Chapter 1.12
Emergence Index in Image Databases

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INTRODUCTION

Images are generated everywhere from various sources. It could be satellite pictures, biomedical, scientific, entertainment, sports and many more, generated through video camera, ordinary camera, x-ray machine, and so on. These images are stored in image databases. Content-based image retrieval (CBIR) technique is being applied to access these vast volumes of images from databases efficiently. Some of the areas, where CBIR is applied, include weather forecasting, scientific database management, art galleries, law enforcement, and fashion design.

Initially image representation was based on various attributes of the image like height, length, angle and was accessed using those attributes extracted manually and managed within the framework of conventional database management systems. Queries are specified using these attributes. This entails a high-level of image abstraction (Chen, Li & Wang, 2004). Also there was feature-based object-recognition approach where the process was automated to extract images based on color, shape, texture, and spatial relations among various objects of the image.

Recently combining these two approaches, efficient image representation and query-processing algorithms, have been developed to access image databases. Recent CBIR research tries to combine both of these above mentioned approach and has given rise to efficient image representations and data models, query-processing algorithms, intelligent query interfaces and domain-independent system architecture.

As we mentioned, image retrieval can be based on low-level visual features such as color (Antani, Rodney Long & Thoma, 2004; Deb & Kulkarni, 2007; Deb & Kulkarni, 2007a; Ritter & Cooper, 2007; Srisuk & Kurutach, 2002; Sural, Qian & Pramanik, 2002; Traina, Traina, Jr., Bueno, & Chino, 2003; Verma & Kulkarni, 2004), texture (Antani et al., 2004; Deb & Kulkarni, 2007a; Zhou, Feng & Shi, 2001), shape (Ritter & Coo-

per, 2007; Safar, Shahabi & Sun, 2000; Shahabi & Safar, 1999; Tao & Grosky, 1999), high-level semantics (Forsyth et al., 1996), or both (Zhao & Grosky, 2001).

But most of the works done so far are based on the analysis of explicit meanings of images. But image has implicit meanings as well, which give more and different meanings than only explicit analysis provides. In this paper we provide the concepts of emergence index and analysis of the implicit meanings of the image which we believe should be taken into account in analysis of images of image or multimedia databases.

BACKGROUND

Concepts of Emergence

A feature of an image which is not explicit would be emergent feature if it can be made explicit. There are three types of emergence: computational emergence, thermodynamic emergence and emergence relative to a model (Cariani, 1992). We would use the latter one in our chapter.

Whenever we shift our focus on an existing shape, in other words an image, new shape emerges. The representation of the new shape is based upon our view of the original shape. The new shape emerges as we change our view of the original shape. This is the most important idea of emergence. Two classes of shape emergence have been identified: embedded shape emergence and illusory shape emergence (Gero, year unknown; Gero & Maher, 1994). These procedures could be based on geometrical, topological, or dimensional studies of the original shape.

Model of Emergence

To extract emergent shape from an image, first we have to destroy the original shape of the image. This would give us an unstructured image. Now we take the unstructured image and find out the

extra or implicit meaning out of it, in addition to the original meaning, and this process gives rise to emergent image with implicit meaning making explicit and emergent image would be generated. This can be defined in a model as follows (Gero & Yan, 1994):

Definition of Emergence Index

Image retrieval where the hidden or emergence meanings of the images are studied and based on those hidden meanings as well as explicit meanings, where there is no hidden meaning at all, an index of search is defined to retrieve images is called emergence index.

When images are retrieved based on textual information then various parameters and descriptions might define the input and the images of the database. Whenever there would be symmetry of parameters and descriptions, the image could be retrieved. As mentioned earlier, in CBIR, color,

Figure 1 . Model of emergence
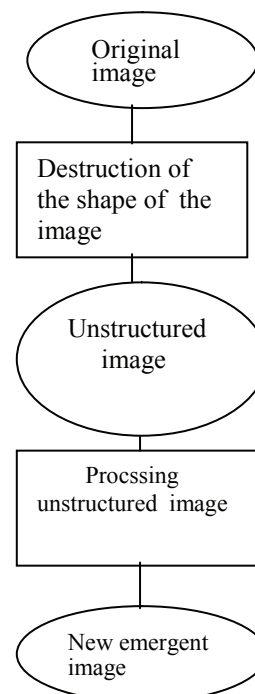
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