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Research paper

Study of Different Features and Classifiers for Image Retrieval

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Abstract

With the advent of multimedia and imaging technology, lots of images sharing and uploading over the internet have been increased. It instigated development of potential image retrieval system to satisfy the requirement of mankind. The content-based image retrieval (CBIR) system retrieves the desired image by low level features similar to color, shape and texture which are not enough to explain the user's high level perception for images. Therefore reducing this semantic gap problem of image retrieval is challenging task. Some of the concepts in image retrieval are keywords, conditions or text. Conditions are used by human to explain their information need and it also used by system as a way to stand for images. Here in this paper different types of features their advantage and disadvantages are described.

Keywords: *Automatic image retrieval; Low Level features; Classification; Distances.*

1. Introduction

Due to the acceptance of amusing interacting and broadcasting administration websites large number of images is uploaded and aggregate on the internet are scaled. Users started tagging the images or attaching some concepts.

Some media administration websites such as Twitter, facebook, flicker, instagram and pinterest etc had made it habitual of administration and tagging images to users. So the expansion of the terrific retrieval arrangement to amuse the animal desires is appropriate in animosity of ample calibration of angel data.

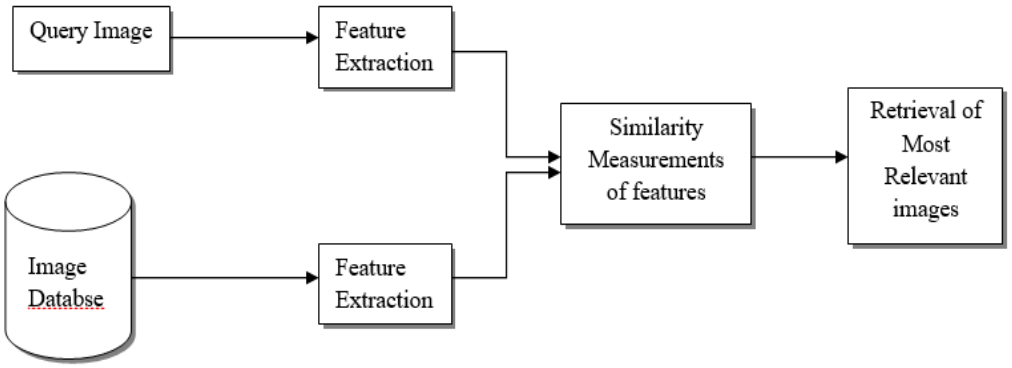

Fig. 1: Simple Image Retrival Flow

Picture recovery frameworks bring produced from content built picture recovery (TBIR) to content built picture recovery (CBIR). Done TBIR pictures would retrieved starting with those database built upon those quick connected with pictures. Same time to CBIR frameworks need aid dependent upon the visual properties of the pictures. It employments picture low level visual features for example, color, texture, shape, spatial majority of the data to recover pictures from huge set of database. Taking after fig. 1. 1 indicates the all stream of the CBIR framework. Low level offers concentrated to CBIR frameworks would not addition to portray the user's large amount discernment to that inquiry picture. Thusly those semantic whole issue may be arises clinched alongside picture recovery frameworks which is those befuddle between the client necessities Furthermore competencies of picture recovery frameworks. Mankind's way they decipher those pictures utilizing large amount offers for example, such that keywords, quick alternately tag co hosted will pictures. Same time CBIR framework employments low level offers with speak to the pictures. Subsequently semantic hole may be generally exists the middle of mankind's and picture recovery frameworks.

2. Problems on Image Retrieval Methods

CBIR methods are lack of human understanding due to which semantic gap problem is arises [2] [5] [6]. In real life different user or the same user can interpret the same image differently; below dissimilar conditions [8]. Therefore we can say that image can be

elucidate in several ways. Later we canister that the picture low level features cannot correctly represent the semantics of an image, since humans also interpret the same image in several ways and perception subjectivity problem is present in this type of system. Low level features do not wholly designate the image as compared to word or keywords related to image can.

Fig. 2: Tag Based Approach

Fig. 1.2 (a) shows that the users have their specific preference towards visually similar image and Fig. 1.2 (b) shows that the visually similar images are of different location are tagged with different keywords. So this Fig. conclude that the only visual features are not sufficient to user's perception for image retrieval system. If we also consider the keywords then it will give more accurate results.

On the other side only Context based image retrieval is not sufficient because if keywords related to image are wrong and not appropriate then false retrieval may occur also ambiguous keywords may cause problem to image retrieval systems. For Example consider the keyword "jaguar", jaguar would be a luxury car or it would be animal it totally depends on the particular user's intention which gives query to image retrieval system. So in this case context based image retrieval system cannot understand the user's perspective and false retrieval occurred [3] [4]. From these issues we can say that we have to develop the system which considers appearance little close structures as well as image big equal structures to efficient retrieval of images and for understand the human's perception behind query.

We can enhance the presentation of picture recovery system by combining to advantages of context based image similarity methods and CBIR. It will bond the semantic break among little equal structures and high level semantics. These types of methods can be used in various photo sharing and hosting website's search engines in which images are available with their tags. E.g. Flickr, Facebook, Instagram etc.

3. Different Techniques

With the increasing demands, many techniques and algorithms of automatic image retrieval are proposed and implemented. Techniques of feature extraction, classification and similarity measurement are briefly described in this section.

3.1. Feature Extraction

There are numerous characteristics to CBIR Be that four about them need aid acknowledged with make the fundamental offers. They would color, texture, state Also spatial properties. However spatial properties are implicitly taken under record thus those fundamental offers would color, composition What's more state [8]. For our recommended plan we need aid setting off to utilize color and composition features just since we need aid likewise acknowledging those picture connection i. E tags or keywords identified with pictures something like that there is no requirement with recognizing the shape features unequivocally.

3.2. Color Feature

Color image salvage is most rudimentary and greatest significant methods for CBIR. Color article is greatest basic and distinguishing visual feature. It is also important feature for understanding human insight for image colors. Comparing to other features color feature is very stable and robust. Most of the color features are not sensitive to revolution, conversion and measure change of images. Because of its usefulness, implementation plainness and small storage space requirements color features are used in almost all the CBIR systems.

3.2.1. Convolutional Color Histogram (CCH)

CCH is most widely used method to extract the color features of images. It describe the worldwide color distribution for images. Color histogram is a frequency statistic for different colors in color space. The color space needs to be divided in to several small ranges in order to compute the color histogram. Each interval is regarded as a histogram bin.

CCH is fast to calculate, store and compare. It is also insensitive to rotation, scale and translation of images. CCH describes the global distribution of color in image it cannot describe the local distribution of the image in color space therefore it is suited only for those image which are difficult to segment and which neglect the spatial locations [13].

3.2.2. Fuzzy Color Histogram

CCH is sensitive to small change in the image and also sensitive to noise in the images to overcome the disadvantages of CCH, FCH is proposed [11]. Projecting the 3D histogram in to one dimensional is called histogram linking. In FCH 3D histogram is reduced to one dimensional using histogram linking. In [11] fuzzy histogram linking approach is proposed for FCH.

This approach is based on the L*a*b color space, which approximate the color in the way that human perceive the color. Here L* stands for luminance, a* represents relative greenness-redness and b* represents relative blueness-yellowness. a* and b* components are divide in to the five regions. a* is divided into green, greenish, the middle component, reddish, red respectively. b* is divided in to blue bluish, the middle component, yellowish, yellow. L* represents the shades of the colors that is black, gray and white and is divided into three regions dark, dim and bright areas. The fuzzification of L*,a*, and b* is done using triangular shaped built in membership function (MF). The fuzzy linking of the three components (L*,a*,b*) is made according to 27 fuzzy rules which are given in [11] which finalize the output of the system.

3.2.3. Color Co-occurrence Matrix (CCM)

CCM extracts color feature of the image as well as direction of the texture in image. To extract CCM feature vector, first image is process and changed into four images of motifs of scan pattern into 3 × 3 window, This window can be further constructed into four 2 × 2 matrix. Fig. 2.2 shows four 2×2 grids. Based on this four matrixes the attributes of the image is computed with the motifs of scan pattern and CCM is obtained [10].

3.3. Texture based Feature

In this section various texture feature extraction techniques are discussed. Difference between Pixels of Scan Pattern (DBPSP), Histogram of Oriented Gradient (HOG), and Gabor Wavelet texture feature extractor is discussed in following section.

3.3.1. Difference between Pixels of Scan Pattern (DBPSP)

The CCM features discussed in previous section adequately narrate the direction of the texture but not complexity of texture. Fig. 2.4 shows that the sacn pattern of both (a) and (b) are same but the differences between the four pixel values are very large. DBPSP calculate the disparity between pixels of scam pattern, in this way DBPSP effectively describe the direction of texture as well as complexity of the textures.

3.3.2. Histogram of Oriented Gradient (HOG)

Swine characteristic characterizes the nearby object manifestation Furthermore state by edge course or the appropriation of nearby force level gradients [6]. Swine isolates that picture window under little spatial units as region, amass edge orientations over the pixels for every cell alternately an neighborhood 1-D histogram of gradient directions subsequently picture representable is structured Toward the joined histogram sections. It gives exceptional invariance to shadowing, brightening and so on.
HOG feature is widely used in application of object recognition and object detection. It accurately detects the shapes in images as well as objects in image. But it is sensitive to rotation and scale invariance.

3.3.3. Gabor Wavelet

Wavelet change gives a multi-resolution approach on composition dissection Also arrangement [10]. Gabor wavelet turns out should make exceptionally of service composition Investigation Also is broadly utilized. Gabor Wavelets would assembly of wavelets for which each wavelet catching the vitality toward a particular heading Also recurrence. So Gabor wavelet gives the neighborhood recurrence portrayal for pictures. Textures offers camwood be concentrated starting with these bunch from claiming vitality circulation. Those scales Furthermore introduction invariant property make Gabor wavelet to handy to constructing characteristic vectors [12].

3.3.4. Classification

We have studied several classifiers which are SVM, ANN and K Nearest Neighbor.

3.3.5. SVM (Support Vector Machine)

Backing vector machine (SVM) may be a regulated classifier done machine Taking in. Help vector machines need aid managed Taking in models with co-partnered Taking in calculations which may be dissect information What's more perceive examples. SVM provide for secondary adequacy in secondary dimensional information classifications, especially at the preparing dataset may be little. SVM camwood arrange straight also non-linear information through portion mapping. The profit about SVM contrast with different classifiers is that it accomplishes ideal population limits toward discovering those most extreme separation the middle of classes. SVM utilized under amount about arrangement issues like item recognition, quick arrangement Furthermore picture annotation [1]. The working about SVM classifier may be with discover a hyper plane starting with a preparation situated of specimens with differentiate them. Each preparation example is indicated for a characteristic vector and a class name. The hyper- plane may be figured out how On such an approach that it might differentiate the biggest parcel from claiming tests of the same population from the greater part other specimens [1]. SVM which will be known as a double classifier. The semantic concept(s) will be yield of the classifier. This yield will be utilized to picture annotation [1] [2].

3.3.6. ANN (Artificial Neural Network)

A counterfeit neural system (ANN) may be a Taking in system. An ANN might take starting with illustrations what more might settle on choice for another test. An ANN holds numerous layers about interconnectedness nodes, which would otherwise called neurons or recognitions. Hence, a ANN will be Additionally known as multilayer perceptron (MLP). The to start with layer may be the information layer over which the amount about neurons is equivalent to the size of the enter example. The yield layer did which the amount from claiming neurons may be equivalent to the number for classes [1]. The interfacing edges of the neurons would identifier Eventually Tom's perusing weights. Every neuron may be administered by an actuation capacity which generates outputs In light of interfacing edges and the past layers yield. ANN takes in the edge weights throughout that preparation. Yield neuron generates a certainty measure What's more greatest measure demonstrates the class for those test throughout the testing [2]. An ANN could be utilized for unequivocal arrangement from claiming images, areas alternately pixels, likewise utilized to understood duty for fluffy choices with respect to pictures. Those profits of neural system is that those outputs from claiming yield layer neurons need aid decided by those past layers and the interfacing edges. It doesn't have any desire whatever available parameter tuning or at whatever supposition over the characteristic dissemination [1].

3.3.7. Random Forest

Random Forests is only of the excellent technique for classification and regression. This classifier creates a set of decision tree from randomly selected subset of training set. One can classify large number of dataset with the help of this algorithm. It is based on group of the tree-structured classifiers. The tree is build with the facilitate of the arbitrary values sampled and the forest. The input is set at apex of the tree .The reduced set of data is sampled randomly. Random forests trees constructed in this algorithm helps in finding sample class.

3.4. Similarity Measurement

We studied several distance metrics such as ED (Euclidean Distance), CB (City block distance) and Manhattan Distance, Canberra Distance & Murkowski distance.

1) Euclidean Distance (EB)

Euclidean separation will be the greater part regularly utilized for similitude estimation for picture recovery due its effectiveness what's more viability. It measures those separation between two vectors about pictures Eventually Tom's perusing figuring the quadrangular origin of the complete of the former supreme contrasts and that one could a chance to be computed as:.

$$\Delta d = \sqrt{\sum_{i=1}^{n}(|Q_i - D_i|)^2} \quad (1)$$

2) Manhattan Distance (CB)

This affinity measures is additionally alleged the Manhattan distance. The Manhattan ambit metric has sturdiness for outliers. This ambit metric is figured with process the sum to whole changes amid dual affection courses of images and can be affected as:

$$\Delta d = \sum_{i=1}^{n} |Q_i - D_i| \quad (2)$$

3) Canberra Distance (CD)

The city square separation metric provides for an extensive worth to those two comparable pictures which make divergence between

comparative pictures. Along these lines each characteristic match Contrast may be normalized Eventually Tom's perusing isolating it Eventually Tom's perusing those entirety of cash of a pair from claiming features. Canaanite separation will be utilized for numerical estimation of the separation the middle of the inquiry Also database characteristic vectors Furthermore camwood a chance to be computed as:.

$$\Delta d = \sum_{i=1}^{n} \frac{|Q_i - D_i|}{|Q_i| + |D_i|} \quad (3)$$

The worth from claiming this strategy is orchestrated in rising request such-and-such the Main The majority indicates helter skater similitude. It needs comparability for city piece separation metric. It needs beneficial impact on the information which are spread around those beginning.

4) Murkowski distance

The comprehensive method of the space is defined as:

$$\Delta d = [\sum_{i=1}^{n} (|Q_i - D_i|)^p]^{\frac{1}{p}} \quad (4)$$

Where p is a positive integer.

Table 1: Comparative analysis of feature extraction and classification techniques

Technique	Advantages	Disadvantages
Color Feature		
CCH	Invariant to -Rotation -Translation -Scaling Fast to calculate	-Loss of spatial information -Sensitive to noise variation High dimensionality
FCH	Invariant to -Rotation -Translation -Scaling -Profligate for compute, hoard and associate -Unresponsive to noise and contrast	-Loss of spatial information
CCM	-Detect the color direction pattern in the image.	-Only consider direction of texture but not the complexity of texture. -Sensitive to noise variation
Texture Feature		
DBPSP	-Detect the pattern of the color direction and complexity of texture by considering the intensity of colors in image.	-Sensitive to noise, scale, rotation and variation -High computation
HOG	-Accurately detect the object shapes in image	-Sensitive to scale and rotation variation.
Gabor Wavelet	Invariant to -Rotation -Translation -Scaling -Accurately detect the textures of the image also consider the spatial information.	-High computation cost
Classifiers		
SVM	-Classification accuracy is good -Required less memory -less Complex than ANN	-Sensitive to noisy data -Single labeling
ANN	-Robust to noisy data -Suitable for complex dataset	-Training cost is high -Single labeling
RF	-It reduces over fitting and is therefore more accurate. -Easy to Implement works with all types of data. -Multi classification Support.	-If the dependent variables are taken in to account in the model which are linearly related then it may not work. So correlated variables should be removed with the help of other techniques.

4. Conclusion

The objective of this paper is to discuss all the phases of automatic image retrieval features. This research provides a widespread study for feature extraction methods, classification methods and comparison measurement distances. Automatic image retrieval is a process for perceive scene feature after a photo and apportion to the corresponding classes. The feature extraction, classification and similarity measurement are used based on the size of the dataset. To overcome this issue and provide accurate retrieval of images we have proposed hybrid image retrieval system which is based on image low and high levels of features.

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