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A Survey of Content Based Remote Sensing Images

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Abstract: Content based image retrieval plays an important role in retrieving images from remote sensing image database. They are used in many applications. Satellites are increased rapidly in commercial application of remote sensing for available bandwidth. So remotely sensed image database also increases. For this purpose the effective texture descriptors are introduced here. It describes their important role in content based remote sensing images. They obtain a best retrieval score.

Keywords: *GLOH; SIFT; BOW.*

1. INTRODUCTION

The content based image retrieval consists of similarity measure and feature extraction methods. They are evaluated using texture descriptors. The descriptors are based on shape and spectral descriptions. The global and morphological descriptors are mainly describe in this paper. The coarseness and directionality is the important features in the textural images. When shape and spectral information are more then images are used for various field. Image retrieval are categorized in colour, texture and local geometry. Applications are search by association, target the search, category search. The images are broad and narrow. In broad image the gap between the feature description and semantic interpretation is wide. But for narrow images gap between feature description and semantic description are smaller. Colour image is a three dimensional domain. Gray level images are single dimensional domain. Colour is represented in RGB ,this is a best choice. The feature values preserve all information in images. It also discussed about driving force, heritage of computer vision, affect on computer vision, resemblance and learning, interaction, need for databases and problem of evaluation.[6]

2. DIFFERENT TECHNIQUES

2.1. Local Descriptors

Local descriptors are also called filters. The filters used here are law masks, Gabor filters, wavelet transforms, Discrete cosine transform, eigenfilters, linear predictors and optimized finite impulse response filters. Local descriptors are used to detect image regions for computing invariant descriptors. They are evaluated by comparing and identifiying the similar scenes. They are mainly used in many applications. Local descriptors are distinctive and robust to occlusion. They don't need segmentation. The gradient location and orientation

histogram (GLOH) is an expansion of SIFT descriptor. It increases the robustness and distinctiveness. GLOH is better than SIFT descriptors. Their computational complexity is more[3]. Large geospatial databases of remote sensing images are having higher resolutions. They are used in hazard monitoring, draught management, commercial land use planning, agricultural productivity, forestry, tropical cyclone detection, home land security and military usages. Features are bring out using image segmentations. The local binary pattern (LBP) and Local edge pattern(LEP) are local descriptors. Feature vector is used as index for retrieval. The feature analysis and indexing approach provides best efficiency performance.[8].

2.2. Details of Bag Of Visual Words

The bag of visual words employed for object based classification . It is caused by bag of words(BOW) method for text categorisation. Here the text document is encoded as a histogram of number of occurrences. The text did not considered the grammar and even word. The BOVW performance is better than spectral and texture features. It is nothing but low level features. For very high resolution images , it accurately describes the complex and composite objects .[9] By quantizing local image patches histogram of visual words are constructed using codebooks. The sub graphs are represented as visual words . It is using bag of words model. The graphs are transformed into vector space. It is using statistical classification of images. The classification is performed by support vector machines. Histogram subgraph is used for classifying complex scenes such as dense and sparse urban areas. [23] Spatial co-occurrence kernel (SCK) used with Bag of Visual Words(BOVW) can be evaluated using intersection between histograms and sum of SCK. It is a sum of two kernels. Spatial representation of SCK is supportive to non spatial information of BOVW and the Bag of Visual words combined with Spatial co occurrence Kernel is best when compared with overall dictionary sizes.[21].The feature vector length is reduced by BOVW. It process is to cluster the local descriptors into visual words. The visual descriptors are given as the input to the query image and according to that it calculate the similarity measures[26].

2.3. Latent Dirchlet Allocation

The semantic labelling of several images are considered. LDA is based on semantic classification of images. It uses simple attributes such as mean and standard deviation of pixel intensity values. It is an unsupervised statistical model. It improve the uniqueness of visual words. Unique spatial relationship was do not considered by bag of words method inherent to LDA.[10]

2.4. Purpose of Scale Invariant Feature Transform

Local features are well suited for aerial and satellite imagery. They are increased in spatial resolution. It permits more number of objects and spatial patterns. Latent invariant features are used for large collection of computer vision problems. They also used for detection and classification. The local property of features are robust in image analysis. Local image analysis used for corner and edge detection. SIFT(Scale Invariant Feature Transform) has three features they are translation ,rotation and scale invariant. The normal image features are having uncomplicated statistics, similar texture and colour histogram[22].

The scale invariant feature transform is used for object recognition system. SIFT convert an image into large collection of feature vectors. They are evaluated by staged filters. It produces efficient values. It is used for the benefit of inspection, registration and manipulation. In commercial system it depends on template matching. It is more accurate for pose determination and verification [11].

2.5. Benefit of Support Vector Machines Classification

Support vector machines used for hyper spectral images for spectral and spatial classification. In this image each pixels give a crucial information and lose spatial information's. They are related to physical nature of different materials. It sensors absorbs more than a hundred spectral bands [14]. The Content based image retrieval of hyper spectral system is the dictionary distance between two hyperspectral images by means of

their previously extracted dictionaries. It is extracted by using dictionary based compression such as LZW compression algorithm. The normalised information distance (NID)and normalised compression distance(NCD) are described. The normalised compression distance is a computable distance that approximate NID .The normalised information distance is an universal metric distance based on kolomogorov complexity. It is useful in pattern recognition problems. The cost problem is solved by approximating NCD using dictionaries extracted offline for each of database images[12].

2.6. Usage of Multimedia Information Retrieval

Here the content based method is to improve accuracy in retrieval. In this retrieval searching for a particular media item ,browsing and summarising a media collection are the two important methods. They share different similarities. Learning algorithm are used here for understanding the media collection on semantic level. They share different similarities. The problems are not solved clearly.[5]

2.7. Need for Content Based Image Retrieval

Its functioning, use of patterns, classification of pictures, important of semantics and sensory gap are described in detail. Image retrieval has colour, texture and local geometry. Applications are search by association, target the search, category search. The images are broad and narrow. In broad image the gap between the feature description and semantic interpretation is wide. But for narrow images gap between feature description and semantic description are smaller. Colour image processing is a three dimensional domain and major one in image processing Gray level images are single dimensional domain. Colour is represented in RGB is a best choice. The feature values preserve all information in images. It give detail about driving force, devise of computer vision, impact on computer vision, comparison , learning, database usage and evaluation problem[6]. For feature extraction different approaches are considered. The histogram, segmentation and edge detection based feature extraction. Histogram analysis of image extracted features in the form of bar graph. Segmentation is to segment the image into small images and the colours are extracted as features. In edge detection shape is detected by many techniques. Canny edge detection is one of the techniques [25] used to extract the features which is very hard to detect the shape. The combination of colour and shape features using fusion retrieve similar images for given image from image database[27],[29].The combination of low level and high level features gave best performance in content based face retrieval using histogram descriptors.[30].

2.8. Gabor filters in texture analysis

Gabor filters are used in texture analysis. It discussed about how it produce the orientation and scale selective filters by changing the modulation of Gabor functions. The Gabor filter bank output is used for the analysis of texture and remote sensing images. Gabor filters are the texture descriptors used for content based images.[7]

2.9. Signal Theory Methods in remote sensing

It give the detail of pattern recognition system. It is used for the analysis of various remote sensing images. It also gives the data analysis, hyperspectral analysis spectral feature design, noise in remote sensing system and requirements. It deals with optical remote sensing system and statistical approach. Remote sensing is used for gathering the information and maintaining the earth resources. Sensor systems are explained briefly including the factors that provide distorting influences in the collection of data.[13]

2.10. Hit or Miss Transform analysis

The hit or miss transform (HMT) is an effective morphological tool .Pixel changes can be detected by using Hit or Miss Transform. It constitutes the morphological approach to pattern matching. It is neither increasing nor decreasing so for gray level approach it is complicated. It is used for the detection of various templates, object and data of various colour images.[18]

2.11. Need for Binary Partition Tree

The representation of images based on binary partition tree (BPT) is studied. Here Optical and radar images are used. It provide quantity and quality of information that are available for many applications. The BPT is very flexible it can be applied to any type of images. Computational load is more for Binary partitionTree. It is used for many applications [16].

2.12. Analysis of Multivariate Mathematical Morphology

The mathematical morphology is introduced for binary images. It deals images according to its shapes. It also deals with digital image processing. It is used for multivariate images. They have Structuring Elements. [17]. Morphological attribute profiles(APs) deals with morphological profiles(MPs). It is very flexible tool for Remote Sensing images. They are applied for very high resolution images(VHR). The VHR images are very useful for the analysis of urban environment. The spatial information are extracted from this. They are evaluated using Morphological attribute profiles. These are nothing but attribute filters i.e. opening and thinning operators are used for binary first and then for gray scale. The computational complexity is reduced [4].

The noise is reduced using mathematical morphology[20]. Structural pixel information's can be extracted from directional morphology. The opening and closing are its two operators used for description of directions. The feature vectors are constructed using opening and closing operator. These are used effective for curved road segments[15]. Plant recognition is a veritable scientific and technical challenge. It is one of application for morphological descriptor. Contour covariance and extended circular covariance histogram are morphological descriptors. Contour covariance is used to characterize leaf edges by evaluation of morphological covariance. Extended circular covariance histogram evaluated the circular covariance histogram. Its combination with other descriptors gives best accuracy[19]. The mathematical morphology is a best method for remote sensing data classification. The morphological descriptors are best for texture descriptions[2]. The morphological filters used for the enhancement of medical images. So the edges in the image are more sharpen without noise[28].

3. BEST RETRIEVAL METHOD

The image retrieval is based on different approaches among them the Morphological descriptors are the best one. It is the best descriptors for content based remote sensing image retrievals.

Table 1
Best Retrieval Score of various Descriptors[1]

Descriptors	*Similarity Metrics (Bhattacharyya)*
Gabor	0.719
LBP	0.735
Morphological descriptors + Fourier Power Spectrum	0.575
SIFT[23]	0.617

Table 2
Best Classification rate for different approaches in percentage[21]

BOVW	*BOVW + SCK*	*Colour RGB*	*BOVW + SVM[9]*
76.8	77.7	76.7	93.12

Table 3
Best Error Rates for Morphological descriptors[24]

Shape Images	*Digits*	*Butterfly*	*Fish*
Error Rate	1.07	1.12	1.03

The combination of Bag of visual words and morphological descriptors extracted more features and they are the best for content based remote sensing image retrievals.

4. CONCLUSION

The morphological filters give best performance in texture based image retrieval when compared to other filters. It is suitable for very high resolution images. The Bag of visual words are the useful methods for image retrieval based on classifications. It also reduces the feature vector length. So computation time is better. The unwanted features are removed by morphological descriptors. Thus it reduces the computational complexity.

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