A Survey of Outdoor Scene Classification

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Abstract- Every day thousands of images can be captured, and stored in database, which implies the necessity to classify, organize and access them using an easy, faster and efficient way. Nowadays the classification of images into required class is a challenging and important problem. Many different approaches concerning scene classification have been proposed in the last few years. This paper presents a detailed survey of some of the most commonly used outdoor scene classification approaches.

This paper surveys some systems dealing with the recognition of objects in outdoor environments. The main goal of the paper is to discuss the different approaches for segmentation, object detection, feature identification and the classification of the images. Considering that outdoor scenes are especially complex to treat in terms -wide variety of objects in size, color, texture etc and in different illumination conditions.

Keywords – Outdoor scene, Image segmentation, Object recognition, feature identification.

I. INTRODUCTION

Scene classification is a challenging problem in a computer vision system. For the digitization of visual information it is necessary to develop the technique which is helpful for automatic photo organization from a large number of stored photos. The purpose of this paper is to discuss the ideas and techniques used for scene recognition and classification. This paper suggests how image processing procedures, effective use of multiple features, and a selection of suitable classification method gives the significant improvement in the classification accuracy.

Scene classification is an important issue for many applications such as content-based image retrieval, video surveillance [1], and many multimedia applications [4]. However, it is still a challenging task to deal with outdoor scenes owing to their variability, ambiguity [2], the scale change and different illumination conditions.

In the evolution of image analysis, many features have been proposed that facilitate the recognition of the object and hence classification. The present paper illustrates literature survey held on some of the IEEE papers. The systematic survey allows exploratory analysis of the papers sample suggesting some trends for the study [3] of outdoor image characteristics.

II. LITERATURE SURVEY

2.1 The 2010-2017 Literature Survey –

All articles are selected only for outdoor scene classification as its title published from 2010 to 2017. These articles are selected from international conference and journal of Electrical and Electronics Engineers (IEEE). From the selected articles, methodology referred for outdoor scene classification has been organized in a Table 1.

Table 1 presents information about the outdoor scene understanding process applied in each paper. It includes Color space & dataset used, Descriptors/segmentation methods, Objects to recognize and features to be extracted, Classification method applied were considered.

Table 1. Literature survey 2010-2017, for outdoor scene classification

References	Color space & dataset	Descriptors/segmentation method	Objects to recognize and features	Classification by
Luming Zhang et al. [1],2011	RGB histogram, SUN [10] and LHI [25]	Local descriptors, benchmark-segmentation, over-segmentation and deficient segmentation	Entire image-Global features sub-region of the image, Local features	Linear SVM, multi-class graphlet boosting algorithm,
Takayuki Baba and Tsuhan Chen [17],2010	RGB-value, color histogram, LabelMe	Multiple mage segmentations with the exemplar regions	shape, texture, color, and location, gist features [26]	SVM classifiers
Gaetan Martens et al. [16], 2010	Color, WWW	Segmentation by use of SOM	Color, edges, shape	SOM(self Organizing Map) based classification

Dahua Lin, Jianxiong Xiao [19],2013	RGB color, MSRC (v2)[20], SUN [10],	Local descriptor, semantic segmentation	Noisy regions , local features	K-means ,SPM and STP for scene recognition, SVMs
R.Raja, et al. [21]	Eight scene Categories dataset, Upright vs Inverted dataset, COREL dataset	opponent color descriptor, PHOG descriptor	Low level features - color, texture and edge like features	Multiclass SVM classifier, KNN classifier
Haibing Zhang, et al. [5],2014	Luv color space, open-universe datasets	Mean shift algorithm for image segmentation [7] [8]	sky, tree, building, road and car, SIFT features	-------
Zheng Zhang and Huadong Ma[9],2015	LAB color space, MWI (Multiclass Weather Image)	textures/edges	Sky and shadow-Sunny features, HOG based template matching feature, snowflake noise feature –snowy feature, contrast and saturation-Global Features	KNN classifier
A. Niranjil Kumar, et al. [12], 2013	CIE (Commission International de l'Eclairage) color space , Gould data set and Berkeley segmentation data set	bottom-up segmentation	structured (buildings, persons, car, etc.) and unstructured background objects (sky, road, grass, etc.)	Background classification, initial classification map
Cewu Lu, Di Lin et al. [13],2014	C channel of LCH color space , HSV color , LAB color space ,new weather dataset –images obtained from Sun Dataset [10], Labelme Dataset [11] and Flickr.	boundary descriptors, SIFT descriptor	shiny objects , brightly-litmatte /dull object ,weather feature-weather cues (such as sky, shadow, reflection, contrast and haze), Low level features, illumination-invariant features such as SIFT or HOG	SVM classification

Table 1 cont..

References	Color space & dataset	Descriptors/segmentation method	Objects to recognize and features	Classification by
S. Guzmán et al.[18]	Car images	histogram of oriented gradients (HOG)	Car, HOG features [24]	SVM classifier
Tin Tin Yu and new war[15], 2017	Pedestrians, Highway, PET 2006	Segmentation mask and reference mask(ground truth)	Moving objects , HOG (Histogram of Gradient) feature	multi-support vector machine (multi-SVM)

Qiang Li et al. [14], 2016	MIT outdoor scene, PASCAL VOC 2007 and PASCAL VOC 2012, MULAN scene dataset	SIFT descriptors,	PHOW features and Deep CNN features	MLC algorithm CorrLog (correlated logistic model)
Anish Chand et al. [6], 2016	Oliva Toralba dataset from Corel stock photo Gallery	---	Complex Gabor filter based global features, Energy and entropy features	SVM classifier
Wei-Ta Chu et al. [4], 2016	Image2Weather dataset, EC1M dataset	---	Visual features and weather information, color / texture / intensity	SVM classifier, random forest classifier
Jun Chu et al. [22],2015	PH2000 and MSRC21 database	NC-SIFT, Color Multi-Directional Context SIFT	Image patch, scene objects, color feature	SVM classifier
Soltani-Sarvestani M.A. and Azimifar Zohreh [23], 2015	HIS, Lab and RGB color space, dataset of car bodies	k-means and batch k-means	areas of the image ,Bag of Features, color feature	SVM to classify colors, Kmeans and batch Kmeans, sparse coding method

IV.CONCLUSION

In this paper a detailed outdoor scene categorization is specified. Table 1 shows that number of proposals has been suggested which includes several image features for recognition of an object and hence the classification.
Studies approaching qualitative aspects of the different environmental and illumination condition are still needed. To recognize the scene, different objects are justified by its complexity while considering outdoor scene defining elements such as sky, buildings and roads, trees and plants etc. But this is a challenge that should to be faced to improve the scene classification accuracy.

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