Content Based Image Retrieval Using Wavelet Transform

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Abstract

The recovery of images based on content, a technique that uses visual content to search for database images as per the user's demand. Content-based image retrieval is a method of computer vision for the problem of retrieving images from the search for digital images in very large databases. In this document, proximity measures effectively calculate the similarity between images to improve the search for similarities in CBIR. However, according to this study, there is a limitation regarding the accuracy level of the recovered images. To eclipse these limitations, the study proposes an improved technique for controlling similarity in CBIR. The general motive of this study is to develop an improved method for the search of similarity in CBIR. The Discrete Wavelet Transform and Convolutional Neural Network are the two techniques which we will be using for efficient retrieval of images.

Keywords: *CBIR, DWT, CNN.*

I. Introduction

With the development of the Internet and the availability of image capturing devices such as image scanners, digital cameras and the size of the collection of digital images is rapidly increasing. Users require different search tools, search and retrieval of electronic client images, including remote sensing, fashion, publications, medicine, architecture, etc. To this end, systems with many general-purpose image recovery have been developed.

Text-based and Content-based are the two main frameworks for CBIR. There are two limitation to the text-based approach. The first problem is that human labor is required for entering the search information. The second problem is due to the subjectivity of human perception with the inaccuracy in the annotation. Content-based image retrieval (CBIR) was introduced to overcome these limitation in a text-based recovery system,

An image retrieval system provides a best way to access, explore and recover similar result in the application in real time [7]. This system gives a set of images from image collection in the database to satisfy the users' demand with similarity evaluations, such as the similarity of the content of the image, the similarity of the border pattern, the similarity of color, etc. [11]. In the image retrieval based on content, the contents of the visual images are represented as image entities that are extracted using the feature extraction method that is performed automatically. The recovery of images on content involves two steps, feature representation and similarity measures. The extraction of the characteristics of the image is usually done in the low-level characteristics of the image, such as color, texture and shape. The next step is the measurement of similarity. Due to well-known semantic gap that exists between high-level semantic concepts perceived by human and low-level image pixels caught by machines, CBIR remains to be a difficult problem. To fill this gap, Machine learning is one promising technique in the long term [12]. One important technique is known as deep learning. CNNs are used to generate feature representation.

II. Related Work

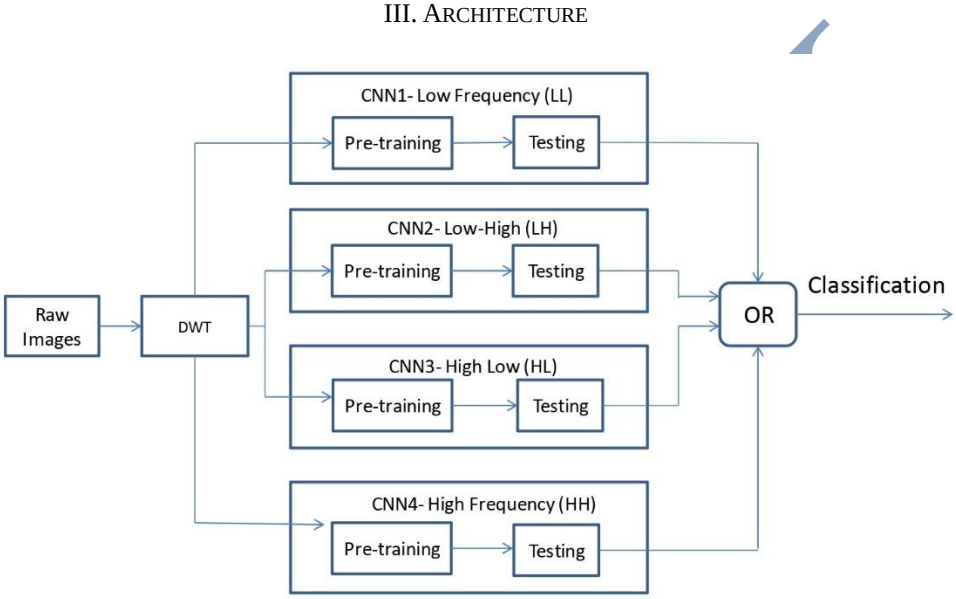
This section explores the various techniques for content-based image retrieval (CBIR).

Yinghui Zhang et al. [1] proposed a technique to identify the disease using the Gray Level Co-occurrence Matrix along with the histogram. According to this technique, the images of the area of interest of a patient present with the complete series of the image of a previous patient can be compared to diagnose the disease. S. Rubini et al. [2] addressed a technique for establishing color characteristics using the Color Design Descriptor and the use of these feature vectors for similar images is retrieved for greater efficiency. According to the observations, the color characteristics gave approximately similar results with a much shorter execution time compared to an individual approach.

Chintamani Chavan et al. [3] discussed a technique that provided Magnitude Fusion and modified block truncation coding using cloud computing by retrieving content of the images (CBIR). In this review article, Stanisław Deniziak et al. [4] addressed a new method for image retrieval that is based on two ideas: an object representation and matching algorithm. Here the new CBIR algorithm was presented, which uses the query in an approximate way.

V Ramya et al. [5] noted that among all grouping techniques, K-Means is the most commonly used grouping method in the process of content-based image retrieval. K-Means performs effectively and reduces execution time. Rehan Ashraf et al. [6] introduced a mechanism for automatic image retrieval. The characteristics of the images, such as color, histogram analysis and the discrete cosine transform, are used because they are robust and require less computing power.

III. ARCHITECTURE



"Content-based" means that the search will analyse the actual content of the image. The word "content" here refers to colours, shapes, textures or any other feature that may be derived from the image. Without the power to examine the content of the image, searches should be based on metadata such as titles or keywords, which can be tedious or expensive. The key function in the CBIR system (content-based image retrieval) is image segmentation.

The most common methods for image segmentation are based on color and texture. The color-based search suffers from the drawback that it groups the nearby elements as a part and, in general, ends by grouping two close, but different objects. The strategy based on texture, on the other hand, suffers a poor segmentation. The generic architecture of CBIR is as shown in the figure. The systems implement the CBIR algorithm following four basic stages: feature extraction, recovery approach, image comparison and relevance feedback [11].

• Feature extraction:

Media representation must acknowledge which features are most useful for representing media content and which ways can productively encode the attributes of the media. The features are usually extracted offline, so the efficient calculation is not a big problem, but large collections still need more time to calculate the features. The characteristics of the multimedia content can be classified into low and high-level characteristics [8].

1. Low-level features like the movement of objects, color, shape, texture, volume, power spectrum, bandwidth and tone are extracted from the media in the database. Characteristics at this level are derived objectively from the data rather than referring to any external connotation. The features extracted in this level can solve problems such as retrieving images with more than 20% of the distribution in blue and green, which could recover many images with blue coloured sky and green coloured grass. Many productive methods for the extraction of low-level features have been established for several purposes.

2. High-level features are also called semantic characteristics. It is assumed that high-level functions are concerned with semantic queries (for example, finding an image of water or searching for Mona Lisa Smile). The last query contains semantics of greater degree than the previous one. As the water in the images shows the homogeneous texture shown in the low-level features, this query is simpler to execute. To recover the last query, the recovery system

requires prior knowledge that can identify that Mona Lisa is a woman, that she is a specific character instead of other woman's painting.

• Retrieval approaches:

Once a decision has been made about the choice of visual feature set, the next concern is how to direct them towards accurate image recovery. A semantic categorization (for example, graphic - photograph, textured - non-textured) for the extraction of suitable characteristics followed by a measure of general similarity based on the region, allows a solid image match. An important aspect of this system is its recovery speed. The match measure, called CNN Classifier has been built for faster recovery using the grouping of region entities and the principle of highest similar priority. Another viewpoint in image retrieval has been the region-based query using homogeneous color texture segments called spots, rather than a picture-to-picture match.

• Comparison of images:

For the image comparison, normally used to measure similarity, the general method is to show the characteristics of the data as multidimensional points and then find the distances between the multi-dimensional points. The metrics selection has a direct impression on the performance of a recovery system. Euclidean distance is the commonly used metric to measure the distance of two points in multidimensional space. But, for some applications, this distance formula is not suitable with the similarity perceived by man. Many metrics have been developed for certain purposes.

• Relevance and learning comments:

Relevance Feedback is a query improvement technique, which originates in the retrieval of information that makes an effort to capture the precise needs of the user through repetitive feedback and refinement of the query.

• Query specification:

The query is used to find a set of results with content similar to the specified examples. Depending on the type of media, queries in content-based recovery systems can be designed for various modes (for example, query by sketch, query by painting(video and image), query by song (audio) and query for example). In the consultation process, users may be required to interact with the system to provide relevant feedback, a technique that allows users to rate the search results in terms of their relevance.

IV. METHODOLOGY

We will use 2 algorithms, DWT and CNN for the recovery of Images based on Content [10][13].

Discrete Wavelet Transform shows the signal in dynamic sub-band decomposition. The production of the DWT in a wavelet package lets sub-band analysis without the restriction of dynamic decomposition. The certain decomposition will be based on an optimization criterion. The DWT is based on the time scale representation, provides an efficient decomposition of multiple signal resolution sub-bands. It has become an efficient tool for signal processing and recognize numerous applications in several fields, such as audio and video compression, audio signal processing, image processing, etc. an important job in several image/video coding applications.

Convolution Neural Network is a type of artificial neural network where the individual neurons are blocked in such a way that they respond the regions which are over-lapping in the visual field. They are biologically-inspired invariant of Multi-layer Perceptron (MLP) which are designed for the purpose of minimal pre-processing. These models are widely used in image and video recognition. Compared to other feature extraction and classification algorithms, convolutional neural networks use relatively not much pre-processing. This means that the network is responsible for developing its own filters (unsupervised learning), which is not the case with other more traditional algorithms. The lack of initial parameterization and human intervention is an advantage of CNN. The main objective of this work is to profit from the performance of CNN and SVM but with the minimum of material and time resources.

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VI. CONCLUSION

CBIR is an important and progressively popular approach that supports in the recovery of image data from a large collection. The proposed system will consist of feature extraction, image recovery, image comparison and relevant comments. In our work, we will use the CNN for feature representation and we will use it to compare similarities. The algorithms that will be used are Discrete Wavelet Transform and Convolution Neural Network have the potential to perform efficiently in terms of average precision and recall values. The mentioned retrieval algorithm will minimize the computation time and increase user's interaction.

VII. REFERENCES

[1] Yinghui Zhang; Yantong Cui; Ruoci Ning(2018): Classification Of Biomedical Images Using Content-Based Image Retrieval System. IRJET-International Research Journal of Engineering and Technology Volume 5 Issue 2.

[2] S.Rubini; R.Divya; G. Divyalakshmi; Mr. T.M. Senthil Ganesan (2018): Content-Based Image Retrieval using Colour Descriptor. IRJET-International Research Journal of Engineering and Technology, Volume 5 Issue 3.

[3] Chintamani Chavan; Madhavan Dixit (2017): A Survey of Content-Based Image Retrieval using Cloud Computing. IJESC-International Journal of Engineering Science and Computing, Volume 7, Issue 6.

[4] Shailesh Kumar; Arun Kumar Shukla (2017): Design and Analysis of CBIR System using Hybrid PSO and K-Mean Clustering Methods. International Journal of Current Engineering and Technology, Volume 7, no. 2.

[5] StanisławDeniziak; Tomasz Michno (2016): Content-Based Image Retrieval using Query by Approximate Shape. ACSIS: Agents for Cooperative Secured Information Systems, Volume 8.

[6] R.K. Gupta; Kratika Sharma (2016): A Novel CBIR System using Adaptive K-means Clustering and Multi-Class SVM Classification. IJSART-International Journal for Science and Advanced Research in Technology Volume 1, Issue 6.

[7] V. Ramya (2018): Content-Based Image Retrieval System using Clustering with Combined Patterns. IJSRSCEIT International Journal of Scientific Research in Computer Science, Engineering and Information Technology, Volume 3, Issue 1.

[8] Aasia Ali; Sanjay Sharma (2017): Content-Based Image Retrieval using Feature Extraction with Machine Learning International Conference on Intelligent Computing and Control Systems.

[9] Lei Zhu; Jialie Shen; Liang Xie (2016): Unsupervised Visual Hashing with Semantic Assistant for Content-based Image Retrieval. Institute of Electrical and Electronics Engineers (IEEE) Transaction on Knowledge and Data Engineering.

[10] Rehan Ashraf; Mudassar Ahmed; SohailJabbar; Shehzad Khalid; Awais Ahmad; Sadia Din; GwangilJoen (2017): Content-Based Image Retrieval by Using Colour Descriptor and Discrete Wavelet Transform. Springer International Publishing.

[11] Nidhi Singhai; Shishir Shandilya (2010): A Survey on: Content Based Image Retrieval Systems. International Journal of Computer Applications Volume 4 – 2.

[12] Ruigang Fu; Yinghui Gao; Ping Wang (2016): Content Based Image Retrieval Based On CNN and SVM. Institute of Electrical and Electronics Engineers (IEEE).

[13] Ouhda Mohamed; El Asnaoui Khalid; Ouanan Mohammed; Aksasse Brahim (2019): Content-Based Image Retrieval Using Convolutional Neural Networks. Springer International Publishing.