Handwritten Digit Recognition using Gentic Algorithm

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ABSTRACT

Image processing is a technique that can identify shades, colors and relationships that cannot be perceived by the human eye. It is used to solve identification problems such as in forensic medicine or in creating weather maps from satellite pictures. It deals with images in bitmapped graphics format that has been scanned or captured with digital cameras. Image processing is a form of signal processing and the input is an image, such as a photograph or video frame. The output of image processing may be either an image or a set of characteristics or parameters related to the image. Computer vision is the science and technology of machines that the machine is able to extract information from an image that is necessary to solve some task. As a scientific discipline computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms such as video sequences, views from multiple cameras or multi-dimensional data from a medical scanner. Applications of computer vision include systems for controlling processes, detecting events, organizing information, modeling objects or environments and interaction.

Genetic Algorithm (GA) was introduced as a computational analogy of adaptive systems, Genetic Algorithm is a population-based optimization tool it could be implemented and applied easily to solve various function optimization problems. Handwritten input gets from the user. The handwritten digits are recognized with the help of GA, applying selection, reproduction, mutation and crossover methods. The main strength of GA is its fast convergence, it compares favorably with many global optimization.

I. Introduction

One of the most prominent application fields is medical computer vision or medical image processing. This area is characterized by the extraction of information from image data for the purpose of making a medical diagnosis of a patient. Generally image data is in the form of microscopy images, X-ray images, angiography images, ultrasonic images and tomography images. An example of information can be extracted from such image data is detection of tumors, arteriosclerosis or other malign changes. It can also be measurements of organ dimensions and blood flow. This application area also supports medical research by providing new information about the structure of the brain or about the quality of medical treatments.

II. Related work

Mitchell [11] proposed an introduction to genetic algorithms. The author introduced description method for arbitrary two dimensional shapes is proposed in this paper. The 2D shape is given as a silhouette and its structure is automatically approximated by the use of a set of rectangles by the proposed method. Sizes, positions and rotational angles of the rectangles are approximate adequately the given 2D shape are searched by a Genetic Algorithm (GA). The coding of GA, chromosome of each individual is a bit string corresponding to parameter sets of several rectangles. Through generation iteration, accuracy of approximation of the given 2D shape is improved. In this paper, the total number of rectangles to be used for description is assumed to be given before shape description. By changing the total number of rectangles, hierarchical description of given 2D shapes is achieved.
This method can be applied to shape description and object recognition in the field of computer vision and to abstraction of 2D shapes in the field of artistic applications by the use of computers.

Nagao, Agui and Nagahashi [12] proposed fitting three dimensional models to stereo images using a genetic algorithm. The author introduced predictions of image features and their relations are made from three dimensional geometric models. Instructions are generated to tell the interpretation algorithms to make use of image feature measurements to derive three-dimensional size, structural and spatial constraints on the original three-dimensional models.

Forrest [5] proposed genetic algorithms principles of natural selection applied to computation. The author introduced Local measurements of three dimensional positions and surface normal recorded by a set of tactile sensors may be used to identify and locate objects from among a set of known objects. The objects are modeled as polyhedral having up to six degrees of freedom relative to the sensors. Inconsistent hypotheses about pairings between sensed points and object surfaces can be discarded efficiently by Using local constraints on distances between faces, angles between face normal and angles (relative to the surface normal) of vectors between sensed points.

David G. Lowe [2] proposed fitting parameterized three dimensional models to images. The author develops Object recognition and positioning explicitly relating the shape of image contours to models of curved three-dimensional objects. Object models consist of collections of parametric surface patches and their intersection curves. Elimination theory reduces the unnecessary parameters. Equation is parameterized by the object’s position and orientation with respect to the observer. Determining the parameters are reduced to a fitting problem between the theoretical contour and the observed data points the proposed approach readily extends to parameterize Models. It has been implemented for a simple world composed of various surfaces of revolution and successfully tested on several real images.

Agui, Nagao and Nagahashi [1] proposed extraction of two dimensional arbitrary shapes using a Genetic Algorithm. The author develops interpretation of a triplet of any image lines as the perspective projection of triplet of linear ridges of the object model. The geometrical transformations to apply to the model to bring it into the corresponding location are obtained by the resolution of an eight degree equation. The number of admissible solutions can still be reduced, using simple pruning rules. Because few admissible hypotheses are retained, the line matching procedure by prediction-verification is less complex.

Davis [3] proposed Handbook of Genetic Algorithms. The author presents computational theories and deal with geometrical aspects of interpreting images as a three-dimensional (3D) scene. The presentation covers three levels of descriptions micro-surface level, volumetric-object level and scene level. This is relationship between surface orientations of small surface patches and image properties. Handles shape representations of primitive objects the relationship between 3D shape of an object and its projections onto images must be understood. Constructing and maintaining the 3D description of the whole scene.

Dhome, Richetin, Laprest’e and Rives [4] proposed determination of the attitude of 3-D objects from a single perspective view. The author discuss about the exploitation of natural symmetries in a well-defined family of patterns. The results in an extension of the data and imposes even and odd symmetry on the Eigen functions of the covariance matrix without increasing the complexity of the calculation. The resulting approximation of faces projected from outside of the data set onto this optimal basis is improved on average.

Ponce and Kriegman [13] proposed recognizing and positioning curved 3D objects from image contours. The author introduces a new compact representation of object appearance that is parameterized by pose and illumination. For each object of interest, a large set of images is obtained by automatically varying pose and illumination. The large image set is compressed to obtain a low-
dimensional subspace, called the Eigen space, in the object is represented as a hyper surface. Given an unknown input image, the recognition system projects the image onto the Eigen space. The object is recognized based on the hyper surface it lies on. The exact position of the projection on the hyper surface determines the object's pose in the image.

Holland [10] proposed adaptation in natural and artificial systems. The author describes special-purpose character recognition system uses contextual information for the recognition of words from any given dictionary of words. This research introduces the concept of binary diagrams overcomes some of the problems of past approaches. The modified recognition system is allowed to output several alternatives for each character and the postprocessor selects the proper string of characters by having access to both the dictionary and the dictionary syntax.

III. Handwritten Digit Recognition using Genetic Algorithm
In this approach, choose the initial population of individuals and evaluate the fitness of each individual in that population then feature extraction is done to get a high recognition performance. Apply mutation and crossover functions for selected features and again to get a accuracy and faster recognition rate. Finally recognize the digit. The proposed recognition system is designed using Graphical User Interface and presented [13].

VI. Results
The digit taken from the digit database and results are shown in Figure1.

![Figure 1. Recognition of digit 0](image1.jpg)

The Table represents the digits performance result and no of iterations to recognize the digits.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Digit database</th>
<th>Digits</th>
<th>Average Fitness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sampleimage1.jpg</td>
<td>0</td>
<td>84%</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>1</td>
<td>81%</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>2</td>
<td>92%</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>3</td>
<td>86%</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>4</td>
<td>90%</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>5</td>
<td>84%</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>6</td>
<td>88%</td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td>7</td>
<td>83%</td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td>8</td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>93%</td>
</tr>
</tbody>
</table>
5. Conclusion
The proposed system split the images into 2D geometrical shapes as rectangle, circle, ellipse, triangle and other geometrical shapes based on the input image, the image is split into single shape or combination of more than one shapes. The parameters are extracted from the shapes and the nearest object recognition result is extracted from the parameters using Genetic Algorithm. The object recognition result is more accurate than the existing system due to the parameters of different shapes.

REFERENCES

Author Biography
Mrs. D.Devikanniga is currently working as Assistant Professor in the Department of Information Technology at Sri Ramakrishna Engineering College, Coimbatore. She has a Bachelor’s degree in Information Technology (2003), a Master’s degree in Advanced Computing (2005). She has above 9 years of teaching experience and guided 16 UG projects. Her research and teaching interests include Data Mining, Cloud computing, Big Data, Opinion Mining and Sentimental Analysis, Data Structures, Design and Analysis of Algorithms. She is a life time member in ISTE and IAENG. She published papers in National and International Conferences and Journals.
Dr. M. Thangamani is nearly 20 years of experience in research, teaching, consulting and practical application development to solve real-world business problems using analytics. Her research expertise covers data mining, machine learning, cloud computing, big data, fuzzy, soft computing, ontology development, web services and open source software. She has published 50 articles in International journals and presented over 67 papers in national and international conferences in above field. She has delivered more than 35 Guest Lectures in reputed engineering colleges on various topics. She has organized many self supporting and sponsored national conference and Workshop in the field of data mining, big data and cloud computing. She is on the editorial board and reviewing committee of leading research journals, and on the program committee of top international data mining and soft computing conferences in various countries. She also seasonal reviewer in IEEE Transaction on Fuzzy System, international journal of advances in Fuzzy System and Applied mathematics and information journals. She has organizing chair and keynote speaker in international conferences in India and abroad. She is currently working as Assistant Professor in Kongu Engineering College.