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Literature Review: Analysis of Soft Computing Techniques Used In Pattern Recognition of 2-D Diagram/Object

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Abstract: *When images are to be used in different areas of image analysis such as object recognition, it is important to reduce the amount of data in the image while preserving the important, characteristic, structural information. Many soft computing technique are been studied here, for object detection and analyzing the importance of it. Mathematics of soft computing technique varies according to the problem statement applied, here we are discussing most of the soft computing mathematics and how we are integrating with our object and pattern detection. We are discussing here about various past work in two dimensional diagram and pattern recognition. We have also discussed about some soft computing technique like Hough transform, genetic algorithm, neural network and ant colonization optimization.*

I. Introduction

Object recognition in computer vision is the task of finding the objects present in an image or video sequence. Humans recognize objects in images with little effort, despite the fact that the objects may vary in viewpoints, sizes, scale, texture or even when they are translated or rotated. Even objects that appear in many different forms or objects that are subject to considerable shape deviations can easily be generalized by our brain to one kind of object. Furthermore, humans can generalize the process by recognizing objects that have never been seen before. The problem here is classification or recognition that involves building a system where it can fit the given system

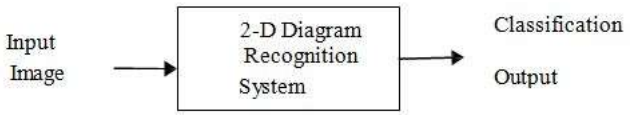

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Figure1.1: 2-D diagram/object Recognition system

A digital image can be considered as a matrix whose row and column indices identify a point (x,y) in the image and the gray level at that point. These elements are called picture elements, pixels. So to a computer the shapes of objects we easily extract from their surroundings area clutter of pixels and the pixel itself conveys no information related to the recognition of objects. It is difficult to separate these pixels from the random pixels surrounding it. A lot of processing can help to extract some information on the shapes of objects present in an image. The goal is to recognize the objects based on the shape of the object. In designing a system for object recognition, careful attention has to be put on few major challenges. The central problem to object recognition systems is caused by the fact that it can be in any kind of position, rotated, mirrored, or any kind of transformation that preserves distance ratios as well as co-linearity. Objects might have different physical sizes, or they might be geometrically rendered differently, depending on the distance between the camera and the object. Another hardest problem of object recognition in real images is that the objects may not appear alone leading to multiple object case. The single object case is the simplest one. The problem of segmentation of objects involves when there is more than one isolated object in the image. In multiple object case, the objects are either isolated or overlapping. The problem even becomes harder when two objects are touching or overlapping, since the separation of objects in an image is not a trivial task. The algorithm should be able to handle the crossing problem to segment the different objects.

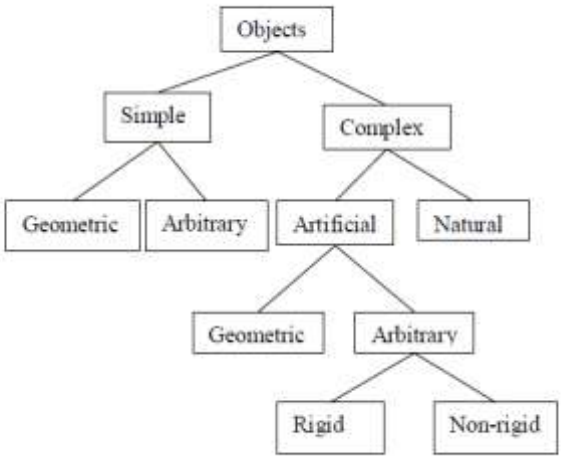

Figure 1.2: Types of objects for object recognition problem

Another basic problem to object recognition system is the different lighting conditions the image has been taken under. The effect of lighting on colours is extremely large, and especially in colour based recognition it is considered to be one of the most difficult problems. Mechanisms like edge extraction are sensitive to lighting conditions. When the lighting becomes dim the difference in brightness of pixels tends to decrease sometimes making the edges disappear. And with brighter images small colour changes can become more visible that lead to the extraction of too much edge information. Usually environments are quite cluttered, and the object is occluded by other objects in the world. Self-occlusion can even occur when dealing with quite articulated objects. Object recognition is a modern day machine intelligence problem with various applications in a wide field including face recognition and character recognition. Its ability to read text and shapes plays an important role in medical diagnostic science, machine conditioning and monitoring. Other applications include robotics, object counting and monitoring, visual positioning and tracking, security, biometric recognition, industrial inspection, content-based image retrieval, medical imaging, human computer interaction, intelligent vehicle systems and biometrics. Issues such as definition of pattern classes, sensing environment, pattern representation, feature extraction and selection, cluster analysis, classifier design and learning, selection of training and test samples, and performance evaluation needs careful attention in the design of pattern recognition systems. It is generally agreed that a well-defined and sufficiently constrained recognition problem will lead to a compact pattern representation and an efficient decision making strategy.

II. About 2-D Diagram

A shape with only two dimensions (such as width and height) and no thickness. Squares, Circles, Triangles, etc are two dimensional objects. In two dimensional diagrams areas of the diagrams are used to represent the magnitudes. Rectangles, squares and circles with area proportional to the observations are used to represent each category. Of these, circles are most commonly used. Such diagrams are called pie-diagrams. Circles drawn with areas proportional to the magnitudes of the observations constitute a pie-diagram.

III. About Soft Computing

In computer science, soft computing (sometimes referred to as computational intelligence, though CI does not have an agreed definition) is the use of inexact solutions to computationally hard tasks such as the solution of NP-complete problems, for which there is no known algorithm that can compute an exact solution in polynomial time. Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty, partial truth, and approximation. In effect, the role model for soft computing is the human mind.

The principal constituents of Soft Computing (SC) are Fuzzy Logic (FL), Evolutionary Computation (EC), Machine Learning (ML) and Probabilistic Reasoning (PR), with the latter subsuming belief networks and parts of learning theory.

Soft computing (SC) solutions are unpredictable, uncertain and between 0 and 1. Soft Computing became a formal area of study in Computer Science in the early 1990s.[1] Earlier computational approaches could model and precisely analyze only relatively simple systems. More complex systems arising in biology, medicine, the humanities, management sciences, and similar fields often remained intractable to conventional

mathematical and analytical methods. However, it should be pointed out that simplicity and complexity of systems are relative, and many conventional mathematical models have been both challenging and very productive. Soft computing deals with imprecision, uncertainty, partial truth, and approximation to achieve practicability, robustness and low solution cost. As such it forms the basis of a considerable amount of machine learning techniques. Recent trends tend to involve evolutionary and swarm intelligence based algorithms and bio-inspired computation.[2][3]

There are main differences between soft computing and possibility. Possibility is used when we don't have enough information to solve a problem but soft computing is used when we don't have enough information about the problem itself. These kinds of problems originate in the human mind with all its doubts, subjectivity and emotions; an example can be determining a suitable temperature for a room to make people feel comfortable.

IV. Review of work on 2-D Diagram Recognition

Author	Workdone in the field of 2-D diagram/object/pattern recognition	Summary
Shalinee Patel, Pinal Trivedi, and Vrundali Gandhi 2013	"2D Basic Shape Detection Using Region Properties [4]"	Object recognition can be done in two ways
M. Sezgin and B. Sankur 2004	"Survey over Image Thresholding Techniques and Quantitative Performance Evaluation[5]"	Comparing every pixel in the image to the pixels
G. Wyszecki and W. S. Styles 2000	"Color Science: Concepts and Methods, Quantitative Data and Formulae[6]"	calculating certain metrics based on this information and comparing the values of these metrics to predetermined values
R. S. Berns 2000	"Principles of Color Technology[7]"	Introduction to color technology.
M. Hagedoorn 2000	Pattern Matching Using Similarity Measures[8]	Introduction to pattern matching
R. C. Veltkamp and M. HagedoornTechnical Report, Utrecht, 1999	"State of the Art in Shape Matching[9]"	used in applications like fingerprint recognition where a large database of fingerprint
D. Sharvit, J. Chan, H. Tek, and B. Kimia 1998	"Symmetry-Based Indexing of Image Databases[10]"	Studied image data base and matrix structure.
N. Otsu 1997	"Threshold Selection Method from Gray-level Histograms[11]"	intensive as well as time consuming
J. L. Vincent 1993	"Morphological Grayscale Reconstruction in Image Analysis: Applications and Efficient Algorithms[12]"	Extracting information from the image
N. R. Pal and D. Bhandari 1992	"On Object Background Classification[13]"	facial image samples is maintained in image form
G. Scott and H. Longuet-Higgins 1991	An Algorithm for Associating the Features of Two Images[14]	limitations on memory as well as time required to process data and produce results
ROSEN, C. A. 1967.	Adaptive machine[15]	Computer acceptable data set, Information about common pattern recognition method

Table 1.1. shows the current status in 2-D diagram, pattern and object recognition studies

V. Conclusion

This chapter has covered regressive literature survey on pattern, object and diagram recognition by using various specialized and unspecialized soft computing technique. It started from the basic pattern recognition, and then integrated lot of RGB format with clustering mechanism in it. The clustering pattern is the input for lot of artificial intelligence system, like Ant colonization algorithm, Neural Network and Genetic Algorithm. We have successfully studied the mathematics of it, and concluded that all the AI based technique gives a prominent result, but efficient and fast algorithm can be Ant Colonization algorithm for object and Pattern recognition in terms of efficiency and speed.. The deficiencies and draw backs of this method for pattern recognition task are also reported from the review of literature. The various modifications and improvements are also considered and reported. Various techniques of feature extractions those have been investigated in literature are reported with their merits and demerits. In the last the hybrid evolutionary techniques are reviewed. This review started from the discussion of Ant Colonization Algorithm with its capabilities for searching. There are various works base on ACO with neural network techniques have reported for the task of pattern recognition. It has been investigated that the feed forward multilayer neural network with enhance and extended version of back propagation learning algorithm is more suitable for handling the complex pattern classification or recognition tasks in spite of its inherited problem of local minimum, slow rate of convergence and no guarantee of convergence. Ant Colonization Algorithm have been used in a number of applications such as pattern recognition & classification, remote sensing, dynamic modeling and medicine.

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