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GRAPH PARTITIONING FOR IMAGE SEGMENTATION USING ISOPERIMETRIC APPROACH: A REVIEW

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ABSTRACT

Graph cut is fast method performing a binary segmentation. Graph cuts proved to be a useful multidimensional optimization tool which can enforce piecewise smoothness while preserving relevant sharp discontinuities. This paper is mainly intended as an application of isoperimetric algorithm of graph theory for image segmentation and analysis of different parameters used in the algorithm like generating weights, regulates the execution, Connectivity Parameter, cutoff, number of recursions. We present some basic background information on graph cuts and discuss major theoretical results, which helped to reveal both strengths and limitations of this surprisingly versatile combinatorial algorithm.

KEYWORDS- *Graph cut method, isoperimetric algorithm, and connectivity parameter*

I. INTRODUCTION

Graph cut is new algorithms for image processing may be crafted from the large corpus of well-explored algorithms which have been developed by graph theorists. For example, spectral graph partitioning was developed to aid in design automation of computers and has provided the foundation for the development of the Ncuts algorithm. Similarly, graph theoretic methods for solving lumped Ohmic electrical circuits based on Kirchhoff's voltage and current law. Adaptive sampling and space-variant vision require a "connectivity graph" approach to allow image processing on sensor architectures with space-variant visual sampling. Space variant architectures have been intensively investigated for application to computer vision for several decades, partly because they offer extraordinary data compression [1].

The isoperimetric algorithm is easy to parallelize, does not require coordinate information and handles non-planar graphs, weighted graphs and families of graphs which are known to cause problems for other methods. This algorithm provides fast segmentation without affecting the stability. Local Global interactions are well expressed by graph theoretical algorithms. New algorithm for image processing may be crafted from large set of well-explored algorithm which can be developed by graph theories. Adaptive sampling and space variant requires a "connectivity graph" which can be well established using graph theories.

New architectures for image processing may be defined that generalize the traditional Cartesian design. Just in the special case, the temporal domain can (and does, in animals) exploit an adaptive, variable sampling strategy. In a computational context, this suggests the use of graph theoretic data structures, rather than pixels and clocks. Some applications based on graphs have no counterpart in quasi-continuous, pixel based application. For example, the small world property of graphs, which allows the introduction of sparse global connectivity at little computational cost, has been applied to image processing with good results. In general, the flexible nature of data structures on graphs provides a natural language for space-time adaptive sensors.

Graph processing algorithms have become increasingly popular in the context of computer vision. Typically, pixels are associated with the nodes of a graph and edges are derived from a 4- or 8-connected lattice topology. Some authors have also chosen to associate higher level features with nodes. For purposes of importing images to space-variant architectures, we adopt the conventional view that each node corresponds to a pixel. Graph theoretic algorithms often translate naturally to the proposed space-variant architecture. Unfortunately, algorithms that employ convolution (or correlation) implicitly assume a shift-invariant topology. Although shift-invariance may be the natural topology for a lattice, a locally connected space-variant sensor array (e.g., obtained by connecting to K-nearest-neighbors) will typically result in a shift-variant topology. Therefore, a re-construction of computer vision algorithms for space-variant architectures requires the use of additional theory to generalize these algorithms [2].

II. LITERATURE SURVEY

Mo Chen et.al. in paper "isoperimetric cut on a directed graph". In this paper, we propose a novel probabilistic view of the spectral clustering algorithm. In a framework, the spectral clustering algorithm can be viewed as assigning class label to samples to minimize the Byes classification error rate by using a kernel density estimator (KDE).From this perspective, we propose to construct directed graphs using variable bandwidth KDEs. Such a variable band width KDE based directed graph has the advantages that it encodes the local density information of the data in the graph edges weights. In order to cluster the vertices of the directed graph, we develop a directed graph portioning algorithm which optimizes a random walk isoperimetric ratio. The portioning result can be obtained efficiently by solving a system of linear equations .We have applied our algorithm to several benchmark data sets and obtained promising result [12].

Daming Zhang et.al in paper [8] "Image Threshold Selection with Isoperimetric Partition" In this paper we deduce the unified form of the normalized cut (Ncut) algorithm and the Isoperimetric algorithm, and then a new Isoperimetric based thresholding algorithm is proposed [8]. Unlike Tao and Jin's Ncut-based thresholding algorithm, the proposed algorithm need not to search all possible thresholds, nevertheless yields similar results. A large number of examples are presented to show the effectiveness of the proposed algorithm [8].

Wenbing Tao et.al in paper [10] "Image Thresholding Using Graph Cut "In this paper, we have developed a thresholding algorithm based on the normalized-cut measure. Unlike the existing graph-cut-based image segmentation approaches which are in real-time applications due to their high computational complexity, the proposed method requires significantly less computations and, therefore, is suitable for real-time vision applications, such as ATR. Significant reduction of the computational cost and memory storage are achieved by constructing new weight matrix based on gray levels instead of pixels. In addition, the use of the normalized-cut measure as the thresholding principle enables us to distinguish an object from background without a bias. Because of the compact and fixed size of the weight matrix, we can quickly obtain the graph-cut value for all the possible thresholding values and determine the optimum threshold values. The effectiveness of the proposed method, as well as its superiority over a number of contemporary thresholding techniques, has been confirmed by using a series of infrared and scenic images [10].

III. SUMMARY OF LITERATURE

From the study of all the papers it is observed that there is uses a different algorithm and method related to graph theory. From these paper some unsolved issues, such as how to computes the edges weight, vertices connectivity parameter.

IV. OBJECTIVES

In order to cluster vertices of the directed graph, we have to develop a directed graph partitioning algorithm which optimizes a isoperimetric ratio. Our object is to design a graph portioning algorithm to minimize the isoperimetric constant. Graph cut is fast algorithm for performing binary segmentation used to achieve accurate segmented output. It improves the speed of image segmentation without losing stability. We have to design isoperimetric algorithm for finding edges, nodes, vertices etc.

V. PROPOSED METHODOLOGY

Graph cut:

Local Global interactions are well expressed by graph theoretical algorithms. New algorithm for image processing may be crafted from large set of well-explored algorithm which can be developed by graph theories. Adaptive sampling and space variant requires a "connectivity graph" which can be well established using graph theories.

Isoperimetric Algorithm:

The isoperimetric algorithm is easy to parallelize, does not require coordinate information and handles non-planar graphs, weighted graphs and families of graphs which are known to cause problems for other methods. This algorithm provides fast segmentation without affecting the stability.

Graph Cut:

In graph theoretic definition, the degree of dissimilarity between two components can be computed in the form of a graph cut. A cut is related to a set of edges by which the graph *G* will be partitioned into two disjoint sets A and B. As a consequence, the segmentation of an image can be interpreted in form of graph cuts, and the cut value is usually defined as**: Cut (A,B) = ∑u€A,v€B** w(u,v), where u and v refer to the vertices in the two different components.

The first which presents a segmentation algorithm within a frame work which is independent of the feature used & enhance the Correctness and Stability with respect to parameters of different images.

The graph partitioning problem is to choose subsets of the vertex set such that the sets share a minimal number of spanning edges while satisfying a specified cardinality constraint. Graph partitioning appears in such diverse fields as parallel processing, solving sparse linear systems, and VLSI circuit design and image segmentation.

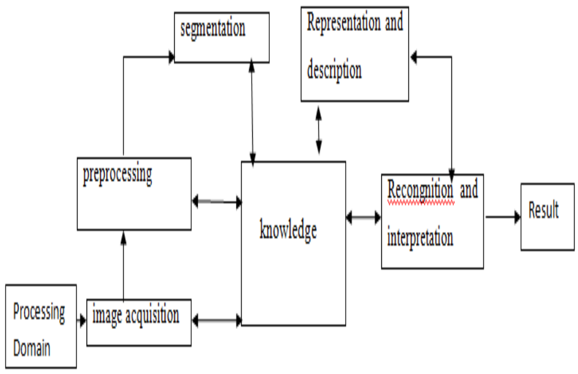

Figure 1: Image segmentation pipelining

VI. RESULT AND CONCLUSION

After simulation probable outcomes will be obtained as weight of all edges. Segmented image will be having high accuracy and high computational efficiency as compare to other algorithm. As, it has been shown the application of Graph Theory and its algorithms in Image Processing and especially in the area of Medical Image Analysis makes the development of a Graph Theory library for the ITK library a necessary and useful addition for accurate and effective processing and analysis of images. The implementation has been made flexible in order to allow it to be applied to varying problems. Further definitions of function classes for Prim's minimum spanning tree, depth first search, Dijkstra's shortest path algorithm and Kruskal's minimum spanning tree will be designed as future work. Also, designs for the graph traits classes will be made more generic and user defined. This way the application of all the graph classes will be truly generic and graph theory can be applied easily for image analysis

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