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Blood Cells Images- Based on Chaos Theory

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Abstract: The fractal functions are considered a good choice to represent natural tissue surfaces. Which were chosen because of the importance of short period characteristics of classifying images since the fractal dimension of a surface has an approximation of complete relation with surface toughness. Therefore, the idea of using a new group of fractal characteristics is utilized to differentiate medical images. This work demonstrates the technique of using chaos theory and principles of fractal engineering in the processes of describing and differentiating medical images of red blood cells and while blood cells. A group consisted of two fractal characteristics, which are the fractal dimension, and the Lacunarity are developed to describe and differentiate medical images. An alternative method of box counting and mass radius is implemented to calculate those two fractal characteristics of images surface Furthermore, an instructional program designed by using PowerPoint and includes three instructional modules depending on system? approach knowledge based of using chaos theory and fractal engineering m the medical applications.

Key words: Cells images, fractal geometry, van koch curve, elay and gerlach model

INTRODUCTION

Fractal geometry and Chaos theory provide us with a new perspective lo view the world. For centuries we have used the line as a basic building block lo understand the objects around us. Chaos science uses a different geometry called Fractal geometry. Fractal geometry is a new language used to describe, model and analyze complex forms found in nature. Fractal provide a different way of observing and modeling complex phenomena than Euclidean Geometry or the calculus developed by Leibniz and Newton also the biologists diagnose dynamical diseases and others (Andwer, 1998). Fractal and Chaos modeling is applied in different Held, Target recognition, Remote sensing (Chang, *et al*, 1992). Used for describing the data in biology and physical science, medical image through out fractal dimension of bones. Retina vessels Diseases of lungs and concur. It is found that the Recognition by the fractal dimension is effective over other methods (Gabber, 2001), The exactly self-similar objects such as Mandelbrot set or Van Koch curve differ from the statistical self-similar objects like The coastline in one significant aspect. Upon magnification, segment of the coastline look like, but never exactly like segments at different scales. The concept of fractal dimension, however, can also be applied to such statistically self-similar objects- Each small section of a coastline looks like (but not exactly like) a larger portion. When using a ruler of size r to measure a coastline's length, the total length equals the ruler size (r) times the number {N (r)} of steps of size r taken in tracing the coast (Jonescu, 2003).

$$\text{Length}=r*N® \quad (1)$$

The properly that objects can lake statistically self-similarity while at some time different in details at different length scales is the central feature of fractals in nature . Under an affine transform, on the other hand, each of (he E-coordinates of X may be sealed by a different ratio (r_1,r_2, r_3,....., r_E). Similarly, S is transformed to r (S) with points at (r_1x_1, r_2x_2,....., r_Ex_E)

Abounded set S is self -affine when S is the union of N distinct subset each of which is similar in distribution to r(s) . The fractal dimension D, however is not easily defined as with self-similarity, now we can summarize some of the main features of fractals:

- They have a fine structure; which mean? that, they contain details at arbitrarily small scales. The more we enlarge, for example, the picture of the Mandelbrot set, the more details became apparent to the eyes.
- They are too irregular to be described in traditional geometrical language, both locally and globally.
- Often, they have form of self-similarity, perhaps approximate or statistical.
- Usually, their fractal dimensions are greater than their topological dimensions.
- In most cases of interest, they are defined in a very simple way, perhaps recursively . For example one construction of Mandelbrot set consisted of repeatedly adding the square of the complex number. Successive steps give increasingly good approximations to the final Mandelbrot set.
- Although they are in some ways quite large set (they are uncountable infinite), their size are not quantified

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by the usual measures such as length or area or volume as in the traditional Euclidean shape,

- Although they have an intricate detailed structure, the actual definitions of them are very straightforward.
- Method of classical geometry and calculus are not suited for Studying fractals and thus we need alternative techniques, the main tool of fractal geometry is the fractal dimension.

MATERIALS AND METHODS

Testing Models: there are several models are used for medical images, blood testing as follows :

- Box counting model (Kadham , 2002),
- Mass-radius method (Macculary, Candpaki, c, 1990).
- Petrosian's Algorithm Model (Mana, 2004),
- Lacunarity and Texture Measures Models (Nonnenmacher, *et al*., 1994; Penn, 2004; Saban, 2004 and Snenber, *et al*., 2000).
- Ely and Gerlach model (Xia and Gaow , 1996).

Instructional Design: Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the entire process of analysis of learning needs and goals development of instructional materials and activities; and tryout and evaluation and the development of a delivery system to meet those needs. R

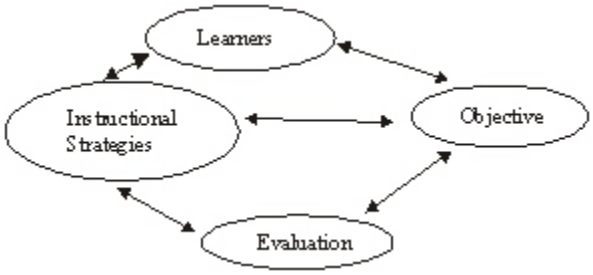


Fig. 1: shows component of instructional design process.

includes of all Instruction and learner activities (Wielgus, *et al*., 2000) (Fig. 1).

Ely and Gerlach model: The Ely and Gerlach model is an attempt to portray graphically a method of systematically planning instruction. Incorporated in this model are two items; the necessity of carefully defined goals and the tactics on how to reach each goal. Both parts are absolutely essential for effective teaching (Xia and Gaow, 1996), Fig. 2. this method at present work has been adapted for blood cells testing.

Research Procedures: The researchers have determined the information specified of the used images (RBC\

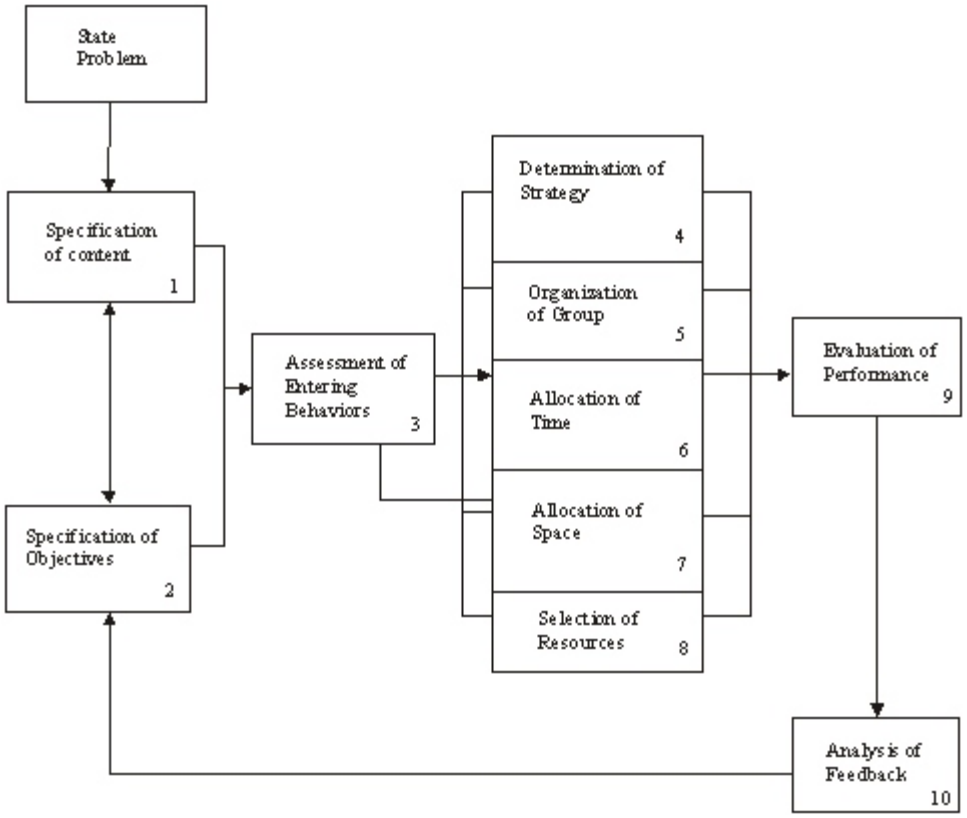


Fig. 2: Shows Ely £& Gerlach model

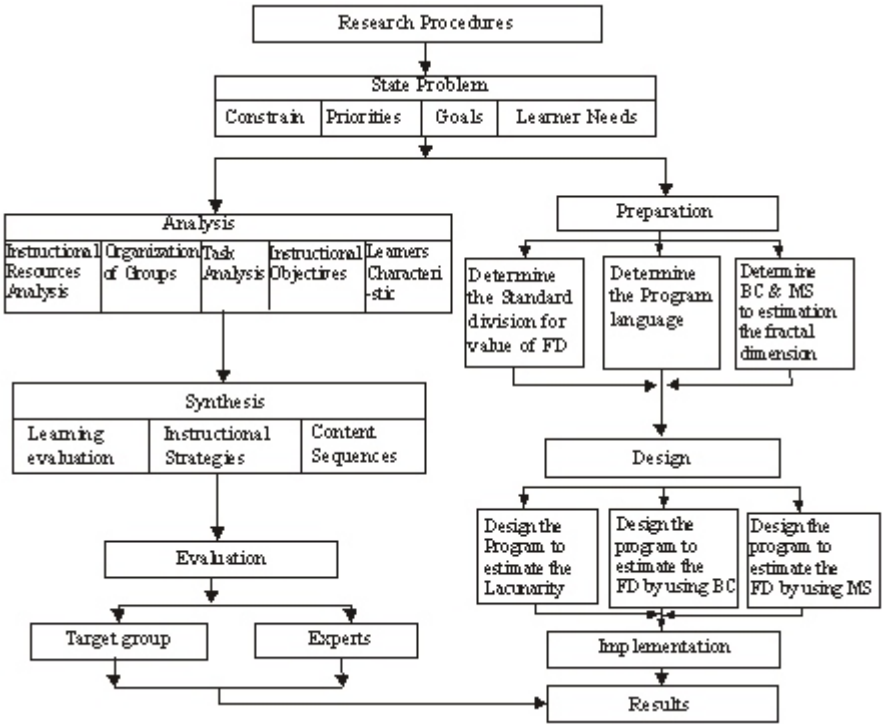


Fig. 3: shown the flowchart of research procedures

Table 1: Mean value? of fractal dimension using box counling method.mass radius method of used RBC\ WBC for (L^^O) and ®^^).

Number of Image	RBC infected image Fractal dimension (D)		RBC uninfected image Fractal dimension (D)		WBC infected image Fractal dimension (D)		WBC uninfected image Fractal dimension (D)	
	BC	MR	BC	MR	BC	MR	BC	MR
1	2.873	2.901	4.019	4.301	3.28	3.623	1.476	1.511
2	2.885	2.904	4.068	4.351	3.276	3.624	1.447	1.481
3	2.887	2.908	4.136	4.353	3.278	3.626	1.428	1.471
4	2.889	2.908	4.203	4.191	3.279	3.625	1.47	1.451
5	2.89	2.94	4.225	4.151	3.277	3.623	1.472	1.445
Mean:	2.88	2.94	4.13	4.258	3.27	3.62	1.45	1.44
σ:	0.006	0.004	0.008	0.008	0.001	0.001	0.02	0.002

WBC) represented by image dimension (64*64) and their gray level is about 0 to 255 within (bmp) file, then designing and implementing a program in (Visual basic V.6) language lo calculate the fractal dimension and lacunarily by using box counting method and mass radius techniques to application the chaos theory in this images also designing tihe instructional program according to a system approach (Ely and Gerlach) model as a developed technique in the learning process to provide learner with the key principles of chaos theory and fractal engineering. (Fig. 3)

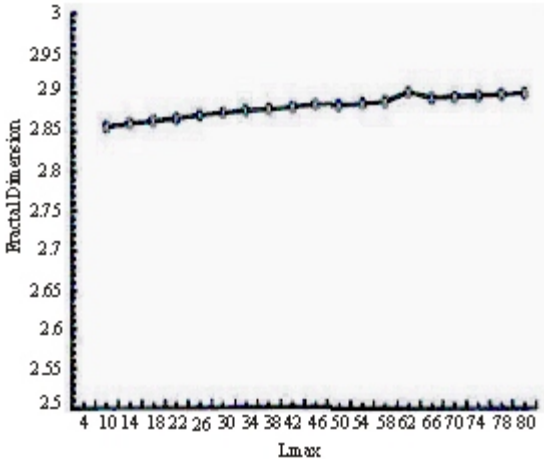
RESULTS

Five samples of each kind of red blood cells (RBC) and infected while blood (WBC) cells are chosen, in addition lo five samples of uninfected cells and for a different ages, The result attainted in Table 1 indicate mean values of fractal dimension using box counting method, mass radius method of used RBC, WBC for (Lmax =30) and (r =32). The relation between maximum side length box (Lmax) used to calculate the fractal dimension and its values and values of Lacunarity shows that uninfected cells have shapes and relation different from those of infected cells . (Fig. 4a,b).

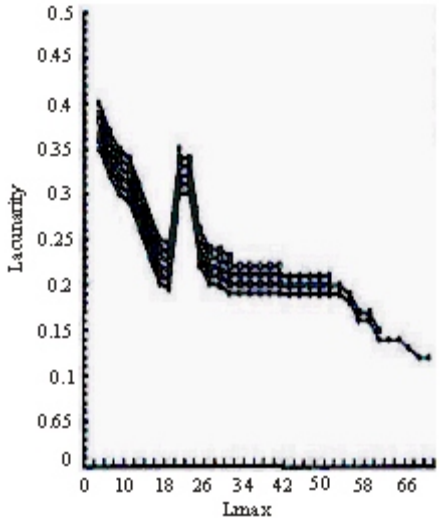
illustrates the relation between the Lmax and values of fractal feature (fractal dimension and Lacunarity) for the infected cells RBC Fig. 4b illustrates the relation between the radius r and values of fractal Feature (fractal dimension and Lacunarity) for the infected cells RJ3C(5) illustrates the relation between the Lmax and values of fractal feature (fractal dimension and Lacunarity)for the infected cells WBC. (Maha, 2005).

CONCLUSION

A novel approach has been presented to detect and classify the electronic microscope image for RBC and WBC infected and uninfected by using the concept of chaos theory (Table 1)]. The properties and characteristics of a fractal set are not completely determined by its fractal dimension. Indeed fractals that have the same fractal



(a)



(b)

Fig. 4: Show the calculated fractal features versus the maximum length of box.

dimension may look very different, they have different "texture", more specifically, different Lacunarity. It is a counterpart to the fractal dimension that describes the texture of a fractal- The surface irregularity has shown as increase in neoplaststic cells of leukemia cells was connected with their fractal dimension increases for normal cells, fractal dimension =1.44. whereas for neoplastic ones >1.44. Values of fractal dimension in box counting method are round to be Lmax>64 (larger than the size of the images) .This unsuitability. Fractal dimension allows to perform the mathematical estimation of chaos theory. Mass radius method is applied in measurements of images when radius (r=32). Dimension analysis is a tool to quantify structure information of artificial and natural objects. It is also designing an instructional program according to the methodology of system approach Ely and Gerlach model and in the form of instructional modules helped to overcome the individual differences among learners.

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