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Comparative Study on Classification of Digital Images

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ABSTRACT

Digital images are widespread today. The use of digital images is classified into natural images and computer graphic images. Discrimination of natural images and computer graphic (CG) images are used in the applications which include flower classification, indexing of images, video classification and many more. With the rapid growth in the image rendering technology, the user can produce very high realistic computer graphic images using sophisticated graphics software packages. Due to high realism in CG images, it is very difficult for the user to distinguish it from natural images by a naked eye. This paper presents comparative study of the existing schemes used to classify digital images.

Keywords: Digital image, Natural image, Computer Graphic image, Classification.

INTRODUCTION

A digital image is the replica of the scene, what we see from the naked eye. It can be broadly classified into two categories: natural / photographic images and computer graphic images. A natural image is captured from digital camera or still camera while CG images are produced from software's like MAYA, 3D studio max, light scape etc[1]. Recent development in the information technology allows the user to produce, manipulate and distribute the images over the network. This has raised the issue concerning the authenticity and integrity of digital images. CG images are very surrealistic in nature and it is similar to photographic images. Due to this reason, it is very tedious task to differentiate CG images from natural images[2]. To overcome this drawback various schemes have been proposed by the researchers.

Natural images and CG images are classified into three groups based on the features used by various researchers[3]: The existing identification schemes can be classified into three categories according to the features used for identification[3]:

Physical features

Physical features are the features generated at the time of image acquisition.

Statistical features

Statistical features such as mean, variance, standard deviation etc. are obtained from contents of an image.

Geometrical features

Geometric objects are produced by using entities such as lines, points, polylines, arcs, etc. Features may be corners, edges, blobs and so on.

Table 1: performance evaluation of the various schemes used to classify digital images

Work	Feature	Feature dimension	Data set	Classification accuracy
[5]	Histogram features, multi-fractal spectrum features, regression model fitness features	24	Columbia University Image Database, Dresden, Image database	98.69%
[6]	Fractal dimension	20	Columbia University Image Database, www.3dshop.com, www.raph.com	92%
[7]	Peak of histogram, mean value of the difference between the peak and its left and its right values, variance of the histogram	9	Columbia University Image Database.	99.43%
[3]	Multifractal spectrum features of PRNU	8	Columbia University Image Database.	98.99%
[8]	Image Contour Information	46	Columbia University Image Database.	90.36%
[9]	Wavelet based features	330	Columbia University Image Database.	87.6%
[4]	Fractal geometry	30	www.3dshop.com www.raph.com Washington Image Database	91.2%
[10]	Residual pattern noise	15	Natural images taken from various digital cameras,scanner images taken from different scanner models, computer generated images are download from the following links: www.3dlinks.com, www.irtc.com, www.raph.com, www.digitalrepose.com, www.maxon.net www.realsoft.com	85.9%

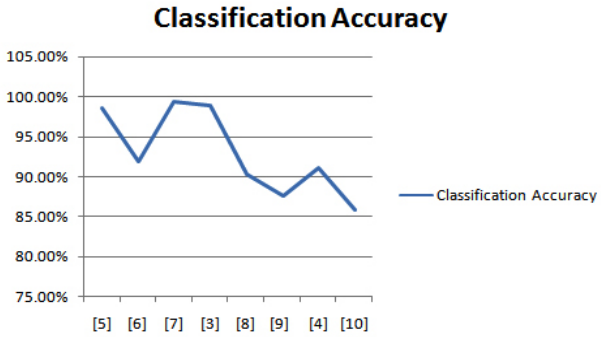

Fig. 1: Performance Evaluation

Organization of the paper is as follows: Section 2 describes the differences between images of two classes. Data set used by various authors and performance evaluation is discussed in Section 3.

Differences between photographic images and computer generated photorealistic images

The differences between the images of two kinds are given below[8].

Acquisition difference

photographic images are taken from various digital cameras where CG images are generated using graphics software packages to achieve realism. The process used to generate natural and CG images are analyzed.

Illumination source difference

light from the surface of the objects captured by a camera is reflected and passed through the lens, filters and CFA (Color Filter Array) and lastly reaches an array of charged couple device. In computer graphics, the object is simulated by specifying shape of the object, its orientation and surface of colors or textures. In addition to this, user has to specify viewer's position and view direction. Finally, the software will calculate the components of the entity that can be perceived by the viewer and only the visible portion is displayed.

Object model difference

photographic images are the replica of the scene. In computer graphics, objects are represented by using polygons and the color for the object is set synthetically.

Presentation difference

The above three differences finally results in the presentation differences of two image kinds. Distribution of the color in photographic images is not saturated where as in CG images are saturated to an extent.

Data Set and Performance Evaluation

Table 1 shows the performance of various proposed methods to distinguish between natural images and CG images.

CONCLUSION

In this paper, comparative study of proposed technique is used to classify digital images such as natural and computer graphics images were presented. From the analysis of existing schemes, it is found that the authors have used the features and their combinations which were discussed in introduction section to classify natural images and CG images. Modern day computer graphics are capable of generating highly photorealism images. For this reason, sometimes it is very challenging to discriminate CG and photographic images.

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