IDEA GROUP PUBLISHING



701 E. Chocolate Avenue, Hershey PA 17033-1117, USA Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com **ITB8032**

Inc.

Representing Symbolic Pictures Using Iconic I-1

Chin-Chen Chang and Yung-Kuan Chan National Chung Chen University, Taiwan

Annie Y. H. Chou and Wei-Pang Yang National Chiao Tung University, Taiwan

2D-string and 2D H-string are commonly used to describe the spatial relationships among the objects of a picture. This chapter introduces a new data structure, called N-string, to characterize the spatial information of the objects on a picture. The N-string is isomorphic to the 2D H-string in postfix notation. Algorithms for transformations between symbolic pictures and N-strings are developed as well. In addition, this chapter also provides an efficient method for image matching based on the N-string representation. This chapter shows that in most cases the storage space needed by N-strings is less than that by 2Dstrings, too. Besides, the experimental results show that N-strings are superior to 2D-strings. Hence both N-string and 2D H-string in postfix notation are good for representing symbolic pictures. That is, both N-string and 2D H-string in postfix notation are good for iconic indexing of pictures.

INTRODUCTION

Much attention has been paid to the design of picture database over the past few years. Similar picture retrieval is an important task in many picture database applications, such as office automation, multimedia, computer-aided design and medical picture archiving. Spatial similarity retrieval is to seek the pictures satisfying a certain picture query based on the spatial relationships among the objects of a picture. An object represents an entity on a physical picture, which is recognized by some pattern recognition techniques. A symbolic picture consists of a set of objects, each of which is attached with a symbolic name. The centroid coordinates of the objects with reference to the picture frame are extracted as well. The symbolic picture offers an efficient and compact way to construct a physical picture and also an ideal one to describe a picture query. By searching for the logical pictures, the corresponding physical pictures then can be retrieved and displayed. Therefore, similar picture retrieval can be simplified to the search of symbolic pictures.

This chapter appears in the book, Design and Management of Multimedia Information Systems: Opportunities and Challenges by Syed Mahbubur Rahman. Copyright © 2001, Idea Group Publishing.

Techniques of iconic indexing by spatial constraints originated from the 2D string representation (Chang et al., 1987). In the representation, objects and their spatial relationships in a picture are characterized by a spatial data structure, that is a 2D string. A picture query can be specified as a 2D string too. The problem of similar picture retrieval then turns out to be the matching of 2D strings. This representation allows an efficient and natural way to construct iconic indices for pictures. Subsequently, a great number of other picture representations popped out derived from the 2D string, such as 2D G-string (Chang et al., 1989), 2D B-string (Lee et al., 1992), 2D C-string (Hsu et al., 1998a) and 2D H-string (Chang et al., 1988a), etc.

This chapter will review two data structures, 2D-string and 2D H-string, which are often discussed by many researchers. In addition, this chapter will present a new representation, N-string, which is obtained by scanning the symbolic picture according to an N-order. This chapter also develops some algorithms to support iconic indexing by N-strings. In most cases, the storage space required by the N-strings is less than that by 2D-strings. The experimental results show that the N-strings are superior to 2D-strings, too. This chapter is organized as follows. We briefly reviews the 2D-string and 2D H-sting. Then we introduce the N-string representation. Picture reconstructions from the N-strings are illustrated in the next section. We then devote the next section to some picture matching problems. Following that, the storage of N-string is analyzed. In the next section we then show the experimental results and compare N-strings with 2D-strings. The conclusions are given in the last section.

THE 2D-STRING AND 2D H-STRING

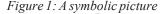
An $m_1 \propto m_2$ symbolic picture f, such as the picture in Figure 1, can be regarded as a mapping $X \propto Y \otimes Z^{\vee}$, where (x, y) denotes a two-dimentional spatial location for x X, y Y, $X = \{1, 2, ..., m_1\}$, and $Y = \{1, 2, ..., m_2\}$. Here, V is a set of symbols each of which is specified as follows:

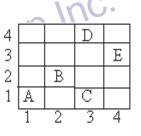
$f(1, 1) = \{A\},\$	$f(2, 1) = \{ \},\$	$f(3, 1) = \{C\},\$	$f(4, 1) = \{\}$
$f(1, 2) = \{ \},\$	$f(2, 2) = {B},$	$f(3, 2) = \{ \},$	$f(4, 1) = \{ \}$ f(4, 2) = \ \ \
$f(1, 3) = \{ \},\$	$f(2, 3) = \{ \},\$	$f(3, 3) = \{\},$	
$f(1, 4) = \{ \},\$	$f(2, 4) = \{ \},$	$f(3, 4) = {D},$	$f(4, 4) = \{ \},\$
4 401	11 1 5	117.1	

where the empty set $\{\}$ denotes a null object. With such a representation, one can derive the spatial relationships among the objects on the symbolic picture f. For instance, the object D is at the north of the object C, and the object E is at the northeast of object A.

Chang et al. (1987) proposed a data structure, called 2D-string, to represent a symbolic picture. Let R be the relation set $\{=, <, :\}$, where each element in R is a special symbol not in V that is used to exactly relation

in V that is used to specify the spatial relationship between two objects. Here, "=" represents the spatial relation "at the same location as," "<" denotes the spatial relation "to the west of or the south of" and ':' indicates the relation "in the same set as." A 2D-string over V≈R is represented as $(O_1x_1O_2 \dots x_{n-1}O_n, O_{p(1)}y_1O_{p(2)} \dots y_{n-1}O_{p(n)})$, where O_1, O_2, \dots, O_n are the symbols over V, p is a permutation from $\{1, 2, \dots, n\}$ to itself, and $x_1, x_2, \dots, x_{n-1}, y_1, y_2, \dots, y_{n-1}$ are the relations





14 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-

global.com/chapter/representing-symbolic-pictures-using-

iconic/8116

Related Content

An Improved Arabic Handwritten Recognition System using Deep Support Vector Machines

Mohamed Elleuchand Monji Kherallah (2016). *International Journal of Multimedia Data Engineering and Management (pp. 1-20).* www.irma-international.org/article/an-improved-arabic-handwritten-recognition-system-using-

deep-support-vector-machines/152865

Context-Based Scene Understanding

Esfandiar Zolghadrand Borko Furht (2016). *International Journal of Multimedia Data Engineering and Management (pp. 22-40).* www.irma-international.org/article/context-based-scene-understanding/149230

A New Framework for Interactive Entertainment Technologies

Guy Wood-Bradley (2009). Encyclopedia of Multimedia Technology and Networking, Second Edition (pp. 1061-1065).

www.irma-international.org/chapter/new-framework-interactive-entertainmenttechnologies/17517

OTT and Live Sports – Indian Premier League 2023 and its Impact on the Future of Sports Broadcasting in India

Josraj Augustine Arakkaland Preetha Menon (2024). *Exploring the Impact of OTT Media on Global Societies (pp. 272-283).*

www.irma-international.org/chapter/ott-and-live-sports--indian-premier-league-2023-and-itsimpact-on-the-future-of-sports-broadcasting-in-india/340647

Multiresolution Wavelet Transform Based Anisotropic Diffusion for Removing Speckle Noise in a Real-Time Vision-Based Database

Rohini Mahajanand Devanand Padha (2020). *International Journal of Multimedia Data Engineering and Management (pp. 1-14).*

www.irma-international.org/article/multiresolution-wavelet-transform-based-anisotropic-diffusionfor-removing-speckle-noise-in-a-real-time-vision-based-database/247124