International Journal of Applied Engineering Research ISSN 0973-4562 Volume 12, Number 18 (2017) pp. 7132-7136

Survey of Methods for Effective Image Classification and Identification

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Abstract

This article highlights a brief survey of methods available for effective image classification. In order to improve the retrieval accuracy of content-based image retrieval systems, research focus has been shifted from designing sophisticated low-level feature extraction algorithms to reducing the 'semantic gap' between the visual features and the richness of human semantics. This paper attempts to provide a comprehensive survey of the recent technical achievements in high-level semantic-based image retrieval. Major recent publications are included in this survey covering different aspects of the research in this area, including glow-level image feature extraction, similarity measurement, and deriving high-level semantic features.

Keywords: Survey, Image Classification, Identification, SVM, mixture model, retrieval, gray level.

INTRODUCTION

The digital revolution across the globe, given a light for the development of methods for effective acquisition of images using multiple sources. Accordingly different models are generated for effective storage of these images. As the number of images is mounting, effective methodologies are therefore needed for identifying relevant images more precisely from this pool of data. Many authors have highlighted different techniques for the retrieval purposes. Most of the techniques are based on Data mining, Neural networks, feature extraction, SVM, edge based and statistical based models. The present article highlights some of the significant contributions made by the authors during 2000-2016 aimed towards classification of images and identification of relevant images. Finally, based on existing technology and the demand from real-world applications, a few promising future research directions are suggested.

LITERATURE REVIEW

Mari Partio et al (2000) have presented a paper on Rock Texture Retrieval Using Gray Level Co-occurrence Matrix. Now days, as the computational power increases, the role of automatic visual inspection becomes more important. The authors presented an application of gray level co-occurrence matrix to texture based similarity by considering rock images. Retrieval results were evaluated for two databases, one consisting of the whole images and the other with blocks obtained by splitting the original images. Retrieval results for both databases were obtained by calculating distance between the feature vector of the query image and other feature vectors in the database. Performance of the co-occurrence matrices was also compared to that of Gabor wavelet features. Co-occurrence matrices performed better for the given rock image dataset. This similarity evaluation application could reduce the cost of geological investigations by allowing improved accuracy in automatic rock sample selection.

Dengsheng Zhang et al (2002) presented an article "A Comparative Study of Three Region Shape Descriptors". In Content Based Image Retrieval (CBIR), shape is one of the primary low level image features. Many shape representations have been proposed. However, most of them assume the knowledge of shape boundary information which is not available in general situations. Among them, region-based shape descriptors are not only applicable to generic shapes, but also robust to noise and distortions. In this paper authors studied and compared three region shape descriptors: Zernike moment descriptors (ZMD), grid descriptors (GD) and geometric moment's descriptors (GMD). The strengths and limitations of these methods are analyzed and clarified. A Java frame retrieval framework is implemented to test the retrieval performance. The study and retrieval experiments on standard shape databases show that ZMD is the most suitable for shape retrieval in terms of computation complexity, compact representation, robustness, hierarchical coarse to fine representation and retrieval performance.

Nawei Chen et al (2004) highlighted an article based on "A survey of document image classification: problem statement, classifier architecture and performance evaluation". Document image classification is an important step in Office Automation, Digital Libraries, and other document image analysis applications. There is great diversity in document image classifiers: they differ in the problems they solve, in the use of training data to construct class models, and in the choice of document features and classification algorithms. Authors projected this diverse literature using three components: the problem statement, the classifier architecture, and performance evaluation. This brings to light important issues in designing a document classifier, including the

definition of document classes, the choice of document features and feature representation, and the choice of classification algorithm and learning mechanism. Authors emphasize techniques that classify single-page typeset document images without using OCR results. Developing a general, adaptable, high-performance classifier is challenging due to the great variety of documents, the diverse criteria used to define document classes, and the ambiguity that arises due to ill-defined or fuzzy document classes.

Jia Li *et al* (2004) have presented a paper on Studying Digital Imagery of Ancient Paintings by Mixtures of Stochastic Models. This paper addresses learning-based characterization of fine art painting styles. The research has the potential to provide a powerful tool to art historians for studying connections among artists or periods in the history of art. Depending on specific applications, paintings can be categorized in different ways. In this paper, authors focus on comparing the painting styles of artists. To profile the style of an artist, a mixture of stochastic models is estimated using training images. The two-dimensional (2-D) multi resolution hidden Markov model (MHMM) is used in the experiment. These models form an artist's distinct digital signature. For certain types of paintings, only strokes provide reliable information to distinguish artists. Chinese ink paintings are a prime example of the above phenomenon; they do not have colors or even tones. The 2-D MHMM analyzes relatively large regions in an image, which in turn makes it more likely to capture properties of the painting strokes. The mixtures of 2-D MHMMs established for artists can be further used to classify paintings and compare paintings or artists. Authors implemented and tested the system using high-resolution digital photographs of some of China's most renowned artists.

Thomas Lombardi (2005) presented a paper on " The classification of style in fine art paintings". This paper proposes a general approach to the classification of style that supports the tasks like recognize painting style, identify key relationship between styles, outline a basis for determining style proximity, evaluate and visualize classification results. The survey of color features revealed that preserving frequency and spatial information of the color content of a painting did not improve classification accuracy. A palette description algorithm is proposed for describing the color content of paintings from an image's color map. This algorithm performed well when compare to similar color features. Style description metrics are proposed as an evaluation technique for classification results.

Mauro Barni et al (2005) have presented a paper on "Image processing for the analysis and conservation of paintings: opportunities and challenges". There has been a greater focus on acquiring and processing art work images data for storage, transmission, representation, and analysis like material analysis, discovery and interpretation of ancient technologies, analysis of artist's environment and mutual relationships, better knowledge of conservation materials. It is also desirable to digitize the art work that facilitates a variety of applications. An important motivation for achieving high quality images is to provide accurate means of measuring the color across the entire surface of the painting to generate a definite record of the state of conservation of an object at the acquisition time. Repeating the measurement overtime supplies a controllable way to monitor the painting conditions and detect any changes that have occurred.

Shuqiang et al *(2006)* have presented a paper on An effective method to detect and categorize digitized traditional Chinese paintings. Traditional Chinese painting (TCP) is the gem of Chinese traditional arts. More and more TCP images are digitized and exhibited on the Internet. Effectively browsing and retrieving them is an important problem that needs to be addressed. Gongbi (traditional Chinese realistic painting) and Xieyi (freehand style) are two basic types of traditional Chinese paintings. This paper proposes a scheme to detect TCPs from general images and categorize them into Gongbi and Xieyi schools. Low-level features such as color histogram, color coherence vectors, autocorrelation texture features and the newly proposed edge-size histogram are used to achieve the high-level classification. Support vector machine (SVM) is applied as the main classifier to obtain satisfactory classification results. Experimental results show the effectiveness of the method.

D. LUetal et al (2007) have presented a paper on A survey of image classification methods and techniques for improving classification performance. Image classification is a complex process that may be affected by many factors. This paper examines current practices, problems, and prospects of image classification. The emphasis is placed on the summarization of major advanced classification approaches and the techniques used for improving classification accuracy. In addition, some important issues affecting classification performance are discussed. This literature review suggests that designing a suitable image processing procedure is a prerequisite for a successful classification of remotely sensed data into a thematic map. Effective use of multiple features of remotely sensed data and the selection of a suitable classification method are especially significant for improving classification accuracy. Non-parametric classifiers such as neural network, decision tree classifier, and knowledge-based classification have increasingly become important approaches for multisource data classification. Integration of remote sensing, geographical information systems (GIS), and expert system emerges as a new research frontier. More research, however, is needed to identify and reduce uncertainties in the image-processing chain to improve classification accuracy. Image classification has made great progress over the past decades in the following three areas: (1) development and use of advanced classification algorithms, such as sub pixel, per-field, and knowledge-based classification algorithms; (2) use of multiple remote-sensing features, including spectral, spatial, multi temporal, and multi sensor information; and (3) incorporation of ancillary data into classification procedures,

including such data as topography, soil, road, and census data. Accuracy assessment is an integral part in an image classification procedure. Accuracy assessment based on error matrix is the most commonly employed approach for evaluating per-pixel classification, while fuzzy approaches are gaining attention for assessing fuzzy classification results. However, even with the most widely used texture information, there is still much uncertainty in the determination of texture measures, image channel, window size, and other parameters. GIS is an essential tool to implement pre-processing procedures before data integration, such as conversion of data format and coordinate systems, data interpolation, and evaluation of data quality.

Krassmira Ivanova et al (2008) have study some of the characteristics of the art painting image color semantics. They analyzed the color features of different artists and art movements. The analysis includes exploration of hue, saturation and luminance. And also used quartiles analysis to obtain the distribution of the dispersion of defined groups of paintings and measure the degree of purity for these groups. A special software system " Art Painting Image Color Semantics (APICSS)"for image analysis and retrieval was created.

Jana Zujovic et al (2009) presented a model for automatic classification of digital pictures of paintings by a particular artistic genre. Automatic classification is useful for organizing large digital collections than existing approaches. Museums and Websites could quickly organize large digital collections and consumer art appreciators could gain insight into a painting by automatically classifying a digital capture. Professionals can easily identify a painting genre based on the artist and year as well as using visual cues like color palette utilized stroke style, edge softness, parallel lines and gradients.

M Spehr et al (2009) have presented a paper on "Image statistics for clustering paintings according to their visual appearance". Identify a set of image measurements that cam capture this "naïve visual impression of art" and use these features to automatically cluster a database of images of paintings into appearance based groups, much like an untrained observer. Authors have presented a method for automatically clustering images according to the overall visual appearance or "look", much have untrained observer do. Because the appearance of paintings is complex and spans many aspects ranging from color content to semantics, argued for using a large number of features, each of which is insufficient to capture appearance on its own but which when taken together can parse a database of Images into visually meaningful groups.

Stephen O' Hara et al (2010) have presented a paper on "Introduction to the bag of features paradigm for image classification and retrieval". Bag Of Features (BOF) methods have been applied to image classification, object detection, image retrieval, and even visual localization for robots. BOF approaches are characterized by the use of an order less of collection of image features, due to its simplicity and performance the BOF approach has become well established.

Razvan George Condorovici et al (2011) have presented a paper on "saliency map retrieval for Artistic paintings inspired from human understanding". Authors present a simple and efficient method for detecting salient regions in digital representation of paintings. The main challenge is to model the way human eye and mind see and understand visual art. Based on a combination of features such as shape, color, local contrast and position, the most relevant areas of a digital representation of a painting are detected.

Jipsa Kurian et al (2012) have presented a paper on *A Survey on Image Classification Methods.* Image classification is one of the most complex are as in image processing. It is more complex and difficult to classify if it contain blurry and noisy content. There are several methods to classify images and they provide good classification result but they fail to provide satisfactory classification result when the image contains blurry and noisy content. The two main methods for image classification are supervised and unsupervised classification. The main aim of literature survey is to provide a brief overview about some of most common image classification method and comparison between them. Finally it has shown that Self Organizing Tree Algorithm, an unsupervised classification method classify the images to 81.5% even it contain blurry and noisy content.

Arpita Mathur et al (2013) have presented a paper on "State of Art Literature Survey on Content base Image Retrieval by Multi Features". The users may require access to the images, based on primitive features, such as color, texture or shape, associated text. The current approaches are broad and inter-disciplinary, mainly focused on three aspects of image research which are text based retrieval, content based retrieval and interactive based image retrieval.

Fahad Shahbaz Khan et al (2014) have presented a paper on "A large scale data base for computational painting categorization". Computer analysis of visual art, especially paintings, is an interesting cross-disciplinary research domain. Most of the research in the analysis of paintings involve medium to small range data sets with own specific settings. Authors proposed a novel large scale dataset of digital paintings, consist of paintings from 91 different painters. Three applications of this dataset namely: artist categorization, style classification and saliency detection.

Anuradha Padala et al (2015) have presented a paper on "an approach for effective image retrievals". This article is developed with the concepts of Generalized Gaussian Mixture Model (GGMM) and semantic attributes. Flicker dataset is considered to experiment the model and efficiency is measured using precision and recall. In this paper a novel approach for retrieving the query images from a social networking model is presented using Generalized Gaussian Mixture Model. The relevant images are retrieved from the

database based on semantic tags associated with the probability density functions of GGMM using fusion. The developed methodology is evaluated using metrics like precision and recall.

Shalu Gupta et al (2015) have presented a paper on " Region and shape based image retrieval using MPEG-7".MPEG-7 databases describes multimedia data like images, audio and video. Authors proposed to detect 2-D shapes such as lines, rectangle, square, circle, semi-circle etc which further helps in object detection. This proposal is based on the statistical measures of distribution of points on the binary image of a shape. The extracted features of query image regions and creating clusters of image regions based on database. It's main focus is on retrieving the geometrical shape features of an image and according to that shape use the clustered image database for detecting the objects. Each extracted features of regions are compared with the specific cluster of image database based on their stored features.

CONCLUSIONS

There are many applications of a image classification and identification such archaeologists for identifying the ancient paintings of particular artists. A number of methods have been proposed in the past for classification, identification and extraction of images. These approaches considered the different attributes related to image attributes or features such as of size, font, style, orientation, alignment, contrast, color, intensity, connected-components, edges etc. These attributes are used to classify image regions from their background or other regions within the image. This paper provides a broad study of the various methods for effective image classification and identifications.

REFERENCES

[1] Y.W. Limn and S.U. Lee, "On the color image segmentation algorithm based on the thresh holding and the fuzzy c-means techniques," Journal of Pattern Recognition, Vol. 23, Issue 9, pp. 935-952, 1990

[2] C. Bouman and B. Liu, "Multiple resolution segmentation of textured images," *IEEE Trans. Pattern Anal. Machine Intell.*, vol. 13, no. 2, pp.99–113, 1991

[3] N. Chaddha, R. Sharma, A. Agrawal, and A. Gupta, "Text segmentation in mixed-mode images," in *Proc. Asilomar Conf. Signals, Systems,Computers*, vol. 2, pp. 1356–1361, Nov. 1994

[4] A. P. Dhawan, Y. Chitre, C. Kaiser-Bonasso, and M. oskowitz, "Analysis of mammographic micro calcifications using gray-level image structure features," *IEEE Trans. Med. Imag.*, vol. 15, pp. 246–259, June 1996

[5] S. Ravela and R. Manmatha, "Image retrieval by appearance," in *Proc.SIGIR*, Philadelphia, PA, pp. 278–285. July 1997

[6] Cheng, "Color Image Segmentation: Advances and Prospects", Pattern Recognition, Vo1.34, pp2259-2281, 2001.

[7] R. Brunelli and O. Mich, "Histograms Analysis for Image Retrieval", Pattern Recognition, vol.34, Issue 8, pp. 1625–1637, 2001.

[8] C.-C. Chen, A. Del Bimbo, G. Amato, N. Boujemaa, P. outhemy, J.Kittler, I. Pitas, A. Smeulders, K. Alexander, K. Kiernan, C.-S. Li, H.Wactlar, and J. Z. Wang, "Report of the DELOS-NSF Working Group on Digital Imagery for Significant Cultural and Historical Materials", DELOS-NSF Rep., Dec. 2002

[9] V. Gouet, N. Boujemaa, "About optimal use of color points of interest for content-based image retrieval", Research Report RR-4439, INRIA, 2002.

[10] Zhang, D. and G. Lu, "A Comparative Study of Three Region Shape Descriptors, in Proceedings of the Digital Image Computing – Techniques and Applications", Melbourne, Australia, 2002

[11] F Long, H Zhang, DD Feng, "Fundamentals of content-based image retrieval", Multimedia Information Retrieval and Management, pp. 1-26, 2003.

[12] Y. Liu, X. Zhou, W.Y. Ma, "Extraction of texture features from arbitrary-shaped regions for image retrieval", ICME04, Taipei, Pp.1891–1894. June 2004,

[13] Mari Partio, B. Cramariuc, and M. Gabbouj, "Texture retrieval using ordinal co-occurrence features", 6th NORSIG, pp. 308– 311, Espoo, Finland, June 2004

[14] J. Li and J.Z. Wang, "Studying digital imagery of ancient paintings by mixtures of stochastic models", IEEE Trans. Image Processing, vol. 13, no. 3, pp. 340–353, Mar.2004.

[15] Thomas Edward Lombardi, "The classification of style in fine-art painting ", ETD Collection for Pace University. Paper AAI3189084, 2005

[16] Barni, M., Pelagotti, A., Piva, "A.: Image processing for the analysis and conservation of paintings: opportunities and challenges". IEEE Sig. Proc. Mag., 141 ,2005

[17] B. Gunsel, S. Sariel, and O. Icoglu, "Content-based access to art paintings", Proceedings of IEE ICIP, Vol. 2, pp. 558-561, Genoa, 2005.

[18] Shuqiang Jiang, Qingming Huang, Qixiang Ye, and Wen Gao. "An effective method to detect and categorize digitized traditional Chinese paintings". Pattern Recognition Letters, 27(7):734 – 746, 2006.

[19] Jiang, S., Huang, Q., Ye, Q., Gao, W.: "An effective method to detect and categorize digitized traditional Chinese paintings". Pattern Recognit. Lett. **27**(7), 734–746, 2006

[20] Yarramalle, Srinivas; Rao, K. Srinivas, ”Unsupervised image segmentation using finite doubly truncated Gaussian mixture model and hierarchical clustering”, Journal of Current Science, Vol. 93, Issue. 4, pp 507, 2007.

[21] Luetal D, Weng Q. “A survey of image classification methods and techniques for improving classification performance”. *International Journal of Remote Sensing*, *28*(5), 823-870, 2007.

[22] D. Lu And Q. Weng, “A survey of image classification methods and techniques for improving classification performance”, International Journal of Remote Sensing Vol. 28, No. 5, 10 March 2007

[23] Nawei Chen · Dorothea Blostein , “A survey of document image classification: problem statement, classifier architecture and performance evaluation”, IJDAR, vol.10,Issue 1, Springer-Verlag Berlin, Heidelberg May 2007 , pp 1-16

[24] Johnson, R., Hendriks, E., Berezhnoy, I.J., Brevdo, E., Hughes, S.M., Daubechies, I., Li, J., Postma, E., Wang, J.Z.: “Image processing for artist identification”. IEEE Signal Process. Mag. **25**(4), 37–48 (2008)

[25] Ivanova K., P. Stanchev, B. Dimitrov. “Analysis of the distributions of color characteristics in art painting images”. Serdica Journal of Computing, 2 No 2, 111–136. 2008

[26] J. Zujovic, L. Gandy, S. Friedman, B. Pardo, and T.N. Pappas. “Classifying paintings by artistic genre: An analysis of features & classifiers”. In Proc. of IEEE MMSP, pages 1–5, 2009.

[27] C. Li and T. Chen, “Aesthetic visual quality assessment of paintings,” IEEE Journal of Selected Topics in Signal Processing, vol. 3, issue 2, pp. 236–252, March 2009.

[28] Spehr, M., Wallraven, C., Fleming, R.W,” Image statistics for clustering paintings according to their visual appearance”. Computational Aesthetics, pp. 1–8. Eurographics, Aire-La-Ville 2009

[29] Y. Srinivas, “An Efficient Approach for Medical Image Segmentation Based on Truncated Skew Gaussian Mixture Model using K-Means Algorithm”, International Journal of Computer Science and Telecommunications, Vol. 2, Issue 6, pp 81-88, Sep 2011

[30] Stephen O Hara, Bruce A. Draper, “Introduction to the bag of features paradigm for Image Classification and Retrieval”, Jan 2011.

[31] Condorovici, R.G., Vranceanu, R., Vertan C, “Saliency map retrieval for artistic paintings inspired from human understanding”. In: Proceedings of the SPAMEC, 2011

[32] Jipsa Kurian, V.Karunakaran, “A Survey on Image Classification Methods”. IJARECE, Vol.1, I4, Oct 2012.

[33] Arpita Mathur, Rajeev Mathur, “State of Art Literature Survey on Content base Image Retrieval”,. IJCA (0975 – 8887), ICRTET' 2013.

[34] Ramadass Sudhir, S. Santhosh Baboo, “A Efficient Content based Image Retrieval System using GMM and Relevance Feedback”, International Journal of Computer Application, Vol. 72-Number 22,2013.

[35] Fahad Shahbaz Khan, Shida Beigpour, Joost van de Weijer, and Michael Felsberg. Painting-91: “A large scale database for computational painting categorization”. Mach. Vis. App., 25(6):1385–1397, 2014.

[36] S.Najimun Nisha, Mrs.K.A.Mehar Ban, “An Enhanced Image Retrieval Using K-Mean Clustering Algorithm in Integrating Text and Visual Features”, International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 1,pp 10-15, March 2014.

[37] Razvan George Condorovici, Corneliu Florea, and Constantin Vertan. “Automatically classifying paintings with perceptual inspired descriptors”. J. Vis. Commun. Image. Represent. 26:222 – 230, 2015.

[38] Anuradha. Padala, Srinivas. Yarramalle, Krishna Prasad. MHM. “An Approach for Effective Image Retrievals Based on Semantic Tagging and Generalized Gaussian Mixture Model”, MECS ,IJIEEB,V3,P39-44,May 2015

[39] ShaluGupta, Y.JayantaSingh, “Region and Shape Features Based Image Retrieval”, IJARCSSE, Vol. 5, Issue 11, pp 601-605, November 2015