IMAGE RETRIEVAL
BY CONTENT MEASURE METADATA CODING

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ABSTRACT

Many image collections contain few or no index terms. To search these collections, a battery of techniques known as Content Based Image Retrieval (CBIR) is used. With CBIR, the user need identify only an image exemplar. The exemplar is processed to extract content measures such as greyscale, lines, and edges. These measures are matched against a database of identical measures for a collection and the results returned to the user. The matching process between image search example and stored image content measures is complex and requires sophisticated data management support. In this paper, image content measures are encoded as metadata tags for the images, and included in the html image header. The support requirements are eliminated. Searching is simplified. Image content index measures are conveniently carried along with the image in an html wrapper. Collections demonstrating the technique are WWW available. Image processing and search software is available without copyright or fee from the author.

Keywords

Image retrieval, image processing, image management, metadata, content based image retrieval

1. CBIR and CONTENT RETRIEVAL

By now, many are familiar with the basic features of the several widely used content based image retrieval (CBIR) products. One of these, Virage, uses row, column sampling for image retrieval. Another two, Excalibur and QBIC-(IBM), use image decomposition techniques. Excalibur and IBM also use these techniques for scene analysis of moving image documents. Moreover, there exist hundreds of important areas (e.g., landsat imagery, engineering diagrams, trademarks, etc.) where CBIR performs well.

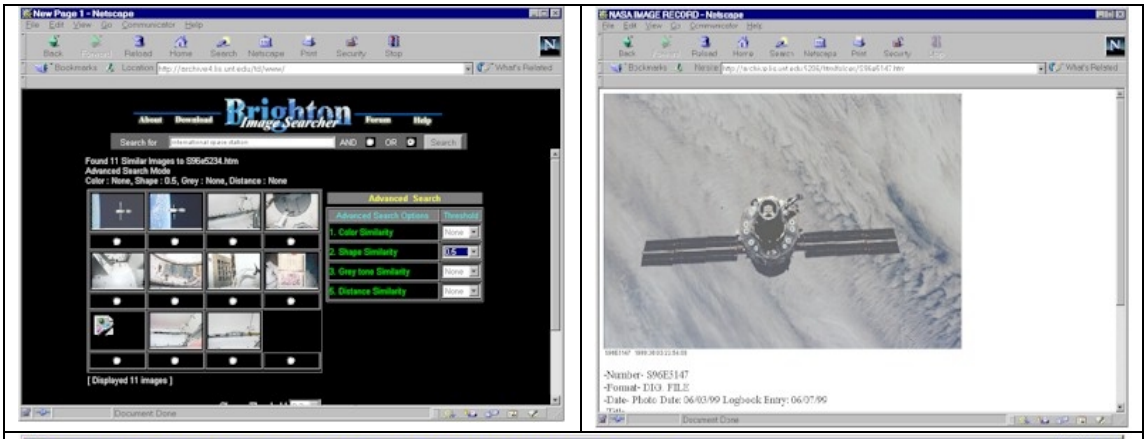
CBIR owes it origins to the seminal work of David Marr who was first to note that primitive image features, such as lines, edges, angles, greyscale, RGB, spatial proximity, etc, were adequate for a machine to extrapolate meaning sufficient for limited image understanding, pattern matching, and retrieval. Although many such primitive measures are possible, there is no set of optimal ones that lead to perfect retrieval. Rather, it is the case that more measures tend to work better than a few, and that, in any case, all such measures must be invariant over image operations such as rotation and inversion .

In a typical procedure, pixel values from an image are placed in histogram intervals. For example, greyscale values for an image would be placed in histogram intervals from 0-255. The histogram is then stored in a DBMS, and is "searched" by comparison of the histogram values of an exemplar image extracted in the same manner with the stored values. The major efficiency drawback to this technique is that the extracted image information is considerable, and must be stored separately from the image in a separate file typically linked to the image source by a DB pointer.

In the procedure of this paper, histogram values are converted to a single value using a technique known as a Lorenz Transform (LT) [1]. In an LT, the shape of the histogram values are recorded through differentiation, and thus reduced to a single number. These numbers may then be recorded as metadata name tags illustrated in Figure 1.

The retrieval algorithm is thus to compare for each tag of the exemplar image, the absolute difference between the first value (e.g. greyscale) of the image collection, stopping the search when a user established threshold has been reached. Moreover, since the tag values are grouped (as shown in Figure 1), different thresholds may be established for different classes of measures such as color or shape.

The image processing software and search system may be obtained from the author through an email request.



Source of: http://archive.lis.unt.edu:5206/htmlfolder/S96e5147.htm - Netscape

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</head>
<body>
<p><img border="0"src="http://archive.lis.unt.edu:5206/sts96i/S96e5147.JPG"></p>

<p>-Number:-        S96E5147<br>
-Format-        DIG. FILE<br>
-Date-          Photo Date: 06/03/99   Logbook Entry: 06/07/99<br>
-Title-<br>
 ISS as seen during fly-around<br>
-Keywords-<br>
 INTERNATIONAL SPACE STATION  STS-96<br>
-Text-<br>
 View of the International Space Station (ISS) - from the Node 1/Unity module<br>
 end - as seen during the fly-around of the STS-96 orbiter Discovery aft<br>
 undocking. A cloudy Earth forms the background (5146-7). A deep blue Earth<br>
 forms the background for this view of the ISS as seen during fly-around<br>
 (5148).<br>
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Figure 1: The three frames above record (a-upper left) a retrieval session page for the image searching system, (b-upper right) a single image chosen by double clicking on an image of the Hubble Space Telescope from (a), and (c-below) the metadata tags for the twelve measures used in this system.

2. NOTES and REFERENCE

A. This research was supported by Intel Corporation.

B. The system in Figure 1 for NASA imagery is available at <http://archive4.lis.unt.edu/td/www>. Searches proceed in two stages with this system. In stage one words are used to select a group of candidate images. From these images, one may be chosen as the exemplar for content searching.

C. An alternative collection is of trademarks is also available at <http://archive4.lis.unt.edu/bis/logo>.

[1] Chang, S.K., Liu, S.H. (1984) Picture Indexing and Abstraction Techniques for Pictorial Databases. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, l984;6(4):475-483. ISSN: 0162-8828.