Utilizing Genetic Algorithms for an Effective Method of Image Matching

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Abstract:- The Genetic Algorithm (GA) is used in this study to provide an effective approach for matching an unknown pattern that represents a partial picture with the original image. This approach makes use of the chromosomal parameter. It represents location coordinates (X, Y) that have been converted into a brief sequence of bits based on the size of the original picture, allowing for quick matching. The chromosome exists as a series of binary bits. An example is given to illustrate the effectiveness of this approach.

Keywords:- *Genetic Algorithm, Pattern Matching, Chromosome, MATLAB Results.*

I. INTRODUCTION

Among the most popular techniques for conducting a random search for typical solutions, genetic algorithms imitate Darwin's theory by putting the survival of the fittest into practice[1,12]. Genetic algorithms are very effective random search algorithms with a probability-based foundation for modeling natural occurrences. Numerous challenging issues have been resolved with success using it.

- *Pattern Recognition.*
- *Image Segmentation.*
- *Contour Matching.*
- *Water Marking.*

The problem at hand is described to represent the chromosomes representing the solutions using a specific coding method in a computer-compatible manner.

There are several ways to encode chromosomes or generation according to the type of matter[4,6]. There is substitution coding, tree coding, and binary coding, which are widely used due to their ease of dealing with them, as each chromosome is a series of limited lengths of successive zeros and units in certain ranks, so that each rank is represented by a value and called a gene, and then each chromosome consists of a group of genes, and this representation has been used. In this paper. In pattern matching issues, the dimensions of the chromosome can be determined according to the requirements of accuracy and reliability of the solution, provided that the length remains constant during the implementation of the genetic algorithm.

This paper presents the design of an efficient genetic algorithm by matching a partial image with dimensions (N1xN2) with an original image with dimensions (M1xM2), Each of the two images in binary represents zeros and ones and converts them from a format such as color or grayscale[8,10]. The proposed algorithm, characterized by the use of a small length chromosome to reduce the constraints imposed on genetic algorithms, was used to split the original image into a number of partial images with dimensions equal to the size of the partial image to be matched with dimensions (N1xN2). The structure of this paper is as follows: In the second section, the problem of pattern matching is discussed; in the third, the algorithm's operation is demonstrated; and in the fourth, the results are given.

II. PATTER MATCHING

- ➢ *The 2D Pattern Matching Process is Described as follows:*

An unknown pattern is matched with previously known patterns, we choose the best match, where the known patterns are in the original image.

We assume that the original image has dimensions (M x N) in space S and the partial image has dimensions (K x L) in space P, so that it is as shown in the figure 1.

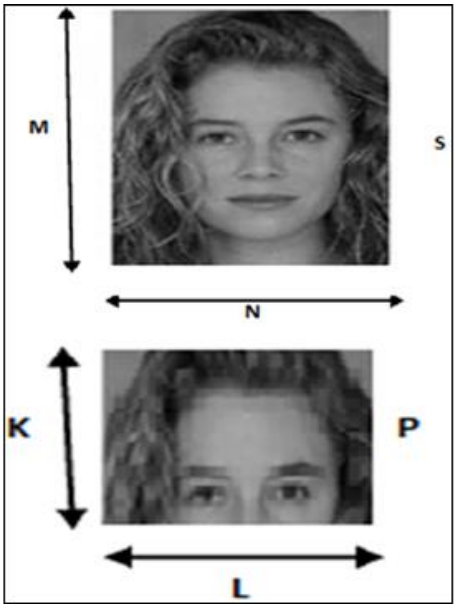


Fig 1 Original and Partial Images

The image to be matched is matched with partial images of the original image S, the number of which depends on the size of the image to be matched P according to the following:

The image S is moved to space (X,Y) [7,11]and a location is chosen that will be represented by the chromosome, as we will see later. The first element of the first generation with location (0 , 0) will be considered from the matching block, whose dimensions are equal to the dimensions of the image [2,12]. The best match is searched for, and images can be matched in several other ways. Among them is the number of image elements that are equal in value between the image to be matched and the matching block.

III. PROPOSED ALGORITHM

I suggest partitioning the original picture space into S-dimensional partial images. Each fragment of a picture is identified by a point with the coordinates (X,Y). In order to depict a chromosome, each position (X, Y) of each partial picture in the space is converted into a binary string. Thus, the elements of the chromosome are bits (0,1) with the shortest possible length.

IV. CHROMOSOME REPRESENTATION

- *The Length of the Chromosome is Chosen According to the Dimensions of the Original Image Space by the Relationship:*

$$LC=D1+D2$$

- *Where D1 Represents the Binary Bits Needed to Represent the Dimension M and D2 is the Binary Bits to Represent the N Dimension . The Chromosome can be Represented in the next Equation :*

$$C=x1x2x3\ldots xD1 \quad y1y2y3\ldots YD2$$

- *The First Elements of the Chromosome Represent the x Coordinate, while the Second Elements Represent the y Coordinate ,that is, the Elements are Represented by Bits (0,1) and C becomes as follows:*

$$C=10001011\ 11010010$$

V. FITNESS FUNCTION

It is the process of converting the genetic data contained by a chromosome into a number value to make dealing with it and quantitatively comparing it to other chromosomes easier.

In our scenario, this subordinate checks to see if the place indicated by the chromosome is present in space s after transferring the incomplete picture there. The following verification procedure states:

$$0 \le X'+K \le M \qquad 0 \le Y'+L \le N\ldots.. \qquad (1)$$

A chromosome is chosen from among the set of chromosomes depending on the value of its optimization function and how close this value is to the optimal value.

VI. GENERATING THE INITIAL CHROMOSOME

The first step is to create the basic assembly by randomly creating a large number of chromosomes, such as 100 chromosomes, for instance. The chance to mate, reproduce, and live is given to the chromosomes with the highest fitness. As a result, it is feasible to get 100 new chromosomes and get rid of the old ones. As a result, we have produced a new generation that is healthier than the one before it. As generations go by, chromosomal fitness increases significantly. Three crucial phases are involved in the creation of chromosomes:

- *Parent Selection*
- *Crossover*
- *Mutation*

- *In our Case, Chromosomes are Generated as follows:*

Randomly generate a chromosome with LC length. If equation 1 is not met for this chromosome, it is neglected and we repeat the previous step. The process stops when the number of chromosomes reaches the predetermined number, let it be 100.

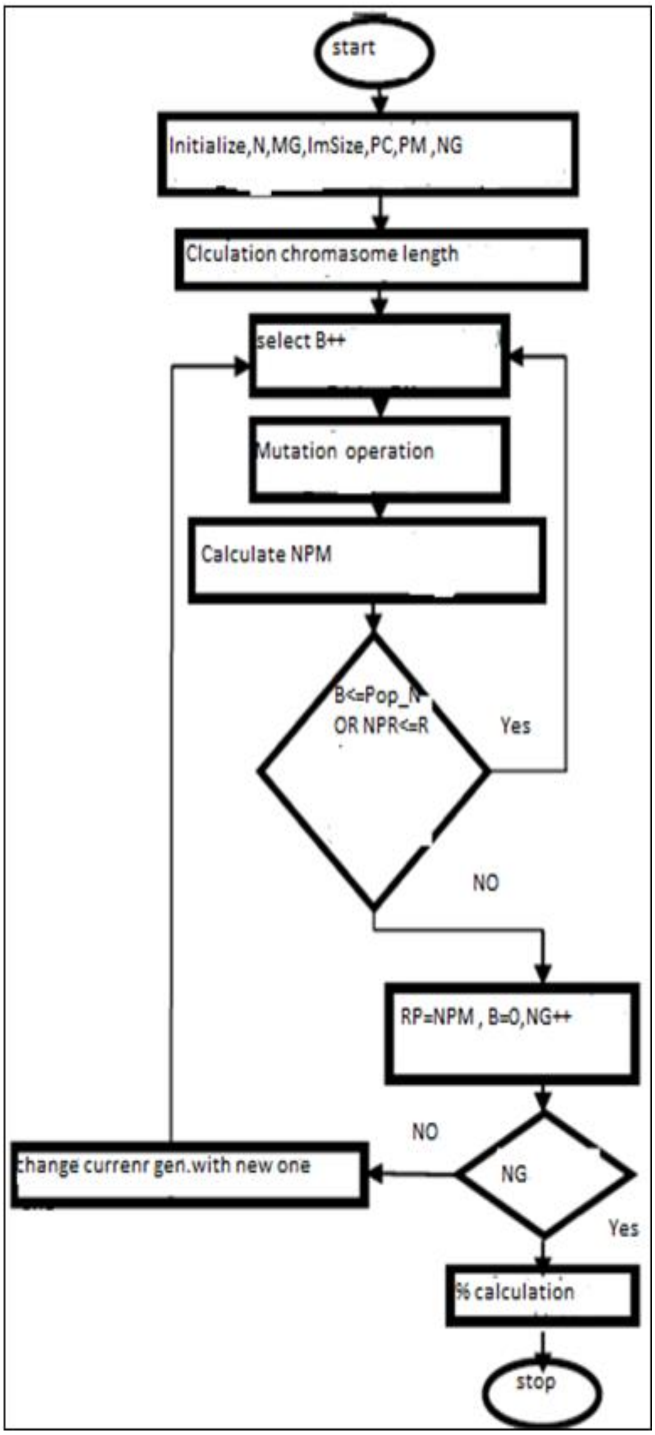
VII. CROSSOVER OPERATION

The next generation is created by chromosomal hybridization. The definition of the exchange point, which is chosen at random inside the domain (LC-0), in accordance with the hybridization ratio Pc, serves to condense this procedure. The two chromosomes that are thought of as the parents swap the portion of their binary number sequence that is divided by the exchange point.

VIII. MUTATION OPERATION

The mutation process in genetic algorithms is summarized by selecting a group of random daughters in a group of chromosomes that are chosen randomly, changing the value of the bit, and choosing the mutation bit randomly within the field.

IX. FLOWCHART



Where:

- Pc The number of image elements in the partial image
- NPM The number of image elements in the partial match
- RP Required image elements
- Pop_N population
- NG Generation counter
- Pc Crossover Rate
- Pm mutation rate
- NRUN no of execution process

X. RESULTS & DISCUSSION

- *The algorithm printed an original image with dimensions 30x15.*
- *As for the partial image, it represents the eye from this image with dimensions of 30x15.*
- *Pop=20 Pc=0.05*
- *Maximum generation,MG=1000*
- *NRUN=10*

- *After Applying the Algorithm, a match Percentage 96% was Obtained as shown in Fig2 and Table1.*

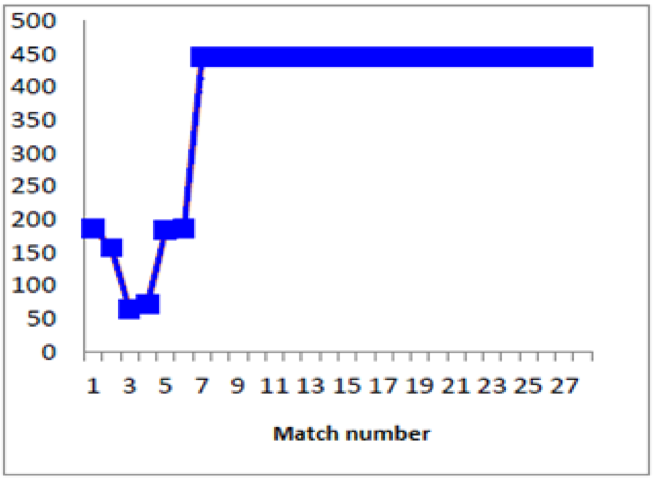


Fig 2 Matching Number

Table1 Percetage Matching

Match ratio	No of matching image elements	no of partial image elements	Partial image size	Actual size
96%	453element	460 element	30x15	**220**x220

XI. CONCLUSION

A method is proposed to match a partial image randomly cut from an original image using genetic algorithms. The original image is divided into a number of partial images with a size equal to the size of the image to be matched. First, the image to be matched was represented into the original image space and the best match was searched using genetic algorithms that depend in their work on genetic chromosomes with a very small length in order to reduce the search time. The chromosome is represented by a coordinate (x, y) converted into a binary value, and then the chromosome is represented by a series of daughters consisting of zeros and ones, which represent the solutions that are searched for to give the best match. The verification algorithm is carried out to verify whether the chromosome represented by the location coordinates (x, y) belongs to the space of the original image, and the hybridization process is performed with the possibility of a mutation occurring, and the best location is chosen that achieves the best match between the partial image and the original. This proposed method was tried and gave excellent results.

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