Intensification and Colour Enhancing for chest X-ray Medical Images by Matlab Program

تكثيف وتحسين اللون لصور الأشعة السينية الصدرية الطبية بتطبيق برنامج الماتلاب

Kawther H. Al-khafaji
Kufa University/College of Education for girls/Physics Department\Image Processing
Kutherh.kafajy@uokufa.edu.iq

Abstract:-

chest X-ray images considered an important test to diagnosis a several of chest diseases, it's the most commonly requested examination in any radiology department in spite of various technological advances in the field of radiology, however explanation of chest X-ray image is a complex task is because this images is tending to noise , low contrast , blurring and unwanted information hindering the analysis of the real problems in chest human being structures, this complexities associated with X-ray images make it difficult to analyze them in an effective way. In this paper, we apply anew algorithm to enhance chest X-ray digital images and thus enhance the diagnosis of specific diseases through the application of a several operations including intensification of the basic features of the images, as well as color enhancement based on applying a number of experiment equations and change the values of the main coefficient for this equations , the medical image that has been conducting all operations onto belong to Hydatid Cysts Parasite diseases in lung . when we observed the resulting images we manifestly noting the Hydatid Cyst inside the right lobe of the lung patient in the upper part of which more clearly than is the case in the original image, and this is a good indicator of the success of the proposed algorithm to enhancing the diagnosis.

Keywords: X-ray, X-ray images, Hydatid Cysts, Medical Image Enhancement.

الخلاصة:-

تعتبر صور الأشعة السينية الصدرية اختباراً مهما لتشخيص العديد من الأمراض الصدرية ، حيث تمثل الفحص الأكثر طلبا عادة في أي قسم للأشعة على الرغم من تنوع التقدم التكنولوجي في مجال الطب الإشعاعي. غير أن شرح صورة الأشعة السينية الصدرية يعد مهمة معقدة وذلك لكون هذه الصور تميل إلى الضوضاء، انخفاض في التباين، الضبابية و احتوائها على المعلومات غير المرغوب فيها والتي تعيق تحليل المشاكل الحقيقية في بنية الصدر للانسان ، هذه التعقيدات المرتبطة بصور الأشعة السينية تجعل من الصعب تحليلها بطريقة فعالة.في هذا البحث قمنا بتطبيق خوارزمية جديدة لتحسين صور الأشعة السينية الصدرية الطبية وبالتالي تحسين تشخيص أمراض محددة من خلال تطبيق العديد من العمليات بما في ذلك تكثيف السمات الأساسية للصور، وكذلك تحسين اللون بالاعتماد على كل من تطبيق عدد من المعادلات التجريبية وتغيير قيم المعاملات الرئيسية لهذه المعادلات،الصورة الطبية التي تم أجراء كافة العمليات عليها تخص مرض الأكياس المائية المتواجد في الرئة. وعند ملاحظتنا للصور الناتجة يتبن لنا بوضوح رؤية الكيس المائي داخل الفص الأيمن لرئة المريض في الجزء العلوي منها بصورة أوضح بكثير مما هو في الصورة الأصلية، و يعد هذا مؤشرا جيدا لنجاح الخوارزمية المقترحة في تحسين التشخيص .

الكلمات المفتاحية:- الأشعة السينية،صور الأشعة السينية،الأكياس المائية،تحسين الصور الطبية.

2.System Overview

The diagnosis is the process of identifying a disease by its medical signs and symptoms and from the results of different procedures ,one of those procedures is X-ray radiography. There are difficulty in detect the Hydatid Cyst in X-ray images because of large variation in density , varying size and also there are some problems in visual diagnosis due to the fact the different between radiologist and another one, all those reasons lead to error in analyzing and detecting X-ray image. The aim of this work is to extracted maximum distinguish features from X-ray images by design of an optical detection system , which will help as to diagnosis the Hydatid cyst precisely.

2.1 Mathematical Analysis

A 2- D digital image of spatial size (M × N) pixels with M,N(rows, columns) may be represented by a function I(x,y) where (x, y) is the location of a pixels whose gray level values (or brightness) is given by the function I(x,y) with x = 1, 2,3,4 … , M ; y = 1, 2,3,4,... N.[4] for chest X-ray medical image, a digital image can be described by experimental equation(1) which is gives the general formula for image enhancement:-

$$I_E(x,y) = \begin{bmatrix} |2\pi\mathcal{F}I_z(x,y)| \\ |2\pi\mathcal{F}I_z(x,y) + \mathbb{N}P| \\ |2\pi\mathcal{F}I_z(x,y) + P| \end{bmatrix} \dots\dots\dots\dots (1)$$

Where, $I_E(x,y)$ is the Enhancing image (the output image).
$I_z(x,y)$ is the Processed image(the image before applying any equation on it).
$\mathcal{F}$ is the Frequency coefficient.
P is the Phase coefficient.
$\mathbb{N}$ is the Optional empirical coefficient.

2.2 Design And Implementation

To enhance the medical images we have proposed and developed this algorithm with the matlab functions for every step, The algorithm has following stages:-

Step1: Image Loading
The image loading is done using a X-ray medical image as an sample image where we used uigetfile function in this step.

Step2: Read X-ray Images
Reading the grayscale image, color image from the specifies files by the string filename where we used imread function.

Step3: Convert RGB Images
We applied the rgb2gray function to Converts the truecolor image RGB to grayscale image**.**

Step4: Intensity adjustment of images
To achieve this goal we have implemented various functions in this step, first we did applied the Max function to returns the largest elements along different dimensions of an image array. second we returns the double-precision value for image array by depending on double function. and all that lead to removed the Extra Black Space Around the Image.

Step5: Adjust image intensity value by imadjust function**.**

Step6:Convert The resulting image to double precision image.

Step7:Input Three Parameters
In this step we add three Important parameter in to the programs, the first one is the Frequency of the image and the second one is the Phase of the image, and we did give them an optional values for all of them.

Step8: Expression of the original image in terms of the Parameters
Here we are linking the original X-ray medical image by the experimental Parameters.

Step9: Implementation of the experimental equations on the images.
In this final step we did Apply several experimental equations on the chest X-ray medical images to enhance them.

2.3 The flow chart of Matlab program

figure(1) shows The basic algorithm stages:-

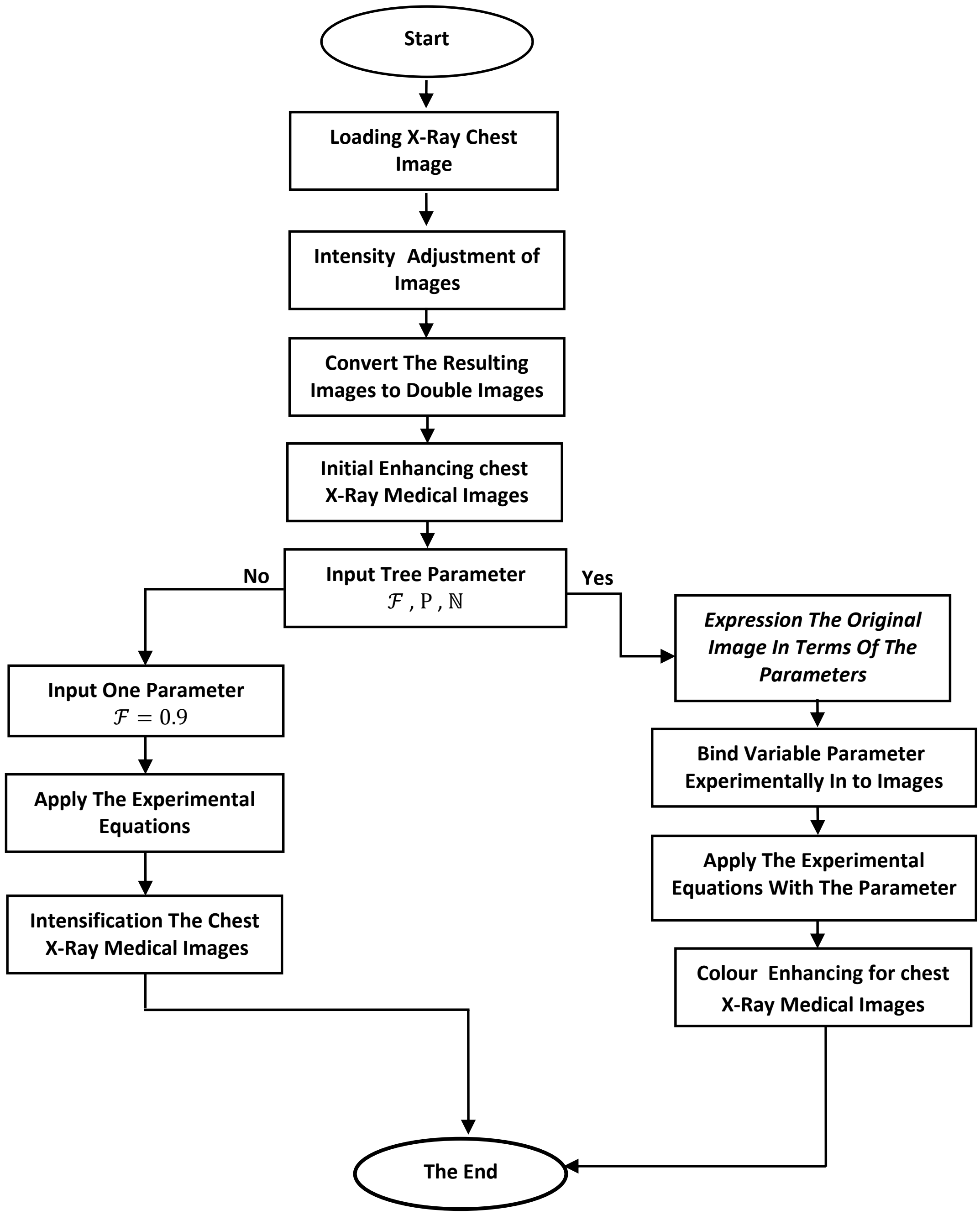


Figure.1 Flowchart of propose algorithm

3. Procedure Followed And Experimental Results

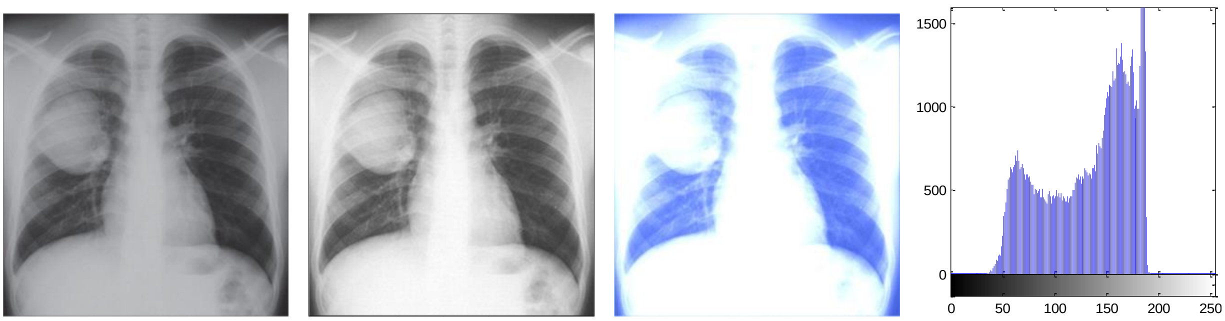
The medical images are visual in nature, hence, there are many different factors affects in human observers ,such as errors due to distractions ,exhausted and limited experience,….etc, [5] and in the same time there are medical images with poor contrast which are difficult or impossible to study and acquire information from. So we should look for new methods to enhance the quality of such images. therefore, we apply this algorithm for enhancing system to improve image quality for diagnosis and analysis chest X-ray images to assisting the radiologists to getting best diagnosis of Hydatid Cyst disease in lung of human body, the proposed algorithm include a number of applications in addition to the initial enhancement such as:-

1. Intensify of the basic features of the X-ray image in order to get the best diagnosis.
2. Colour enhance for chest X-ray image to facilitate the work of radiologists.

3.1 Initial Enhancing to Chest X-ray Medical Images

3.1.1 In this form of image enhancement we apply the four first stages of the specific algorithm, this stage is the basis on the rest of the other stages of enhancement, the resulting image it's shown in figure (2-(b)).

3.1.2 According to section 3.1,when we applying all step of the proposed algorithm represented by experimental equation (1),we found that the resulting image will be blue cyan pale colored, see figure(2-(c)),the difference between the results could be observed by seeing the original test image and the output image, note that the original image is gray level, In this set of tests the values of enhancing equation coefficient were taken as: $\mathcal{F}$ = 0.9, P =0.2, ℕ =0.5.



-a- -b- -c- -d-

Figure.2 (a) An original x-ray image,(b) The first Initial enhancing image,(c) The second enhancing image (d) An original image corresponding histogram.

3.2 Intensify Chest X-ray Medical Images

3.2.1 The proposed method revolve increase the intensity of X-ray image to increase in quality of visibility of small details in X-ray image, by applying the specific stages of algorithm in section 2.2 in order to reduce the defects and enhance the image visual comprehension, In this sub section, we create and execute a number of empirical equations derivative from the equation(1), we take the trigonometric functions (sine, cosine ,tangent, cotangent) of the part $(2\pi\mathcal{F}I_z(x,y))$ after exemption the both coefficients (P) and (ℕ) in main equation , as following:-

$$I_E(x,y) = \begin{bmatrix} |sin(2\pi\mathcal{F}I_z(x,y))| \\ |sin(2\pi\mathcal{F}I_z(x,y))| \\ |sin(2\pi\mathcal{F}I_z(x,y))| \end{bmatrix} \dots\dots\dots\dots (2)$$

$$I_E(x,y) = \begin{bmatrix} |cos(2\pi\mathcal{F}I_z(x,y))| \\ |cos(2\pi\mathcal{F}I_z(x,y))| \\ |cos(2\pi\mathcal{F}I_z(x,y))| \end{bmatrix} \dots\dots\dots\dots (3)$$

$$I_E(x,y) = \begin{bmatrix} |tan(2\pi\mathcal{F}I_z(x,y))| \\ |tan(2\pi\mathcal{F}I_z(x,y))| \\ |tan(2\pi\mathcal{F}I_z(x,y))| \end{bmatrix} \dots\dots\dots\dots (4)$$

$$I_E(x,y) = \begin{bmatrix} |cot(2\pi\mathcal{F}I_z(x,y))| \\ |cot(2\pi\mathcal{F}I_z(x,y))| \\ |cot(2\pi\mathcal{F}I_z(x,y))| \end{bmatrix} \dots\dots\dots\dots (5)$$

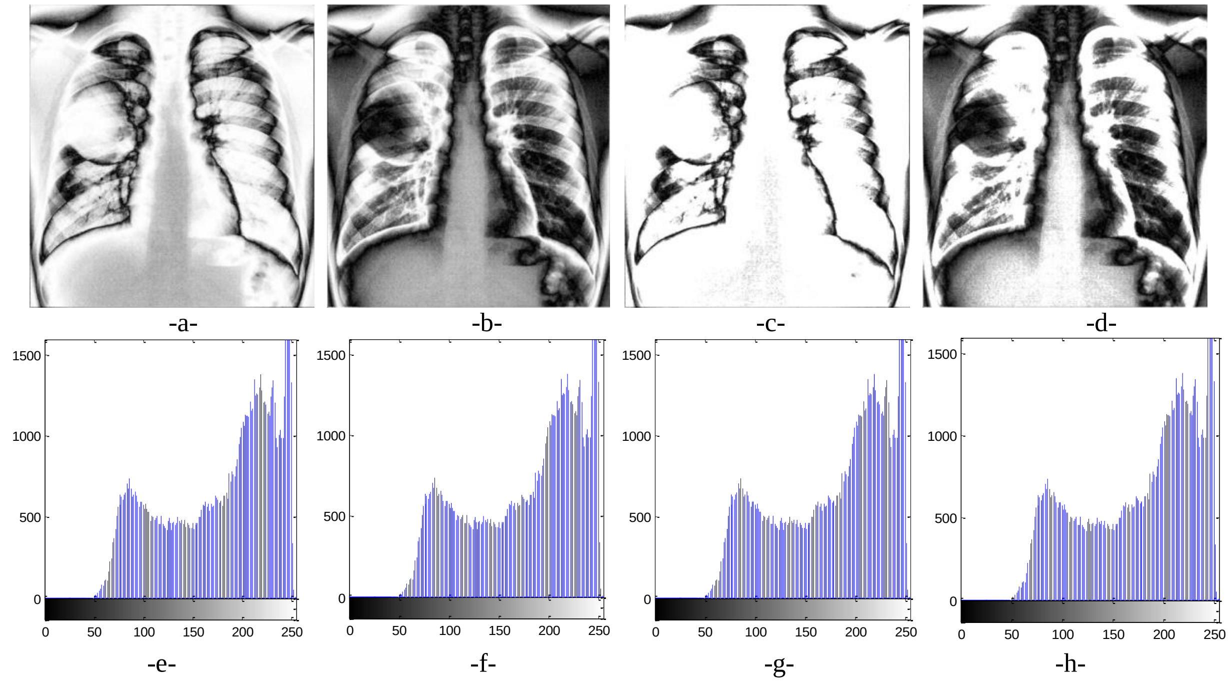
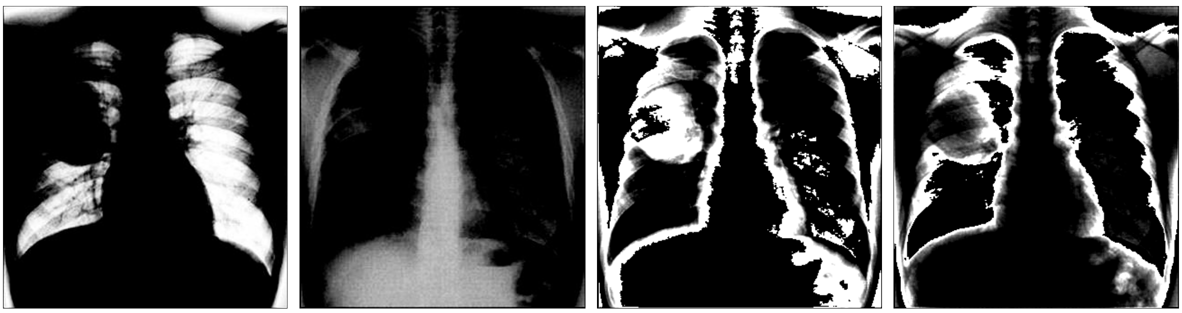


Figure.3 the output intensified image and its related histogram (a) intensified image by taking the sin function for the part ($2\pi\mathcal{F}I_z(x,y)$), (b) intensified image by taking the cosine function for the mentioned part, (c) intensified image by taking the tangent function for the same mentioned part, (d) intensified image by taking the cotangent function for the last mentioned part, (e) the related histogram of intensified image in (a), (f) the related histogram of intensified image in (b), (g) the related histogram of intensified image in (c), (h) the related histogram of intensified image in (d).

3.2.2 canceling the absolute value functions of the part ($2\pi\mathcal{F}I_z(x,y)$) in all set of a triple equations, and apply this procedure to each of the previous equations (2,3,4,5), the new modified equations and new output result image is as follows:-

$$I_E(x,y) = \begin{bmatrix} sin(2\pi\mathcal{F}I_z(x,y)) \\ sin(2\pi\mathcal{F}I_z(x,y)) \\ sin(2\pi\mathcal{F}I_z(x,y)) \end{bmatrix} \ldots\ldots (6) \qquad I_E(x,y) = \begin{bmatrix} cos(2\pi\mathcal{F}I_z(x,y)) \\ cos(2\pi\mathcal{F}I_z(x,y)) \\ cos(2\pi\mathcal{F}I_z(x,y)) \end{bmatrix} \ldots\ldots (7)$$

$$I_E(x,y) = \begin{bmatrix} tan(2\pi\mathcal{F}I_z(x,y)) \\ tan(2\pi\mathcal{F}I_z(x,y)) \\ tan(2\pi\mathcal{F}I_z(x,y)) \end{bmatrix} \ldots\ldots (8) \qquad I_E(x,y) = \begin{bmatrix} cot(2\pi\mathcal{F}I_z(x,y)) \\ cot(2\pi\mathcal{F}I_z(x,y)) \\ cot(2\pi\mathcal{F}I_z(x,y)) \end{bmatrix} \ldots\ldots (9)$$



-a- -b- -c- -d-

Figure.4 The Intensified chest x-ray images (a) intensified image by apply equations(6) ,(b) intensified image by apply equation (7), (c) intensified image by apply equation (8),(d) intensified image by apply equation (9).

3.3 Colour Enhancement to Chest X-ray Medical Images

In this kind of image enhancing we represents the right part $(2\pi\mathcal{F}I_z(x,y))$ for all of triple equations which is parts of the main equation(1) in terms of trigonometric functions(sine, cosine ,tangent, cotangent), we get a wide variety of practical results of enhanced image, see figure (5), these results are related to the new empirical equations those how are derivative from equation (1), hence , the values of enhancing equation coefficient was set as: $\mathcal{F}$ = 0.9, P =0.2, ℕ =0.5.

$$I_E(x,y) = \begin{bmatrix} |\sin(2\pi\mathcal{F}I_z(x,y))| \\ |\sin(2\pi\mathcal{F}I_z(x,y)+\mathbb{N}P)| \\ |\sin(2\pi\mathcal{F}I_z(x,y)+P)| \end{bmatrix} \dots (10) \qquad I_E(x,y) = \begin{bmatrix} |\cos(2\pi\mathcal{F}I_z(x,y))| \\ |\cos(2\pi\mathcal{F}I_z(x,y)+\mathbb{N}P)| \\ |\cos(2\pi\mathcal{F}I_z(x,y)+P)| \end{bmatrix} \dots (11)$$

$$I_E(x,y) = \begin{bmatrix} |\tan(2\pi\mathcal{F}I_z(x,y))| \\ |\tan(2\pi\mathcal{F}I_z(x,y)+\mathbb{N}P)| \\ |\tan(2\pi\mathcal{F}I_z(x,y)+P)| \end{bmatrix} \dots (12) \qquad I_E(x,y) = \begin{bmatrix} |\cot(2\pi\mathcal{F}I_z(x,y))| \\ |\cot(2\pi\mathcal{F}I_z(x,y)+\mathbb{N}P)| \\ |\cot(2\pi\mathcal{F}I_z(x,y)+P)| \end{bmatrix} \dots (13)$$

-a- -b- -c- -d-

Figure.5 An Colour Enhancing images (a) x-ray image colour enhancement by sin functions ,(b) x-ray image colour enhancement by cosine functions,(c) x-ray image colour enhancement by tangent functions,(d) x-ray image colour enhancement by cotangent functions.

Any change in the mathematical experimental equation values of coefficients will lead to getting a new results every time we changing the values of those coefficients, hence ,this procedure can be applied using any of the previous equations, but we used precisely the cosine function representing by equation (11), the results could be summarized by the following remarks:-

I. Changing the value of the coefficient (P) within the range (0.3→1.8) and at the same time leave the coefficient ($\mathcal{F}$) and coefficient (ℕ) without change where takes those coefficients the value (0.9) and (0.5) respectively, figure(6) shows the effect of this kind of change in output images.

Table(1) The contrast values of (P) coefficients

coefficients	a	b	c	d	e	f	g	h	I	J	k	l
$\mathcal{F}$	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
ℕ	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
P	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.2	1.4	1.6	1.8

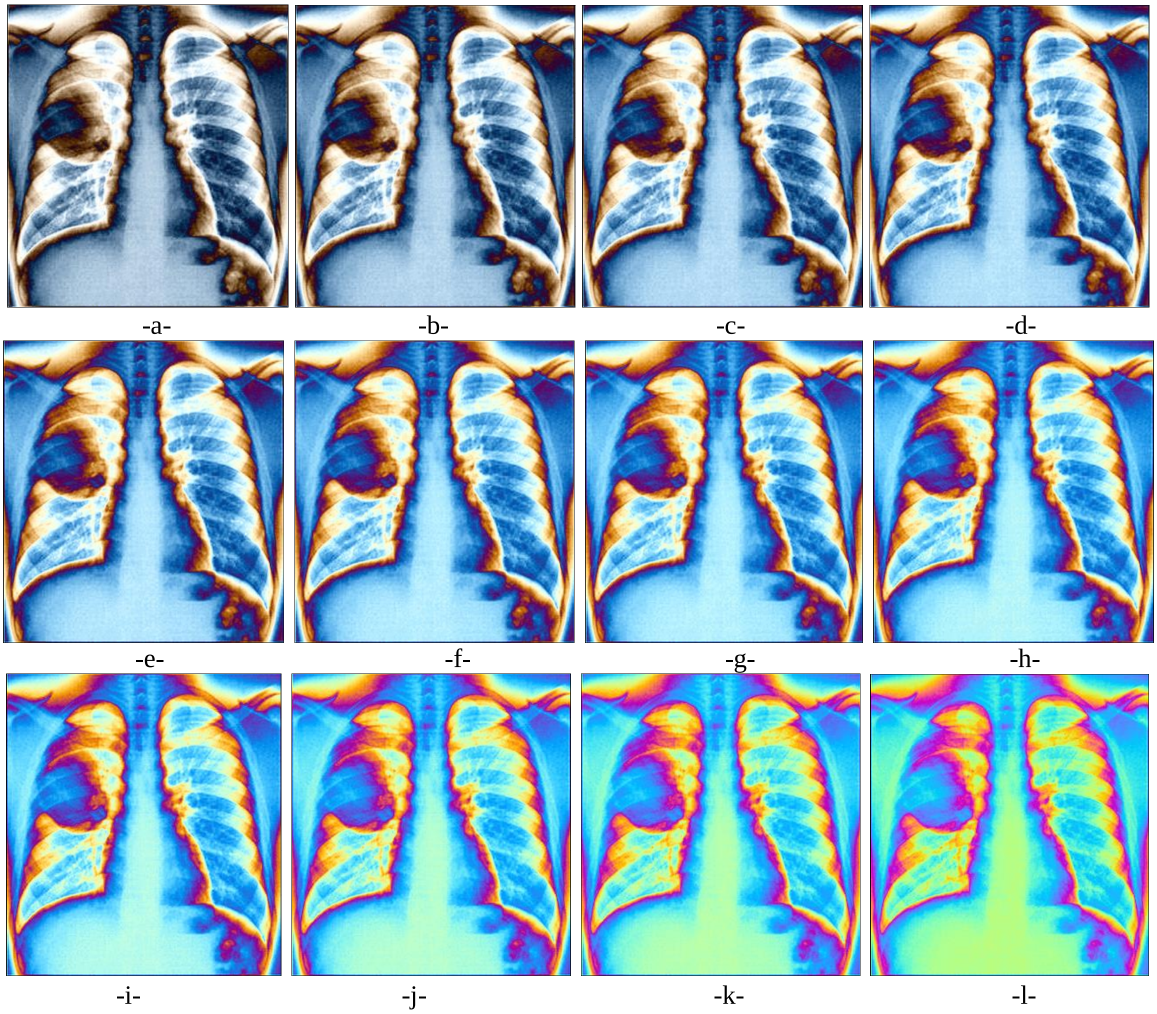


Figure.6 The colour Enhancing image with different P value (a) output image when P=0.3, (b) output image when P=0.4, (c) output image when P=0.5, (d) output image when P=0.6, (e) output image when P=0.7, (f) output image when P=0.8, (g) output image when P=0.9, (h) output image when P=1(i) output image when P=1.2, (j) output image when P=1.4, (k) output image when P=1.6, (l) output image when P=1.8.

II. change the value of the coefficient ($\mathcal{F}$) to takes a set of values extending within the range (0.2→1.7) and at the same time leave the coefficient value (P) and coefficient ($\mathbb{N}$) without changing where those coefficients takes the value (0.2) and (0.5) respectively, lead to getting a different result with every change as shown in figure(7) which indicates a set of enhanced images.

Table(2) The contrast values of ($\mathcal{F}$) coefficients

coefficients	a	b	c	d	e	f	g	h	I	J	k	l	m	n	o
$\mathcal{F}$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.2	1.3	1.4	1.5	1.6	1.7
$\mathbb{N}$	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
P	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

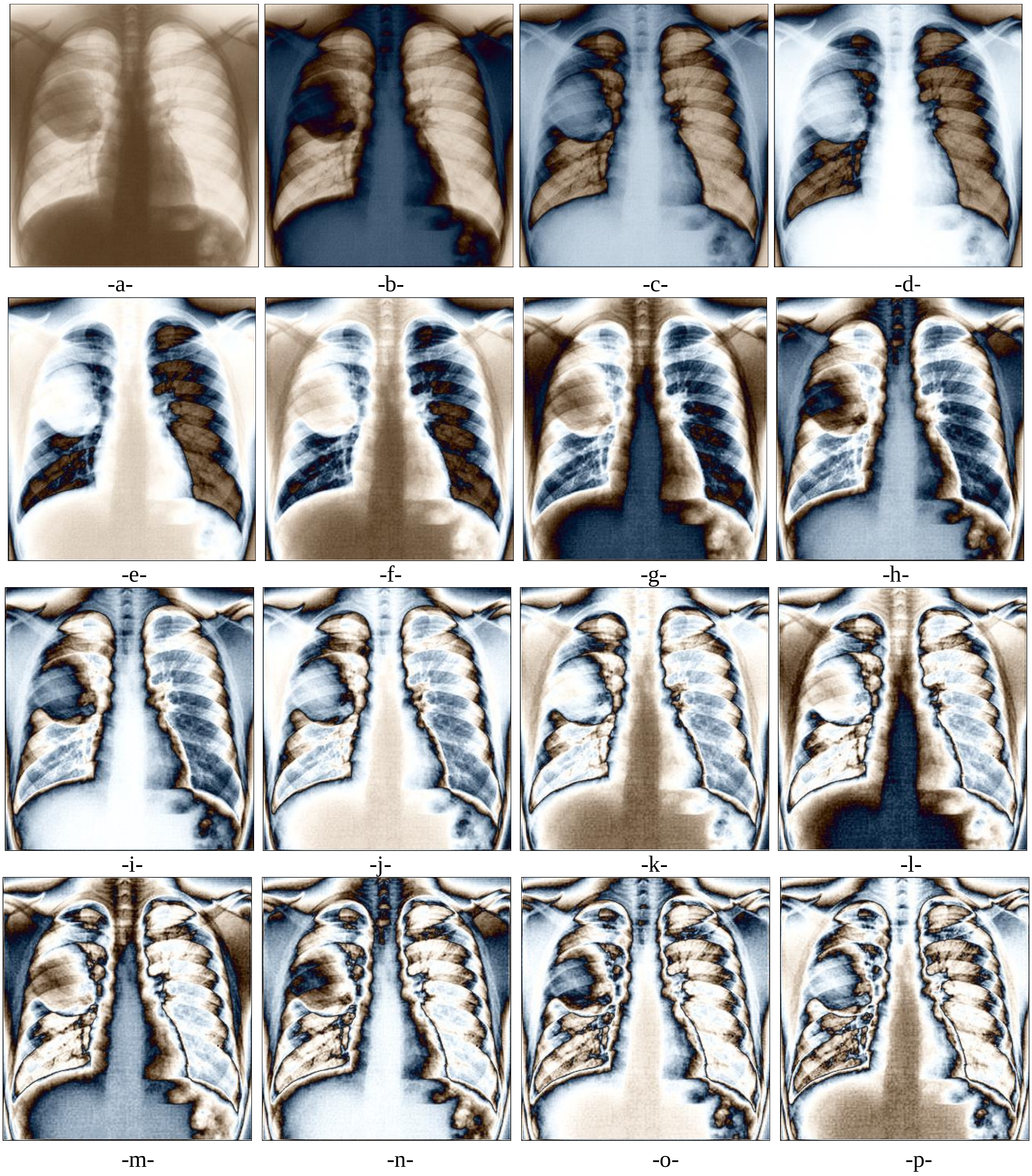


Figure.7 The colour Enhancing image with different $\mathcal{F}$ value (a) output image when $\mathcal{F}$=0.2, (b) output image when $\mathcal{F}$=0.3, (c) output image when $\mathcal{F}$=0.4, (d) output image when $\mathcal{F}$=0.5, (e) output image when $\mathcal{F}$=0.6, (f) output image when $\mathcal{F}$=0.7, (g) output image when $\mathcal{F}$=0.8, (h) output image when $\mathcal{F}$=0.9, (i) output image when $\mathcal{F}$=1, (j) output image when $\mathcal{F}$=1.1, (k) output image when $\mathcal{F}$=1.2, (l) output image when $\mathcal{F}$=1.3, (m) output image when $\mathcal{F}$=1.4, (n) output image when $\mathcal{F}$=1.5, (o) output image when $\mathcal{F}$=1.6, (p) output image when $\mathcal{F}$=1.7.

III. Changing the values of both coefficients ($\mathcal{F}$) and (P) to take the range of values ($\mathcal{F}$=1→2.4) and (P=0.4→1.8) and in the same time leave the value of coefficient ($\mathbb{N}$=0.5) unchanged that lead to get other results as shown in figure(8).

Table(3) The contrast values of ($\mathcal{F}$) and (P) coefficients

coefficients	a	b	c	d	e	f	g	h
$\mathcal{F}$	1	1.2	1.4	1.6	1.8	2	2.2	2.4
$\mathbb{N}$	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
P	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8

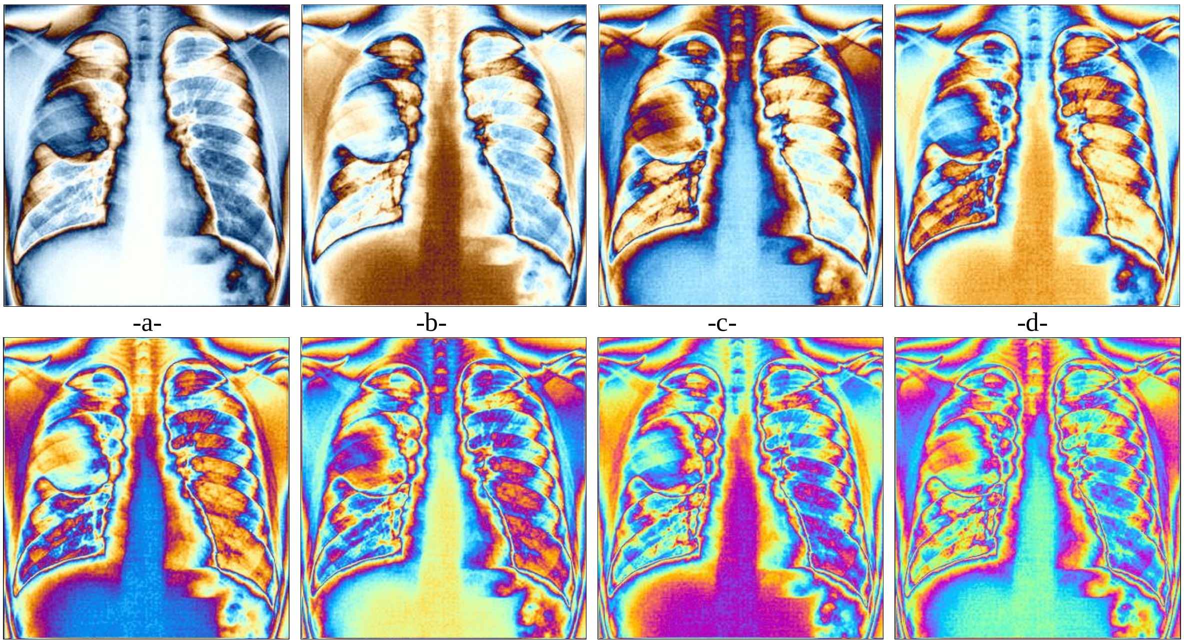


Figure.8 The colour Enhancing image with different P, $\mathcal{F}$ values (a) output image when P=0.4, $\mathcal{F}$=1 (b) output image when P=0.6, $\mathcal{F}$=1.2 (c) output image when P=0.8, $\mathcal{F}$=1.4 (d) output image when P=1, $\mathcal{F}$ =1.6. (e) output image when P=1.2, $\mathcal{F}$ =1.8 (f) output image when P=1.4, $\mathcal{F}$ =2, (g) output image when P=1.6, $\mathcal{F}$ =2.2, (h) output image when P=1.8, $\mathcal{F}$ =2.4

IV. Figure(9) show the effects of changing the values of coefficient ($\mathbb{N}$) on chest X-ray images, Where, the coefficient ($\mathbb{N}$) take the range of the values from(0.1→4.5) and in the same time leave the values of coefficients (P) and ($\mathcal{F}$) unchanged, means that (0.2) and (0.9) respectively ,that lead to get the other of results as follows.

Table(4) The contrast values of ($\mathbb{N}$) coefficients

coefficients	a	b	c	d	e	f	g	h	I	J	k	l	m	n	o	p
$\mathcal{F}$	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
$\mathbb{N}$	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1	1.5	2	2.5	3	3.5	4	4.5
P	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Figure.9 The colour Enhancing image with different ℕ value (a) output image when ℕ=0.1 (b) output image when ℕ=0.2 (c) output image when ℕ=0.3 (d) output image when ℕ=0.4, (e) output image when ℕ=0.6, (f) output image when ℕ=0.7, (g) output image when ℕ=0.8, (h) output image when ℕ=0.9, (i) output image when ℕ=1, (j) output image when ℕ=1.5, (k) output image when ℕ=2, (l) output image when ℕ=2.5, (m) output image when ℕ=3, (n) output image when ℕ=3.5, (o) output image when ℕ=4, (p) output image when ℕ=4.5.

V. Changing the values of both coefficients ($\mathcal{F}$) and ($\mathbb{N}$) to takes a different set of values and at the same time leave the coefficient value (P) without changing where takes the value (0.2), lead to getting a different result with every change as shown in figure(10) which indicates a set of enhanced images.

Table(5) The contrast values of ($\mathcal{F}$) and ($\mathbb{N}$) coefficients

coefficients	a	b	c	d	e	f	g	h	I	J	k	l
$\mathcal{F}$	0.5	0.7	0.8	0.9	1	1.5	2	1	1.2	1.4	1.5	1.6
$\mathbb{N}$	0.5	0.7	0.8	0.9	1	1.5	2	0.5	0.6	0.8	1	1.2
P	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

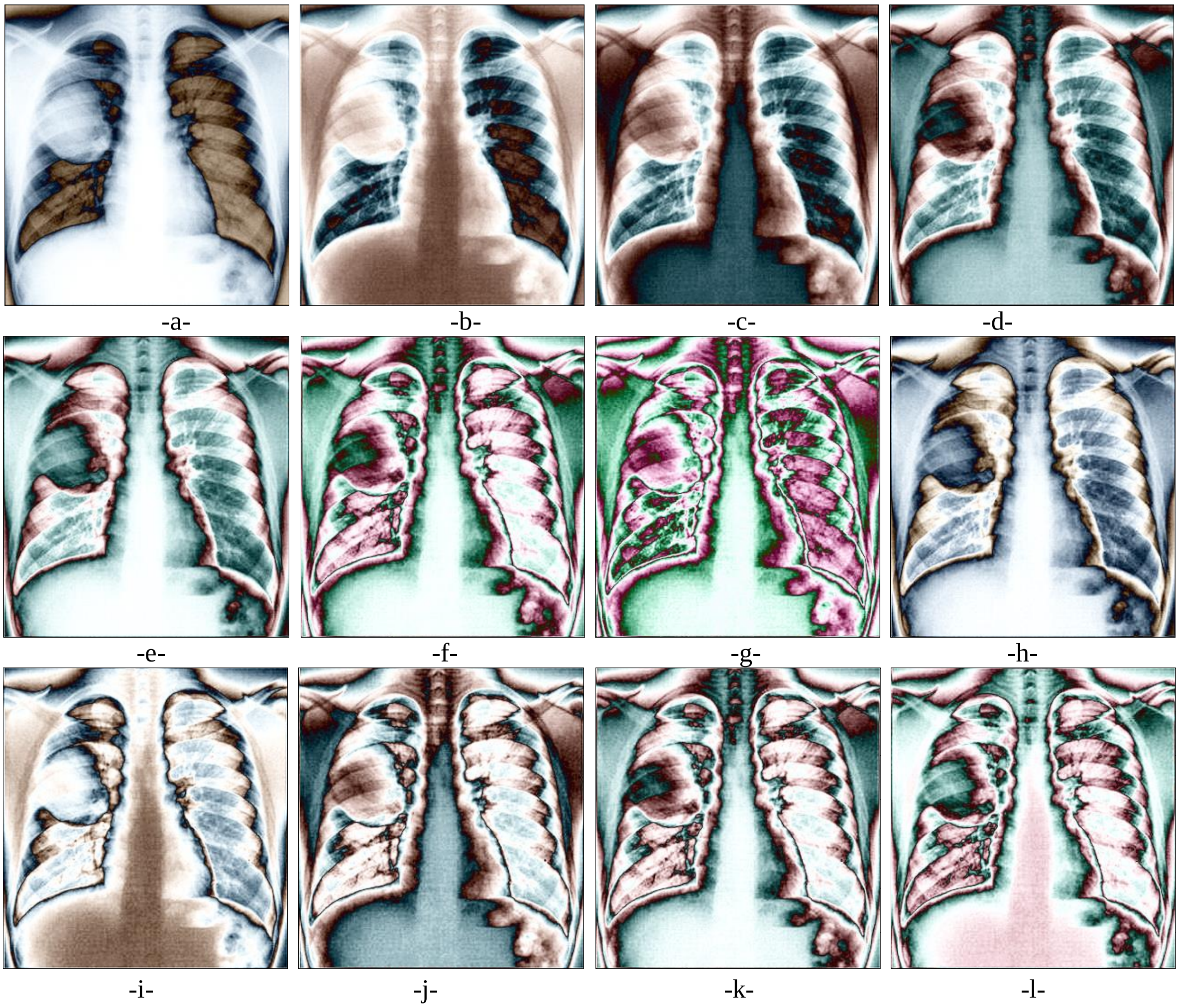


Figure.10 The colour Enhancing image with different $\mathcal{F}$, $\mathbb{N}$ value (a) output image when $\mathcal{F}$ =0.5,$\mathbb{N}$=0.5 (b) output image when $\mathcal{F}$ =0.7, $\mathbb{N}$=0.7 (c) output image when $\mathcal{F}$ =0.8, $\mathbb{N}$=0.8 (d) output image when $\mathcal{F}$ =0.9, $\mathbb{N}$=0.9 , (e) output image when $\mathcal{F}$ =1, $\mathbb{N}$=1 , (f) output image when $\mathcal{F}$ =1.5, $\mathbb{N}$=1.5 , (g) output image when $\mathcal{F}$ =2, $\mathbb{N}$=2 , (h) output image when $\mathcal{F}$ =1, $\mathbb{N}$=0.5 , (i) output image when $\mathcal{F}$ =1.2, $\mathbb{N}$=0.6 , (j) output image when $\mathcal{F}$ =1.4,$\mathbb{N}$=0.8 , (k) output image when $\mathcal{F}$ =1.5, $\mathbb{N}$=1 , (l) output image when $\mathcal{F}$ =1.6, $\mathbb{N}$=1.2.

VI. Changing the values of both coefficients (P) and (ℕ) to takes a different set of values and at the same time leave the coefficient value ($\mathcal{F}$) without changing where takes the value (0.9), lead to getting a different result with every change, as shown in figure(11) .

Table(6) The contrast values of (P) and (ℕ) coefficients

coefficients	a	b	c	d	e	f	g	h
$\mathcal{F}$	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6
ℕ	0.5	1	1.5	2	2.5	3	3.5	4

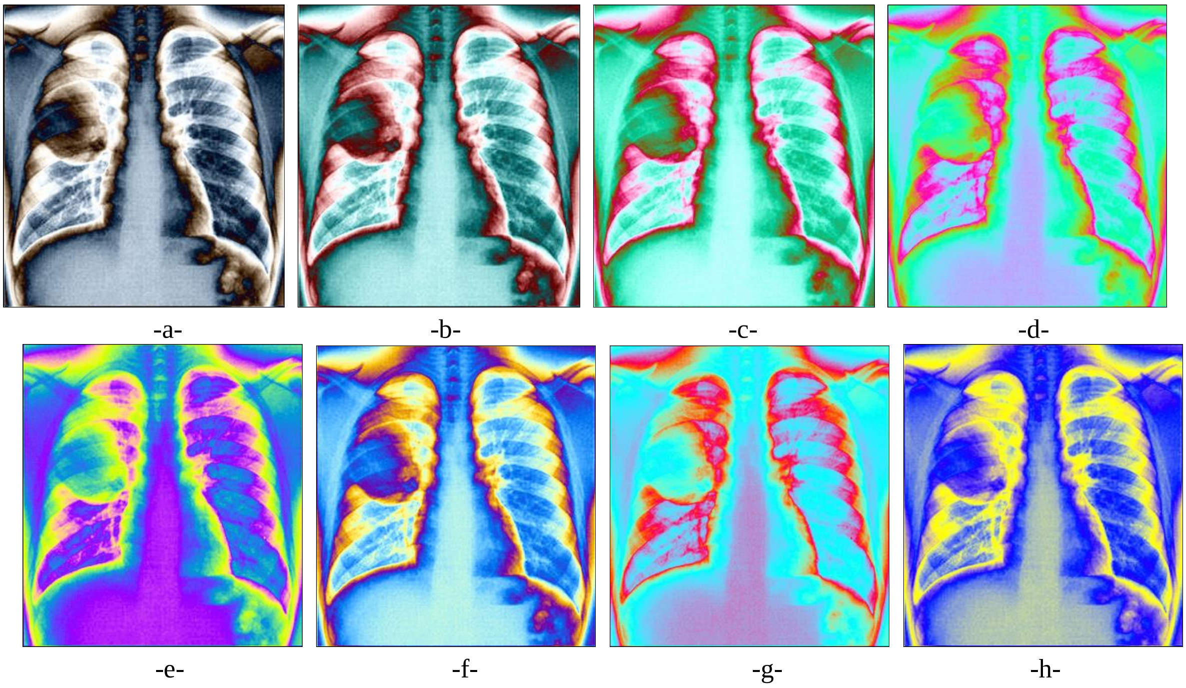
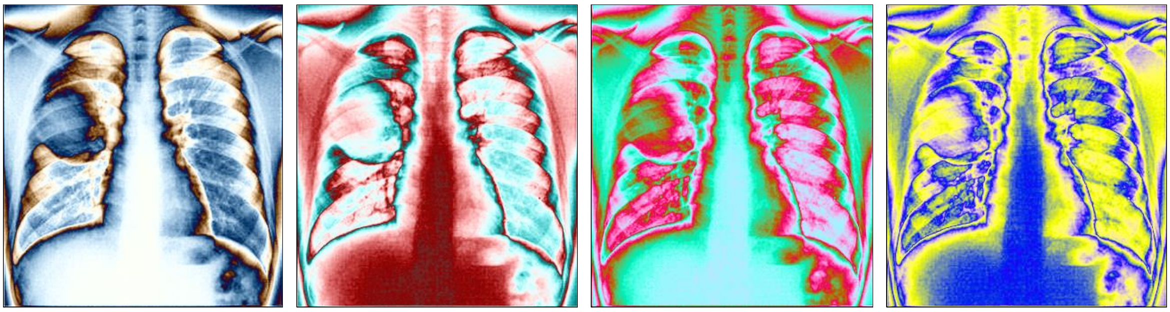


Figure.11 The colour Enhancing image with different (P) and (ℕ) values, (a) output image when, P=0.2, ℕ=0.5(b) output image when P=0.4,ℕ=1 (c) output image when P=0.6 ,ℕ=1.5,(d) output image when P=0.8 ,ℕ=2(e) output image when P=1 ,ℕ=2.5 , (f) output image when P=1.2 ,ℕ=3 , (g) output image when P=1.4 ,ℕ=3.5, (h) output image when P=1.6 ,ℕ=4.

VII. We can see from Figure (12) a set of enhanced images that obtained from changing the values of all coefficients of equation (11) ,in other words change the values of ($\mathcal{F}$) and (P) and (ℕ) together at the same time, the following table show this : -

Table(7) The contrast values of ($\mathcal{F}$) and (P) and (ℕ) coefficients

coefficients	a	b	c	d
$\mathcal{F}$	1	1.2	1.4	1.8
P	0.4	0.6	0.8	1.2
ℕ	0.5	1	1.5	2.5



-a- -b- -c- -d-

Figure.12 The colour Enhancing image with different ($\mathcal{F}$) , (P) and (ℕ) values, (a) output image when $\mathcal{F}$=1, P=0.4, ℕ=0.5(b) output image when $\mathcal{F}$=1.2, P=0.6 ,ℕ=1 (c) output image when $\mathcal{F}$=1.4, P=0.8 ,ℕ=1.5(d) output image when $\mathcal{F}$=1.8, P=1.2 ,ℕ=2.5 .

4. Discussion

The above listed results indicate the following observations:-

1. From the figure(2-b)we see there is approach between an initial enhanced image and an original image but its color is slightly fainter. We clarify from figure(2-c) that the color of the second enhanced image is blue cyan pale but the Hydatid Cysts seems almost clearly defined. cannot see it clearly
2. Using intensify technique that are listed in section 3.2, cause to be the resulting image has become a three-dimensional image, as we note of the set of images in figure(3), those resulting from application of each of the equations (2, 3, 4 and 5), where the ribs have become more prominent as well as in the spine, even the pelvic area, and more importantly the Hydatid Cysts(the affected area) seems almost clearly defined, in another meaning images features become more prominent. with the assurance that the colors of all resulting images were within shades of gray .
3. The abolition of the absolute value function for each of the equations (2, 3, 4 and 5) leads to get different results from previous results, where the two colors white and black overshadow on the image , or white mixed with shades of gray , or black mixed with shades of gray, as is evident from the figure (4-a,c,d) where we see the Hydatid cyst and the resulting image darker, but in figure (4-b) did not see a clear features of the Hydatid cyst in the lung. note the color of the Hydatid cyst it is change with changing of the trigonometric function that implemented.
4. The output images which generated as a result of represented the right part ($2\pi\mathcal{F}I_z(x,y)$) in equation(1) by one of trigonometric functions those images acquire an distinctive colors in addition to the three-dimensional appearance, the colors ranging from brown, light leaden ,blue and pale blue and pale beige, or mixing between all those colors, and those colors that the images discoloration by it make the differentiation of human organ observer pushover, where we find that the rib cage of ribs including its content has become more noticeable. The organs stand out in the human chest area followed by trigonometric function used, as in the case of sine, tangent

functions, we find that the apparent organ is the backbone ,but in the case of the application of the cosine, cotangent functions, we find that the rib cage is the apparent organ, In all these images we can clearly distinguish the Hydatid cyst depending on the colors.

5. When we change the values of mathematical experimental coefficients of the main equation, we found there is changing in the colors spectrum to the Enhanced resulting image. In other words, change the values of those coefficients meant to acquire a different color image with each new value of these transactions. This can be seen easily through a series of images resulting from the change either one of those coefficients as in the case of change P, $\mathcal{F}$, ℕ coefficients as indicated in the points (I) and (II) and (IV),or change two coefficients in one time as ($\mathcal{F}$) and (P) ,($\mathcal{F}$) and (ℕ),(P) and (ℕ) coefficients as indicated in the points (III), (V) and (VI), or changing the values of all coefficients (P, $\mathcal{F}$, ℕ) as indicated in the points (VII).the effects of changing the values of mathematical experimental coefficients on enhancing images could be discussed by the following point:-

a) changing the coefficients values (P) and keeping coefficient (ℕ) and coefficient ($\mathcal{F}$) unchanged(fixed), this procedure has very few impact on the resulting image, sift through figure(6) we see that there is a relative similarity in the colors of a produced images series (a,b,c,d) as well as in the group of images series(e,f,g,h) and(I, j,k,l).
b) Greater impact signify when we change the value of the coefficient ($\mathcal{F}$) and it can be seen clearly through the sequence of image contained in figure(7).
c) Changing the coefficients values (ℕ) and leave the coefficient (P) and coefficient ($\mathcal{F}$) without change, we found there is little effect on the resulting image, from figure(9) we see there is a convergence in the color in the resulting images series (a,b,c,d) ,images (e,f,g,h,i) ,images (j,k,l) and images (m,n,o,p).
d) Different images composed through changing the values of both coefficients ($\mathcal{F}$) and (P), ($\mathcal{F}$) and (ℕ) , (P) and (ℕ) as shown in figure(8), figure(10) and figure(11) respectively.
e) Changing the values of ($\mathcal{F}$) and (P) and (ℕ) together at the same time lead to completely different images than images that followed, the advantage of these images is high quality as well as the broad spectrum of colors, which is different for another image as shown in Figure(12).

5. Conclusion

The main objective of image enhancement is to appear the hidden details in the images and increase a contrast in a low contrast images, since tiny details play a critical role in diagnostic procedures, because some features are hardly detectable by eye. So, we often improve images before display them, it is fundamental to focus attention on features that are important when we exhibiting the medical image ,therefore ,in this paper, anew algorithm to enhance X-ray medical image quality for diagnosis has been proposed, where the enhancement process includes the subsequent operations:- image intensification which means intensification of the basic features of the image, color enhancing and finally image coloring. different enhancement coefficients in different enhancing equation, In addition to that, different values of those coefficients are applied to one specific X-ray image belong to a patient with Hydatid Cysts disease in lung. In each of these processes has been obtained an excellent results in the diagnosis of the presence of Hydatid Cysts which gives to the radiologist an extra advantage for better perception and understanding for X-ray images, Further, it has been conclude that the proposed algorithm gave as splendid results in extraction Hydatid Cysts domain. Results of experiments show that the algorithm not only can extraction the Hydatid Cysts domain in chest X-ray image, but also gave the appearance of a three-dimensional to the image effectively.

6. Future Scope

Future work in this domain may include applying this algorithm and adjusting and adapting the basic experimental equations to accommodate all types of medical images, such as CT scan images, MRI images, Molecular Imaging, Ultrasound Imaging.

7. References

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