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Review

Application of Semantic Image Analysis to Intelligent Image Retrieval

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ABSTRACT

The field of computer vision is seeing unprecedented growth, and one of its most fascinating subfields is image interpretation and analysis. The effective analysis and retrieval of semantic images is made possible by modern computer vision techniques and technology. Images, estimating formulas, and sample densities are the main topics of image analysis. When we do semantic level image analysis, we can automatically extract descriptions of images based on how humans see them. This helps to close the semantic gap between basic visual characteristics and the abstract ideas that capture their meaning. The content of images, particularly significant objects inside them and the relationships between them, is the primary source for retrieving crucial semantic picture information. We begin with an analysis of the image's content in light of semantic concepts, then build a database and knowledge base for images based on their semantic content and retrieval, and finally present and modify the database and knowledge base for the purpose of knowledge delivery. Image retrieval performance and accuracy are both enhanced according to the experimental results.

INTRODUCTION

A processing approach known as "image analysis" examines pictures in order to extract useful information from them. There are significant differences between image processing and image analysis [10]. One way to look at image analysis is as a challenge with estimating parameters or direct measurement in picture transformation.The research involves examining the correlation between sample frequency, measurement precision, and parameter estimate formulae. One kind of analysis that may automatically extract valuable information from images is digital image analysis. Improved and more human-perceived access to picture databases, content filtering and summarization, improved human-computer interaction, etc. are all benefits of semantic image analysis. Several application sectors rely on image analysis, including medical imaging, search engine optimization, and space exploration.

Types of image analysis that are fundamental

We will keep things simple by dividing image analysis into two main camps: computer image analysis and human visual cortex based image analysis.

Computer vision system for analyzing images

As humans, we excel at extracting more abstract information from images. Numerous fields rely on human image analysts, including healthcare, homeland defense, and remote sensing. Many image analysis technologies, such edge detectors and neural networks, take their cues from human visual perception models, which are known to be an outstanding image analysis apparatus.

Analysis of Computer Images

With the rapid and extensive advancement of internet technology and computerization in recent years, there is a growing demand for precise image processing and analysis methods. This is because pictures may be used in many scientific and industrial contexts with the right semantic information extracted from them. Pattern recognition, digital geometry, and signal processing are heavily used in computer image analysis, which encompasses medical imaging and computer or machine vision. There are two subfields within computer vision analysis: digital vision and object based vision. It is a way to describe digital pictures, either in two or three dimensions, quantitatively or qualitatively [7].

1.2. Image Analysis in Practice

There is a wide spectrum of image processing applications in the biomedical industry, from scanning basic barcode tags to more complicated medical image diagnostics. Digital image analysis is finding more and more uses in all sorts of scientific and industrial contexts [10]. Some examples include medical applications (e.g., cancer detection in MRI scans), microscopy (e.g., germ counting in swabs),

remote sensing (e.g., intruder detection in a house and the creation of land cover/land use maps), astronomy (e.g., calculating a planet's size), materials science (e.g., checking for cracks in a metal weld), machine vision (e.g., automatically counting items in a factory conveyor belt), security (e.g., detecting a person's eye or hair color), robotics (e.g., avoiding obstacles when navigating a vehicle), a variety of fields, including optical character recognition (OLPR), assay micro plate reading (AMPR), metallography (MSR), defense, filtering, and automated license plate detection (ALPD).

2. Related work

Recent related research in the field of image analysis, including topics like embryogenesis image analysis, automated image analysis tools, and multiscale mode in image analysis, is the main emphasis of this section.

By integrating techniques from medical imaging and cancer modeling, we have developed a multiscale mode for brain tumor image analysis [21]. An strategy using registration algorithms is suggested, which involves applying a healthy brain atlas to magnetic resonance images of patients with tumors, followed by a healthy atlas and a pathologic patient picture. The purpose of this study is to develop a framework for automated image analysis that is particular to the field of uterine cervix cancer detection [17]. One application of medical image analysis methods is the viewing and analysis of medical the correct manner for images [18]. The suggested method builds its image processing algorithms in MeVisLab, a well-known graphical data-flow designer. Developing embryos Using a novel categorization of the 3D+t structural components, 3D+t morphological processing makes use of image analysis to directly analyze 3D+t picture sequences using mathematical morphology operators [19]. The examination of 3D+t datasets is the exclusive domain of a number of image analysis techniques, including filtering, tracking, and segmentation. Noncontact measurements of irregularly shaped pictures captured with a single camera on a smartphone or tablet are made possible by an image analysis method [20]. The suggested method for analyzing images makes use of feature tracking, a proprietary sensor fusion including inertial sensors, and depth computation with autofocus data.

3. Advanced developments in Image analysis

An automated kiwifruit counting system, a system for detecting and classifying cocci bacteria, a system for processing Brightfield microscopy videos, a system for automatically grading beef steaks, a system for quickly diagnosing crop growth and development, and many more recent and advanced advancements have all been made in the image analysis field.

The automation of industrial processes has made extensive use of image analysis methods for sensing light intensity and reconstructing phase maps throughout the past few decades. Using image analysis methods, digital cameras record changes in interference colors and RGB profiles [2]. The authors use a minimal distance classifier based segmentation algorithm, three basic counting methods, and digital image analysis techniques to construct an automated kiwifruit counting system [5]. Digital microscopic cell photos of various cocci bacteria may now be automatically identified and classified using a program built employing image analysis methods, K-NN and Neural Network classifiers [6]. Brightfield microscopy and persistent staining improve three-dimensional measurements. Automated and efficient digital image processing methods are used to process brightfield microscopy movies [7]. Automatic grading of beef steaks is achieved by the use of digital image analysis methods [8]. Object boundary recognition, particularly for objects with very non-conformal geometries in digital photos with a lot of noise, was accomplished here using an image analysis approach. For rapid diagnosis of crop development and growth, image analysis shows promise. Estimating crop canopy parameters is one agricultural use of digital image analysis technology [12]. By precisely distinguishing the cotton canopy and background pixels, image analysis methods are used to determine the biomass and leaf area index.

4. Proposed image retrieval system with semantic image analysis

Segmentation is the first step in image content analysis. It involves breaking the picture down into its component parts. Clustering follows segmentation; it involves grouping elements and clusters into distinct groups within each segment and then giving each group a semantic word. In order to get a suitable numeric value for each semantic word, examination of real fragments is performed once the appropriate fragment or fragments have been assigned to each term. We conclude by creating suitable semantic networks, as well as partial semantic functions and values. The evaluated picture is given a final semantic function together with its semantic value. Parts of the picture and the full thing are made using clusters. When creating and updating picture databases or doing semantic analysis of image material, it is common practice to use a combination of many image processing methods. Image semantic pixel data, semantic feature data, and semantic fact and figure data were mined using semantic content analysis.

In semantic networks, each picture, pixel, and feature is described orally. details that are saved in a database of semantic feature images. Semantic networks are essentially picture describing or segmentation based auxiliary aids. The object's pixel and feature information from the picture segment is used. Meaningful picture objects and their interrelationships primarily provide the essential semantic information needed to deduce picture content. These things could have strong ties to certain segments that are used for analyzing images at different scales. The field of Fractal Net Evolution brings together knowledge of object orientation with the fractal structure of the universe. Semantic feature information, fact and figure information, and pixel information are the three forms of semantic data presented by each item. Using semantic information as a foundation, fuzzy-logic classifiers are used to classify the extracted items from the images. A system for encoding image data at various resolutions using a hierarchical network of picture objects. Clusters and gasps are the two structural units that each segment uses to store its own semantic information, and partial semantic functions quantify the semantic content of each segment. Images are assessed for their semantic information capabilities using their ultimate semantic function. The

content of a picture, including its segments, clusters, and gasps, may be described using natural language. Fragments of text or semantic networks of information and facts closely associated to the units of an image's structure make up a natural language text about images. By maintaining relationships among these records and facts about image information, the information and facts included inside picture segments are compiled into suitable records or documents. The responsibility for maintaining these relationships between records and facts lies with a semantic feature image knowledge base.

Retrieval and indexing

User fired query to proposed system in the form of query image, feature of query image are extracted using proposed semantic image analysis techniques which are compared with image features stored in semantic feature image knowledge base and retrieved set of relevant images which are further indexed on the basis of relevance feedback.

5. Result

We have implemented a semantic image analysis technique for image retrieval system based on image content. Experimental result shows improved in retrieval performance by utilizing large data set. Proposed system take input in the form of image query as shown in fig. 2(a) and output in the form of set of relevant images as shown in fig. 2 (b). For evaluation of performance, different parameters are used such as precision, recall, rank and f-measure. F- measure is used to calculate accuracy of image retrieval. Precision is the percentage of retrieved images that belong to set of relevant images and recall is the percentage of relevant images covered by the retrieved images. Fig. 3 shows precision and recall curve and Table 1 shows image retrieval result evaluation of proposed system using precision, recall and f-measure. We need to modified feedback strategies in order to improve result and again need to exercise online large image datasets.

6. Conclusion

To improve the efficiency of image retrieval systems, we provide a framework for semantic analysis of images in this research. First, you need to analyze the picture's content using semantic ideas. Then, you may build an image database or knowledge base based on the content's semantics. Lastly, you can use this database or knowledge base to give information or knowledge. Image analysis is crucial in several fields, including agriculture, medical diagnostics, and search engines. Results from experiments demonstrate that semantic content analysis of images increases the recall and accuracy of image retrieval systems.

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