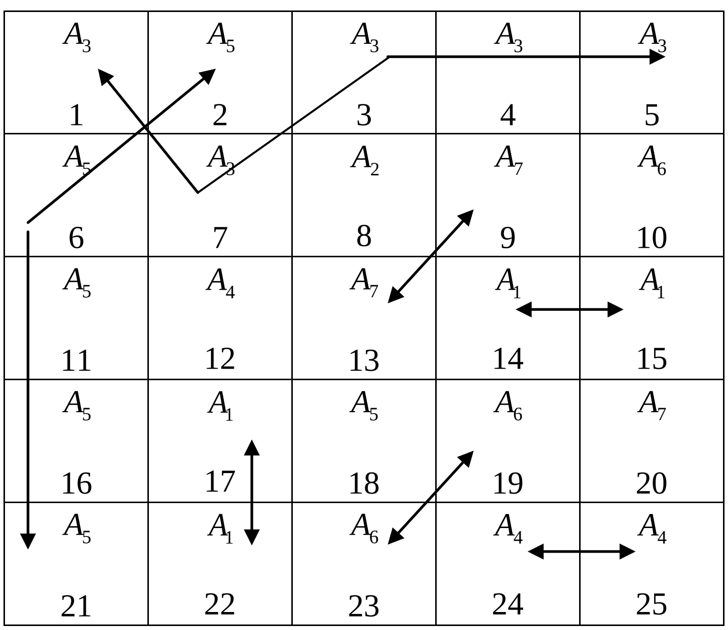
3. Generated the Regular and Irregular Pictures

3.1 Definition:

Let $\{A_i\}_{i=1}^{\mu}$ be a collection of colors and H be a square which is divided into (n^2) of sub-squares, where each sub-square has color A_i for some $(1 \le i \le \mu)$. Then the line which is passing through at least two sub-squares of color A_i is called path and denoted by $P(A_i)$.

3.2 Example:

Let H be a square consists (25) sub- squares, where each sub-square has color A_i for some $(1 \le i \le 7)$ as follows:



Then the following are hold in above example:

1) There are 7 paths which are passing through 20 sub-squares.
2) There are two paths of type $P(A_1)$.
3) There is a single path for each type of $\{P(A_3), P(A_4), P(A_5), P(A_6), P(A_7)\}$.
4) There exists no path of type $P(A_2)$.
5) There is no path of type $P(A_1)$ between sub-squares 14 and 17.

3.3 Definition:

Let $\hat{E}(\Re, p_n, q_n)$ be an effect matrix generated a picture consists of (n^2) squares, where the area of all squares are equal and each square is called cell and has a special color. Then for each pair of cells c_{ij} and c_{kl} whose color A are called $A-$connected, if there is a path $P(A)$ between them. In every other case are called $A-$disconnected.

3.4 Definition:

Let $\hat{E}(\Re, p_n, q_n)$ be an effect matrix generated a picture consists of (n^2) squares, where the area of all squares are equal and each square is called cell and has a special color, this picture is called regular if all pairs of cells whose color A are $A-$connected.

3.5 Definition:

Let $\hat{E}(\Re, p_n, q_n)$ be an effect matrix generated a picture consists of (n^2) squares, where the area of all squares are equal and each square is called cell and has a special color, this picture is called irregular if there are at least two cells whose color A are $A-$disconnected.

3.6 Remark:

In another direction, if any picture has more one path of the same type. Then it is an irregular picture. (In every other case it is a regular picture).

3.7 Synthesis operation:

There are two of geometric operations the first operation is called analysis operation and it is analysis π -dimension into α -dimension where $\pi \geq \alpha$, the second operation is a converse operation which is called synthesis operation, in our work we used synthesis operation to transform the sound to the picture by using effect matrix where the sound has one-dimension and the picture has two-dimensions. In the first stage we need system where it is working to change the sound to the function $u(t)$, as showing figures (3-a) and (3-b).

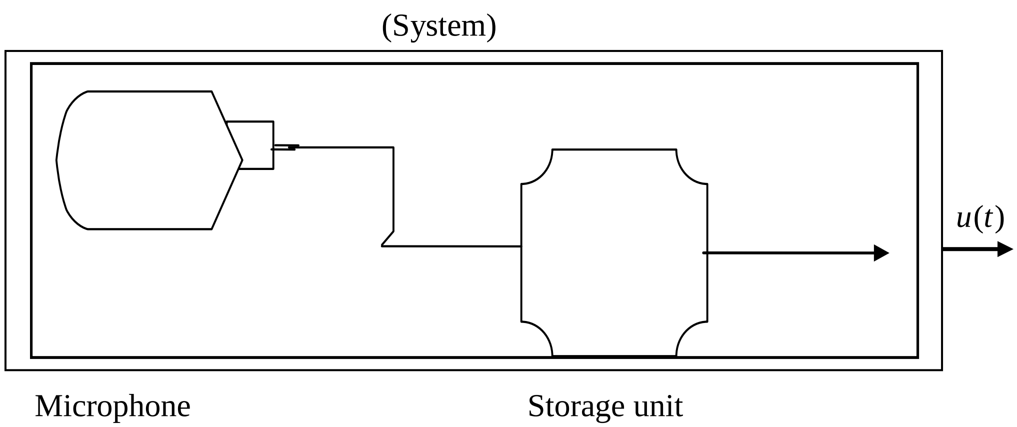


Figure (3-a)

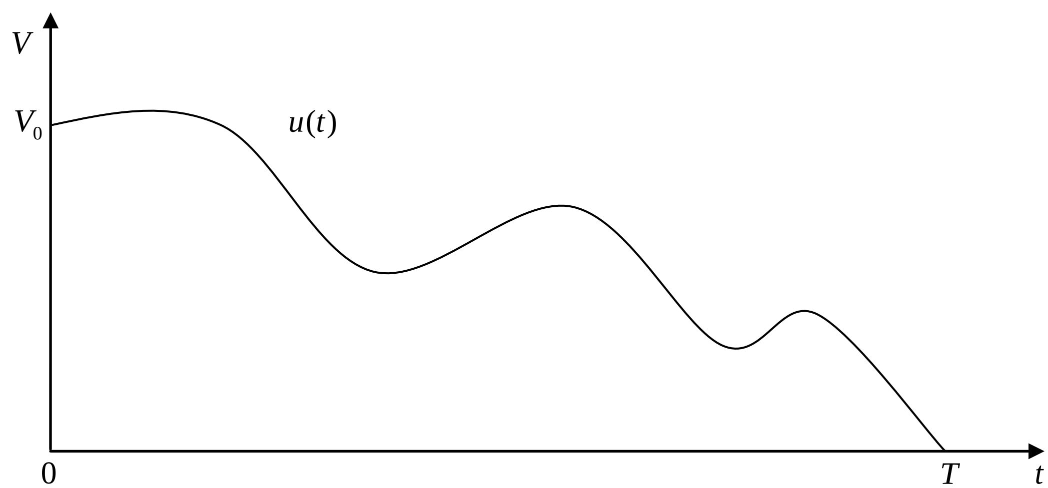


Figure (3-b)

V : Voltage
t : time

Note that:

(1) The system in Figure (1) modify the sound to the function u(t)

(2) If t=0 (initial time), then u(t)= V_0 (initial voltage)

(3) If t =T (finally time), then u(t)=0

3.8 Steps of the work:

If the function u(t) is considered from the special sound by the system which is doing to modify the sound to the function u(t), then the current work to transform the special sound to the picture by using effect matrix can be compressed as following steps:

1) Folding Figure (3-b) as follower:

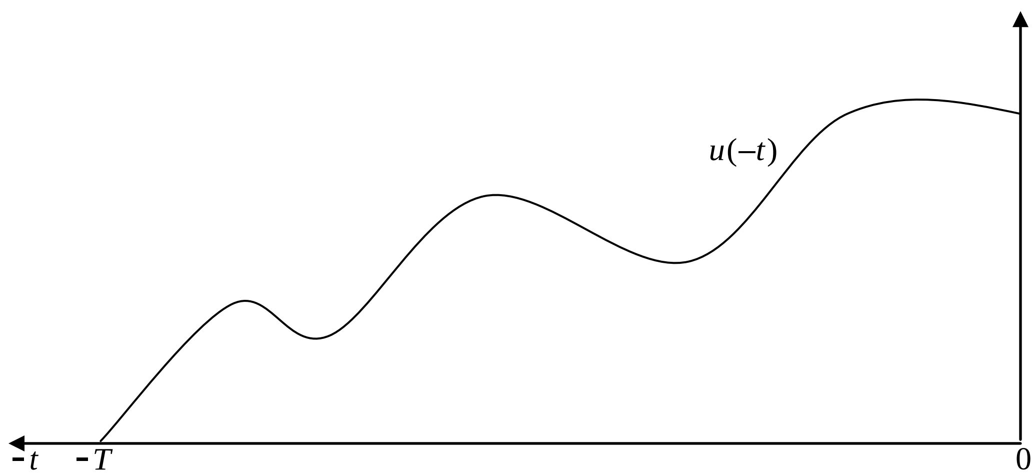


Figure (4)

2) Shift Figure (4) by T to the right as follower:

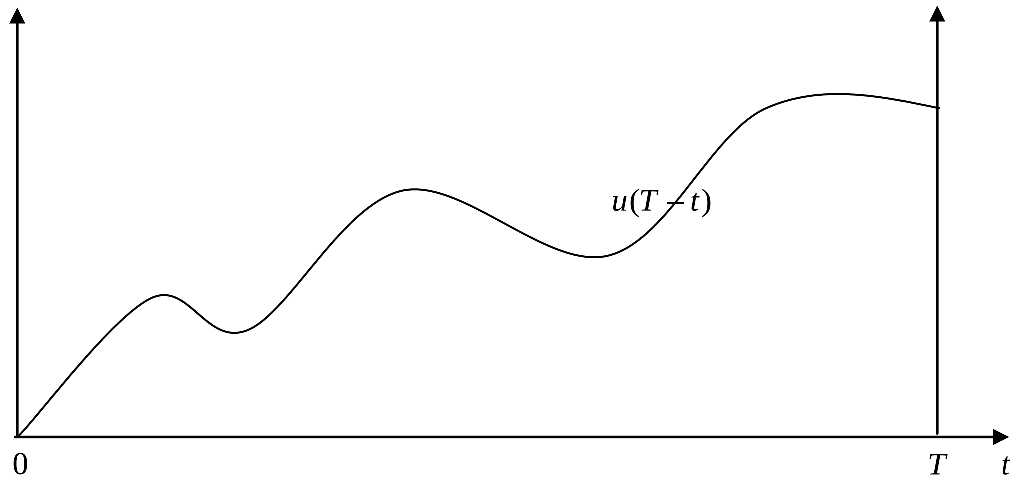


Figure (5)

3) Divide Figures (3-b) and (5) to n of partitions where $\Delta t = \dfrac{T}{n}$.

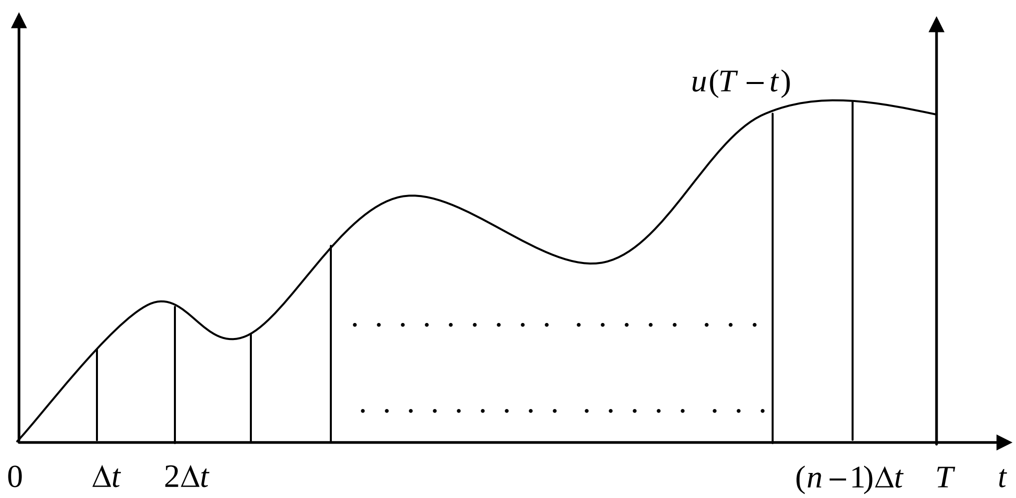


Figure (6-a)

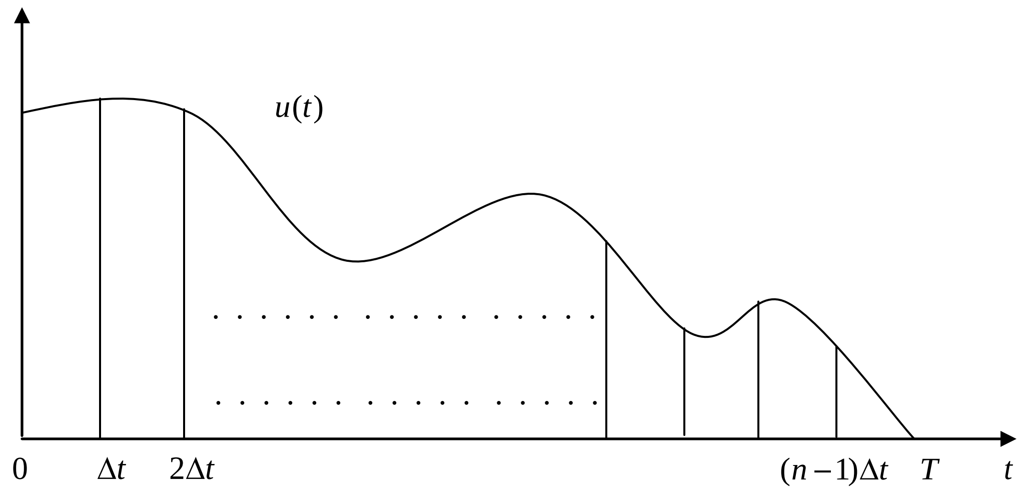


Figure (6-b)

4) Find $S_X(i\Delta t)$ and $S_y(i\Delta t)$,$(0 \le i \le n)$ where $S_X(t) = u(t)$ and $S_y(t) = u(T-t)$.

5) Find $S_{X_i} = \theta_i(S_X(i\Delta t), S_X((i+1)\Delta t))$ and $S_{y_i} = \psi_i(S_y(i\Delta t), S_y((i+1)\Delta t))$ where $(0 \le i \le n-1)$ and θ_i, ψ_i are a known functions.

6) Find $c_{ij} = \sigma(S_{X_{i-1}}, S_{y_{j-1}})$ where $(0 \le i, j \le n)$ and σ is known function.

7) Assume $Max[c_{ij}] = L$, $Min[c_{ij}] = K$ and μ is a number of the colors.

8) Let
$$c_{ij} = \begin{cases} A_1 & if \quad \infty < c_{ij} < \dfrac{\lambda}{2} \\ A_r & if \quad \dfrac{(2r-3)\lambda}{2} \le c_{ij} < \dfrac{(2r-1)\lambda}{2}, (2 \le r \le \mu - 1) \\ A_\mu & if \quad \dfrac{2\mu-3}{2} \le c_{ij} \end{cases}$$

Where $\lambda = \dfrac{L-K}{\mu}$ and each of $A_i\ (i = 1,2,.....,\mu)$ represent a special color.

3.9 Remarks:

1) The number of colors do not depend on the number of partitions (n) or on the number of cells in the matrix (n^2).

2) For each color in a given problem there is a semi open set $[\frac{(2\mu-3)\lambda}{2},\infty)$ or $[\frac{(2r-3)\lambda}{2},\frac{(2r-1)\lambda}{2})$ or an open set $(-\infty,\frac{\lambda}{2})$ in real numbers R, where $(2 \le r \le \mu-1)$ and $\lambda = \frac{Max(c_{ij})-Min(c_{ij})}{\mu}$.
3) If more of colors are given, then a good picture will be seen.
4) For each sound there are (∞) pictures since there are infinitely functions of θ_i, ψ_i and σ.
5) For each $(0 \le i \le n)$ we have $S_X(i\Delta t) = S_y(T-i\Delta t)$.
6) If f_{Max} is the maximum of the frequency that exists in the sound, then the best (n) is chosen which is satisfy that $n = T \times f_{Max}$. (i.e. the best (Δt) such that there is no loss in the information to the humans sound where the maximum of the frequency in the humans sound is $f_{Max} = 4KHZ = 4\times10^3 HZ$, thus $\Delta t = \frac{1}{4\times10^3} = 0{,}250\times10^{-3} = 250\ \ Sec$).

3.10 Transformation the sound to the picture by Effect matrix:

Assume $\Re = \{y_1 = (0,\Delta t), y_2 = (\Delta t, 2\Delta t),..., y_n = ((n-1)\Delta t, T)\}$ where $T = n\Delta t$. Let $\wedge = \sigma$ and $p_i = \theta_{i-1}$, $q_i = \psi_{i-1}$, where $(1 \le i \le n)$

We have $E = \begin{pmatrix} y_{11} & y_{12} & . & . & . & y_{1n} \\ y_{21} & y_{22} & . & . & . & y_{2n} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ y_{n1} & y_{n2} & . & . & . & y_{nn} \end{pmatrix}_{n\times n}$

where $y_{ij} = (((i-1)\Delta t, i\Delta t), ((j-1)\Delta t, j\Delta t))$ and the effect graph give as :

$$\hat{E} = \begin{pmatrix} (\theta_0,\overset{\sigma}{\psi}_0) & (\theta_0,\overset{\sigma}{\psi}_1) & . & . & . & (\theta_0,\overset{\sigma}{\psi}_{n-1}) \\ (\theta_1,\overset{\sigma}{\psi}_0) & (\theta_1,\overset{\sigma}{\psi}_1) & . & . & . & (\theta_1,\overset{\sigma}{\psi}_{n-1}) \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ (\theta_{n-1},\overset{\sigma}{\psi}_0) & (\theta_{n-1},\overset{\sigma}{\psi}_1) & . & . & . & (\theta_{n-1},\overset{\sigma}{\psi}_{n-1}) \end{pmatrix}_{n\times n} \qquad \text{(effect graph)}$$

$\Rightarrow E \bullet \hat{E} = \hat{E}(\Re, p_n, q_n)$ where $(\bullet)$ is effect product.

$$\text{Then } \hat{E}(\Re, p_n, q_n) = \begin{pmatrix} c_{11} & c_{12} & . & . & . & c_{1n} \\ c_{21} & c_{22} & . & . & . & c_{2n} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ c_{n1} & c_{n2} & . & . & . & c_{nn} \end{pmatrix}_{n\times n} \qquad \text{(effect matrix)}$$

where $c_{ij} = (S_{x_{i-1}}) \wedge (S_{y_{j-1}})$. Let $Max(c_{ij}) = L$, $Min(c_{ij}) = K$, where $\begin{Bmatrix} 1 \le i \le n \\ 1 \le j \le n \end{Bmatrix}$

So, suppose the number of colors is μ, and

$$c_{ij} = \begin{cases} A_1 & if \quad \infty < c_{ij} < \dfrac{\lambda}{2} \\ A_r & if \quad \dfrac{(2r-3)\lambda}{2} \le c_{ij} < \dfrac{(2r-1)\lambda}{2}, (2 \le r \le \mu - 1) \\ A_\mu & if \quad \dfrac{2\mu - 3}{2} \le c_{ij} \end{cases}$$

Where $\lambda = \dfrac{L-K}{\mu}$, and each of $A_i \ (i = 1,2,.....,\mu)$ represent a special color.

3.11 Remark:

If we choose (μ) colors it is not necessary all (μ) colors are appear in a picture. [see following example.

3.12 Example:

Let $u(t)=1-t$ be a sounds function with the sound signal 60 sec and $\mu=10$. Find and determine the type of the picture (regular or irregular) which is generated by the effect matrix $\hat{E}(\Re, p_n, q_n)$, where $\Re=\{y_f=(y_1, y_2)\ ;1\le f\le n\ |\ \ y_1=\frac{(f-1)T}{n}, y_2=\frac{fT}{n}\}$ as follows:

1. If $p_i(y_f)=S_X(y_1)+S_X(y_2)$, $q_j(y_f)=(-1)^j\times S_y(y_1)\times S_y(y_2)$ and $n=3$.
2. If $p_i(y_f)=\frac{S_X(y_1)+S_X(y_2)}{2}$, $q_j(y_f)=\frac{S_y(y_1)+S_y(y_2)}{2}$ and $n=4$.

Solution:

Assume $A_1=$white, $A_2=$yellow, $A_3=$orange, $A_4=$rose, $A_5=$red, $A_6=$green, $A_7=$blue, $A_8=$violet, $A_9=$ brown, $A_{10}=$black. Since $T=60\ \ Sec=1\ \min$, then $\Delta t=\frac{T}{n}=\frac{1}{n}$.

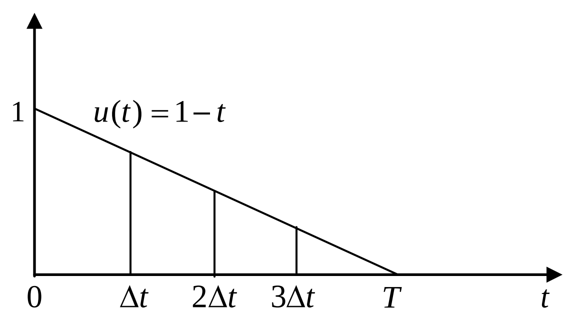


Figure (7)

1. If $p_i(y_f)=S_X(y_1)+S_X(y_2)$, $q_j(y_f)=(-1)^j\times S_y(y_1)\times S_y(y_2)$ and $n=3$, then $\Delta t=\frac{1}{3}$ and the following calculations are considered:

$$E=\begin{pmatrix} y_{11} & y_{12} & y_{13} \\ y_{21} & y_{22} & y_{23} \\ y_{31} & y_{32} & y_{33} \end{pmatrix} \text{ where } y_{ij}=(((i-1)\Delta t, i\Delta t),((j-1)\Delta t, j\Delta t)) \quad \text{and}$$

$$\overset{\times}{E} = \begin{pmatrix} (p_1 \overset{\times}{,} q_1) & (p_1 \overset{\times}{,} q_2) & (p_1 \overset{\times}{,} q_3) \\ (p_2 \overset{\times}{,} q_1) & (p_2 \overset{\times}{,} q_2) & (p_2 \overset{\times}{,} q_3) \\ (p_3 \overset{\times}{,} q_1) & (p_3 \overset{\times}{,} q_2) & (p_3 \overset{\times}{,} q_3) \end{pmatrix} \quad \text{(effect graph)}$$

$$\Rightarrow E \bullet \overset{\times}{E} = \overset{\times}{E}(\Re, p_3, q_3) = \begin{pmatrix} c_{11} & c_{12} & c_{13} & c_{14} \\ c_{21} & c_{22} & c_{23} & c_{24} \\ c_{31} & c_{32} & c_{33} & c_{34} \\ c_{41} & c_{42} & c_{43} & c_{44} \end{pmatrix} \text{(effect matrix)}$$

t	$S_X(t)$
0	1
Δt	0.6666666666666666666666666666666667
$2\Delta t$	0.3333333333333333333333333333333333
T	0

t	$S_Y(t)$
0	0
Δt	0.3333333333333333333333333333333333
$2\Delta t$	0.6666666666666666666666666666666667
T	1

i	$y_{f\,i}$	$p_i(y_{f\,i})$
1	$(0, \Delta t)$	1.666666666666666666666666666666667
2	$(\Delta t, 2\Delta t)$	1
3	$(2\Delta t, T)$	0.3333333333333333333333333333333333

j	$y_{f\,j}$	$q_j(y_{f_j})$
1	$(0, \Delta t)$	0
2	$(\Delta t, 2\Delta t)$	0.2222222222222222222222222222222222
3	$(2\Delta t, T)$	-0.6666666666666666666666666666666667

$q_j(y_{f_j}) = c_{ij}\ \ p_i(y_{f_i})\times$		
0 c_{11} =	0.37037037037037037037037037037037 c_{12} =	-1.1111111111111111111111111111111 c_{13} =
0 c_{21} =	0.22222222222222222222222222222222 c_{22} =	-0.66666666666666666666666666666667 c_{23} =
0 c_{31} =	0.074074074074074074074074074074074 c_{32} =	-0.22222222222222222222222222222222 c_{33} =

λ	0.148148148148148148148148148148148
$\frac{\lambda}{2}$	0.0740740740740740740740740740740405
$\frac{3\lambda}{2}$	0.222222222222222222222222222222222
$\frac{5\lambda}{2}$	0.37037037037037037037037037037037
$\frac{7\lambda}{2}$	0.518518518518518518518518518518518
$\frac{9\lambda}{2}$	0.666666666666666666666666666666666
$\frac{11\lambda}{2}$	0.814814814814814814814814814814814
$\frac{13\lambda}{2}$	0.962962962962962962962962962962962
$\frac{15\lambda}{2}$	1.11111111111111111111111111111111
$\frac{17\lambda}{2}$	1.259259259259259259259259259259258

A_1 = white	A_4 = rose	A_1 = white
A_1 = white	A_3 = orange	A_1 = white
A_1 = white	A_2 = yellow	A_1 = white

Then there are nine pairs of cells $c_{ij} \in \{c_{13}, c_{23}, c_{33}\}$ and $c_{kl} \in \{c_{13}, c_{23}, c_{33}\}$ whose color A_1 and all of them are A_1 – disconnected or in other side there are two paths of type $p(A_1)$. Therefore the picture which is generated by $\overset{\times}{E}(\Re, p_3, q_3)$ is an irregular picture (see Figure 8).

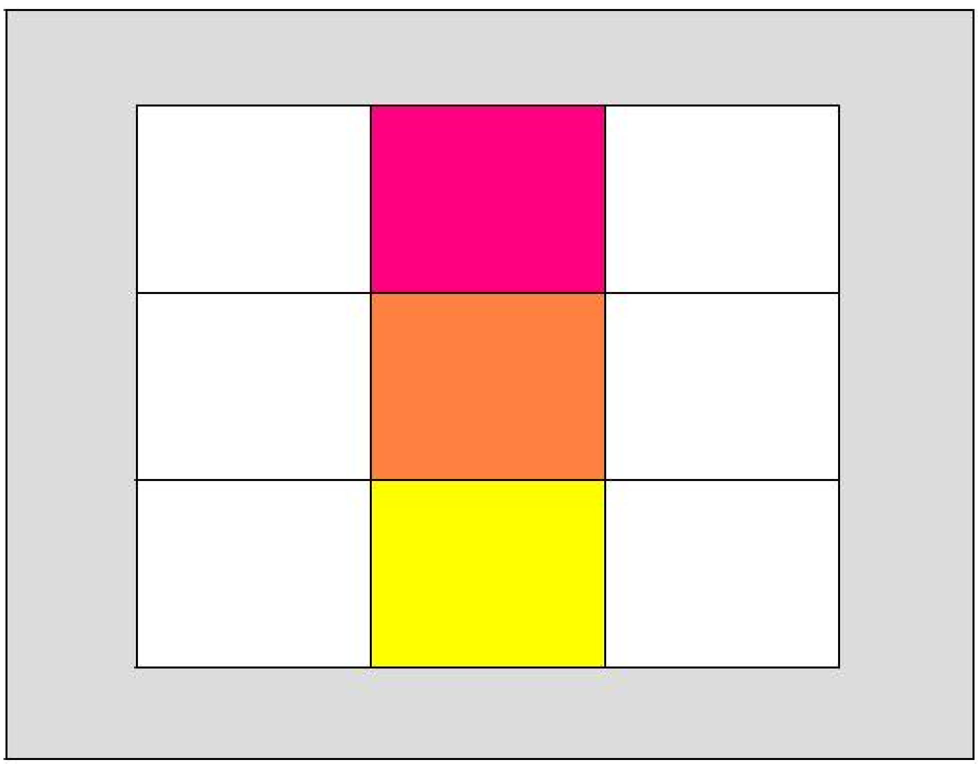


Figure (8)

2. If $p_i(y_f) = \dfrac{S_X(y_1) + S_X(y_2)}{2}$, $q_j(y_f) = \dfrac{S_y(y_1) + S_y(y_2)}{2}$ and $n = 4$, then $\Delta t = \dfrac{1}{4}$ and the following calculations are considered:

$$E = \begin{pmatrix} y_{11} & y_{12} & y_{13} & y_{14} \\ y_{21} & y_{22} & y_{23} & y_{24} \\ y_{31} & y_{32} & y_{33} & y_{34} \\ y_{41} & y_{42} & y_{43} & y_{44} \end{pmatrix} \text{ where } \quad y_{ij} = (((i-1)\Delta t, i\Delta t), ((j-1)\Delta t, j\Delta t)) \quad \text{and}$$

$$\overset{+}{E} = \begin{pmatrix} (p_1 \overset{+}{,} q_1) & (p_1 \overset{+}{,} q_2) & (p_1 \overset{+}{,} q_3) & (p_1 \overset{+}{,} q_4) \\ (p_2 \overset{+}{,} q_1) & (p_2 \overset{+}{,} q_2) & (p_2 \overset{+}{,} q_3) & (p_2 \overset{+}{,} q_4) \\ (p_3 \overset{+}{,} q_1) & (p_3 \overset{+}{,} q_2) & (p_3 \overset{+}{,} q_3) & (p_3 \overset{+}{,} q_4) \\ (p_4 \overset{+}{,} q_1) & (p_4 \overset{+}{,} q_2) & (p_4 \overset{+}{,} q_3) & (p_4 \overset{+}{,} q_4) \end{pmatrix} \text{ (effect graph)}$$

$$\Rightarrow E \bullet \overset{+}{E} = \overset{+}{E}(\Re, p_4, q_4) = \begin{pmatrix} c_{11} & c_{12} & c_{13} & c_{14} \\ c_{21} & c_{22} & c_{23} & c_{24} \\ c_{31} & c_{32} & c_{33} & c_{34} \\ c_{41} & c_{42} & c_{43} & c_{44} \end{pmatrix} \text{ (effect matrix)}$$

t	$S_X(t)$
0	1
Δt	0.75
$2\Delta t$	0.5
$3\Delta t$	0.25
T	0

t	$S_Y(t)$
0	0
Δt	0.25
$2\Delta t$	0.5
$3\Delta t$	0.75
T	1

i	$y_{f\,i}$	$p_i(y_{f\,i})$
1	$(0,\Delta t)$	0.875
2	$(\Delta t, 2\Delta t)$	0.625
3	$(2\Delta t, 3\Delta t)$	0.375
4	$(3\Delta t, T)$	0.125

j	$y_{f\,j}$	$q_j(y_{f\,j})$
1	$(0,\Delta t)$	0.125
2	$(\Delta t, 2\Delta t)$	0.375
3	$(2\Delta t, 3\Delta t)$	0.625
4	$(3\Delta t, T)$	0.875

$q_j(y_{f_j}) = c_{ij}\ p_i(y_{f\,i})\times$			
$c_{11} = 1$	$c_{12} = \frac{2.5}{2}$	$c_{13} = \frac{3}{2}$	$c_{14} = \frac{3.5}{2}$
$\frac{1.5}{2}\ c_{21} =$	$c_{22} = 1$	$c_{23} = \frac{2.5}{2}$	$c_{24} = \frac{3}{2}$
$\frac{1}{2}\ c_{31} =$	$c_{32} = \frac{1.5}{2}$	$c_{33} = 1$	$c_{34} = \frac{2.5}{2}$
$\frac{0.5}{2}\ c_{41} =$	$\frac{1}{2}\ c_{41} =$	$\frac{1.5}{2}\ c_{41} =$	$1\ c_{44} =$

λ	0.15
$\frac{\lambda}{2}$	0.075
$\frac{3\lambda}{2}$	0.225
$\frac{5\lambda}{2}$	0.375
$\frac{7\lambda}{2}$	0.525

$\frac{9\lambda}{2}$	0.675
$\frac{11\lambda}{2}$	0.825
$\frac{13\lambda}{2}$	0.975
$\frac{15\lambda}{2}$	1.125
$\frac{17\lambda}{2}$	1.275

Then all pairs of cells whose color A_i are A_i – connected, where $i = 3,4,8,9,10$, or in other side there is a single path of type $p(A_i)$ for all $i = 3,4,8,9,10$. Therefore the picture which is generated by $\overset{+}{E}(\Re, p_4, q_4)$ is a regular picture (see Figure 9).

violet $A_8 =$	brown $A_9 =$	black $A_{10} =$	black $A_{10} =$
green $A_6 =$	violet $A_8 =$	brown $A_9 =$	black $A_{10} =$
rose $A_4 =$	green $A_6 =$	violet $A_8 =$	brown $A_9 =$
orange $A_3 =$	rose $A_4 =$	green $A_6 =$	violet $A_8 =$

The following Pascal program represents the proposed method, and to simplification the program we assume that $A_1 = A, A_2 = B, A_3 = C, A_4 = D, A_5 = E, A_6 = F, A_7 = G, A_8 = H, A_9 = I, A_{10} = J$

$S_X(i) = S_X(i\Delta t) \Rightarrow S_X(0) = 1, S_X(1) = 0.75, S_X(2) = 0.5, S_X(3) = 0.25, S_X(4) = 0$

```
Program mm;
 type
   list=array[0..10] of real;
   table=array[1..10,1..10] of real;
   table1=array[1..10,1..10] of char;
 var
   m,n,i,j:integer;
   max,min,t,h:real;
   fx,fy,sx,sy:list;
   c:table;
   c1:table1;
 begin
   write('Enter n: ');
   readln(n);
   m:=10;
   writeln('Enter sx :');
   for i:=0 to n do
     begin
      write ('sx[',i,']:=');
      readln(sx[i]);
     end;
   j:=n;
   writeln('sy............');
   for i:=0 to n do
     begin
       sy[j]:=sx[i];
       j:=j-1;
     end;
   for j:=0 to n do
     writeln(sy[j]:6:2);
   readln;
   for j:=1 to n do
     fx[j]:=(sx[j]+sx[j-1])/2;
   for j:=1 to n do
     fy[j]:=(sy[j]+sy[j-1])/2;
   writeln('cij============================');
   for  j:=1 to n do
     begin
```

```
   for i:=1 to n do
     begin
       c[i,j]:=fx[i]+fy[j];
       writeln(c[i,j]:6:2);
     end;
   writeln;
 end;
readln;
max:=c[1,1];
min:=c[1,1];
for i :=1 to n do
  for j:=1 to n do
     begin
       if c[i,j]< min then
         min:=c[i,j];
       if c[i,j]> max then
         max:=c[i,j];
     end;
writeln('min= ',min:6:2,'     max= ',max:6:2);
h:=(max-min)/m;
writeln('h= ',h:6:2);
readln;
for i:=1 to n do
  begin
   for j:=1 to n do
     begin
       if ((c[i,j]<h/2)and (c[i,j]>=0))then
         c1[i,j]:='A'{A1}
        else if((c[i,j]<3*h/2)and(c[i,j]>=h/2))then
           c1[i,j]:='B'{A2}
         else if((c[i,j]<5*h/2)and(c[i,j]>=3*h/2))then
           c1[i,j]:='C'{A3}
           else if((c[i,j]<7*h/2)and(c[i,j]>=5*h/2))then
              c1[i,j]:='D'{A4}
             else if((c[i,j]<9*h/2)and(c[i,j]>=7*h/2))then
                c1[i,j]:='E'{A5}
               else if((c[i,j]<11*h/2)and(c[i,j]>=9*h/2))then
                  c1[i,j]:='F'{A6}
                 else if((c[i,j]<13*h/2)and(c[i,j]>=11*h/2))then
                    c1[i,j]:='G'{A7}
                   else if((c[i,j]<15*h/2)and(c[i,j]>=13*h/2))then
                      c1[i,j]:='H'{A8}
                        else if((c[i,j]<17*h/2)and(c[i,j]>=15*h/2))then
                          c1[i,j]:='I'{A9}
                       else
                          c1[i,j]:='J'{A10};
```

```
                    write ( c1[i,j],'   ');
        end;
        writeln;
  end;
  writeln ;
  readln;
  end.
```

-

-

H	I	J	J
F	H	I	J
D	F	H	I
C	D	F	H

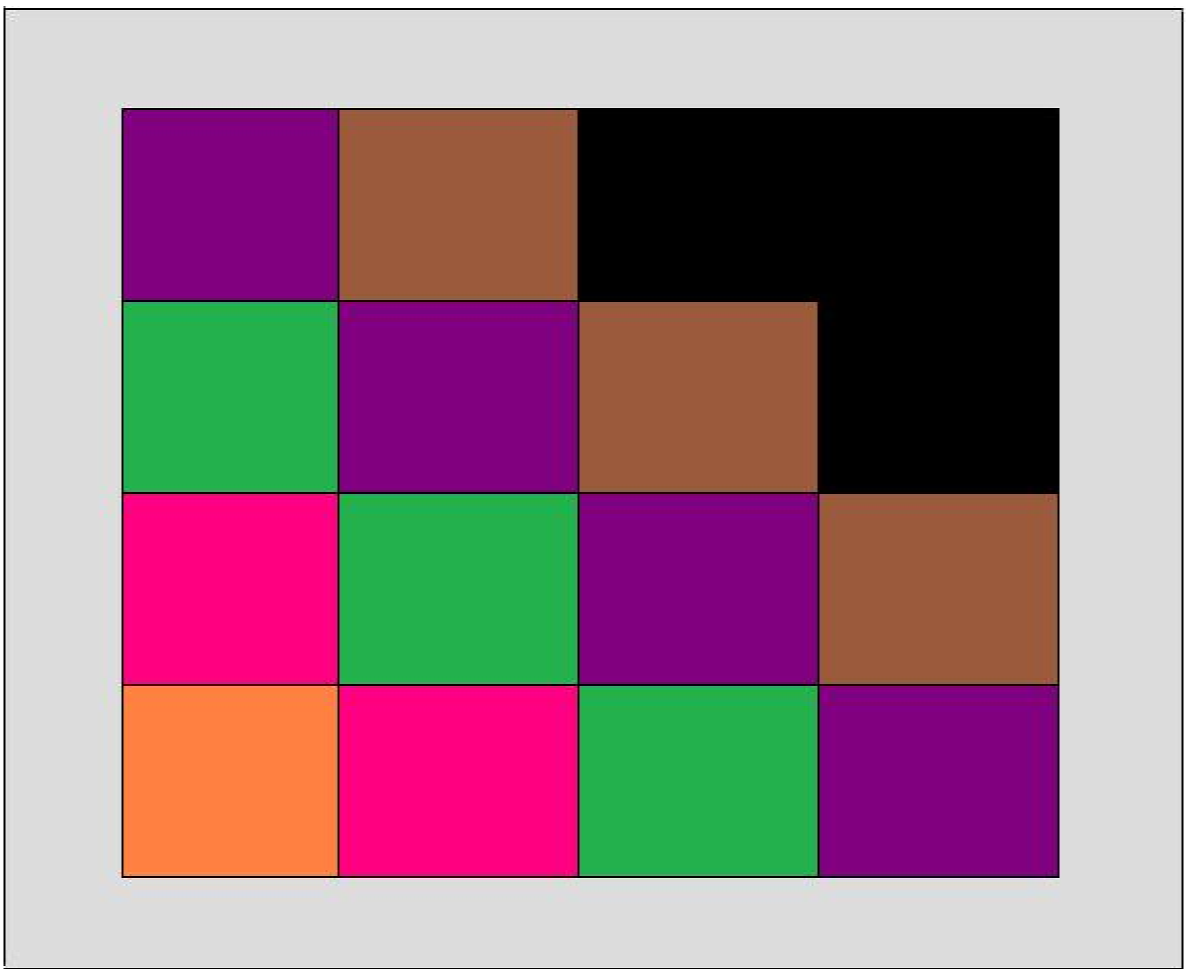


Figure (9)

3.13 Remark: If we increase the number of partitions n in above example from $n = 4$ to $n = 10$, where $p_i(y_f) = \dfrac{S_X(y_1) + S_X(y_2)}{2}$, $q_j(y_f) = \dfrac{S_y(y_1) + S_y(y_2)}{2}$, then the new considering picture contains (100) cells as follows:

G	G	I	F	D	F	G	F	H	F
H	H	J	H	E	H	H	G	I	H
F	F	H	F	C	F	F	E	G	F
H	H	J	G	E	G	H	F	H	G
G	G	I	F	D	F	G	F	H	F
E	E	G	D	B	D	E	C	E	D
G	G	I	F	D	F	G	F	H	F
J	J	J	I	G	I	J	H	J	I
H	H	J	G	E	G	H	F	H	G
H	H	J	G	E	G	H	F	H	G

Where the new considering picture is irregular, see figure (10).

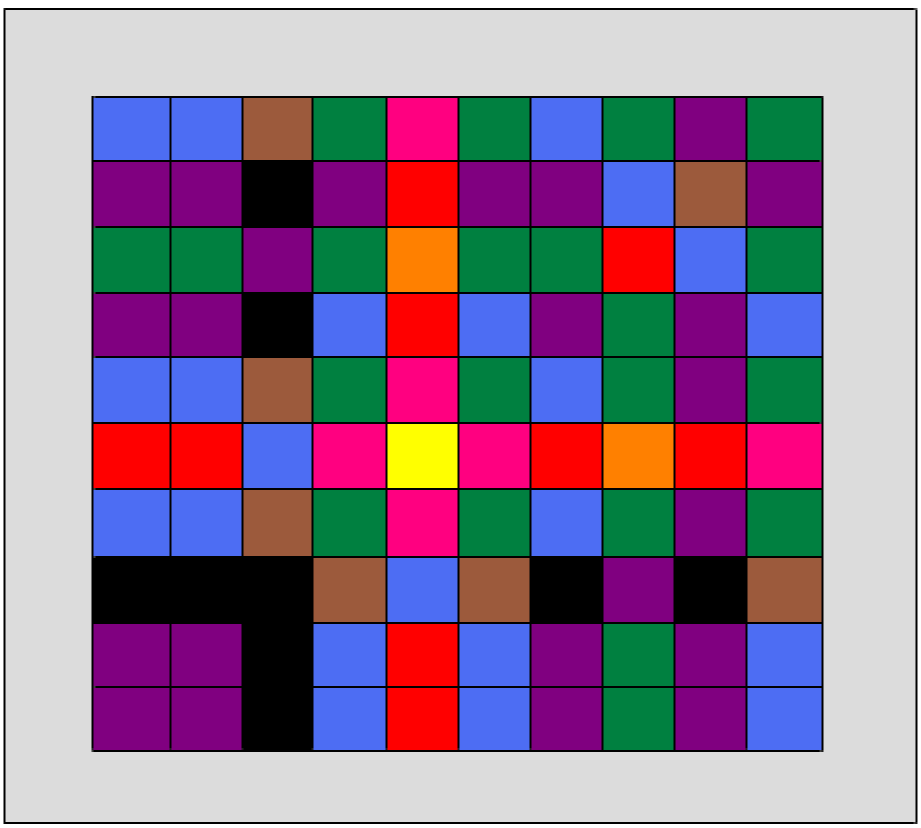


Figure (10)

Conclusion

The main interest of this work is to find a special tactic to study and understand some of the arising sounds for the nature and animals like birds and study the relation between these sounds and weather, where some of animals feel changing of the weather and disaster before they happened, thus their sounds waves will change as following the situation, therefore by using this new method many times them under the same effect matrix , if the similar picture is repeated for the same situation, then we can predict the situation before it happened when we get this similar picture. Moreover, we will understand and decode speech animals. Also, by this new method we can help and deal with mute persons.

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