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Probabilistic Color Image Classifier based on Volumetric Robust Features

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Abstract- Need of more sophisticated methods to handle color images becomes higher due to the usage, size and volume of images. To retrieve and index the color images there must be a proper and efficient indexing and classification method to reduce the processing time, false indexing and increase the efficiency of classification and grouping. We propose a new probabilistic model for the classification of color images using volumetric robust features which represents the color and intensity values of an region. The image has been split into number of images using box methods to generate integral image. The generated integral image is used to compute the interest point and the interest point represent the volumetric feature of an integral image. With the set of interest points computed for a source image, we compute the probability value of other set of interest points trained for each class to come up with the higher probability to identify the class of the input image. The proposed method has higher efficiency and evaluated with 2000 images as data set where 70 % has been used for training and 30% as test set.

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PROBABILISTIC COLOR IMAGE CLASSIFIER BASED ON VOLUMETRIC ROBUST FEATURES

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Abstract- Need of more sophisticated methods to handle color images becomes higher due to the usage, size and volume of images. To retrieve and index the color images there must be a proper and efficient indexing and classification method to reduce the processing time, false indexing and increase the efficiency of classification and grouping. We propose a new probabilistic model for the classification of color images using volumetric robust features which represents the color and intensity values of an region. The image has been split into number of images using box methods to generate integral image. The generated integral image is used to compute the interest point and the interest point represent the volumetric feature of an integral image. With the set of interest points computed for a source image, we compute the probability value of other set of interest points trained for each class to come up with the higher probability to identify the class of the input image. The proposed method has higher efficiency and evaluated with 2000 images as data set where 70 % has been used for training and 30% as test set.

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I. Introduction

Image information systems are becoming increasingly important with the advancements in broadband networks, high-powered workstations etc. Large collections of images are becoming available to the public, from photo collection to web pages, or even video databases. Since visual media requires large amounts of memory and computing power for processing and storage, there is a need to efficiently index and retrieve visual information from image database. In recent years, image classification has become an interesting research field in application.

A number of image features based on color and texture attributes have been reported in literature. Although quantifying their discrimination ability to classification problem has not been so easy. Among the many possible features for classification purpose, extracted from an image. We focus on robust features like color distribution, density features, region features. The reason why we use three different features is the color distribution represent the distribution of color values throughout the image and region feature represent the features spread on a particular region where the density feature represent the feature density on each region.

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The image classification depends on variety of feature where the classification accuracy sit on the type of feature we used. The features of the image are extracted to compute some value which is called feature vector to represent the image in huge space. The classification is performed by computing any form of relevancy with set of feature vectors in the literature. There are many features has been used in the literature to compute the distance for classification.

The probabilistic classifier is one where there are more number of classes with large data set and basically the color images has more values and features. Classifying the color images are not an easy task, the probabilistic classifier computes the probability of input image which tells the relationship of image towards a class in probability manner. In most cases the probability based classifier has produced efficient results with less time complexity.

Efficient indexing and retrieval of large number of color images, classification plays an important and challenging role. The main focus of this research work is devoted to finding suitable representation for images and classification generally requires comparison of images depending on the certain useful features.

II. Background

There are various methods have been discussed and we explore few of the methods for understanding and relate to our problem.

Efficient HIK SVM Learning for Image Classification [5], presents contributions concerning HIK SVM for image classification. First, we propose intersection coordinate descent (ICD), a deterministic and scalable HIK SVM solver. ICD is much faster than, and has similar accuracies to, general purpose SVM solvers and other fast HIK SVM training methods. We also extend ICD to the efficient training of a broader family of kernels. Second, we show an important empirical observation that ICD is not sensitive to the C parameter in SVM, and we provide some theoretical analyses to explain this observation. ICD achieves high accuracies in many problems, using its default parameters. This is an attractive property for practitioners, because many image processing tasks are too large to choose SVM parameters using cross-validation.

Improving Color Constancy Using Indoor–Outdoor Image Classification [6], designed different strategies for the selection and the tuning of the most appropriate algorithm (or combination of algorithms) for each class. We also considered the adoption of an uncertainty class which corresponds to the images where the indoor/outdoor classifier is not confident enough. The illuminant estimation algorithms considered here are derived from the framework recently proposed by Van de Weijer and Gevers. We present a procedure to automatically tune the algorithms' parameters.

Iris image classification based on color information [7], we propose a novel color feature for iris classification, named as iris color Texton using RGB, HSI and lαβ color spaces. Extensive experiments are performed on three databases. The proposed iris color Texton shows advantages in iris image classification based on color information.

Novel color HWML descriptors for scene and object image classification [8], proposed initially a new three dimensional Local Binary Patterns (3D-LBP) descriptor is proposed for color image local feature extraction. Second, three novel color HWML (HOG of Wavelet of Multiplanar LBP) descriptors are derived by computing the histogram of the orientation gradients of the Haar wavelet transformation of the original image and the 3D-LBP images. Third, the Enhanced Fisher Model (EFM) is applied for discriminatory feature extraction and the nearest neighbor classification rule is used for image classification. Finally, the Caltech 256 object categories database and the MIT scene dataset are used to show the feasibility of the proposed new methods.

Color Local Texture Features for Color Face Recognition [9], proposed color local texture features are able to exploit the discriminative information derived from spatio chromatic texture patterns of different spectral channels within a certain local face region. Furthermore, in order to maximize a complementary effect taken by using color and texture information, the opponent color texture features that capture the texture patterns of spatial interactions between spectral channels are also incorporated into the generation of CLGW and CLBP. In addition, to perform the final classification, multiple color local texture features (each corresponding to the associated color band) are combined within a feature-level fusion framework.

The most of the related methods have classification errors and to overcome the demerits we propose a new probabilistic approach using volumetric estimations.

III. Proposed Method

The proposed method has three phases namely sub image generation, interest point computation, and probabilistic image classifier. At the first stage an image is converted to set of small images, at the second stage the images intensity and color features are extracted to compute interest point and at the final stage the probability value is computed for each class for the set of interest points computed based on which the image is assigned with a class.

IV. Integral Image Generation

In order to improve matching accuracy and faster processing, we compute the integral images. The integral images are the small set of images generated using box filters which splits images into many number of sub image set. The input image is selected and number of sub images is created based on the parameters m and n. Here m and n specifies the width and height of the integral image to be generated. The value of m and n is a multiple of width and height of the image. For example for a image with size 300×300, the value of m and n will be 3×5 or 5×3 and so on.

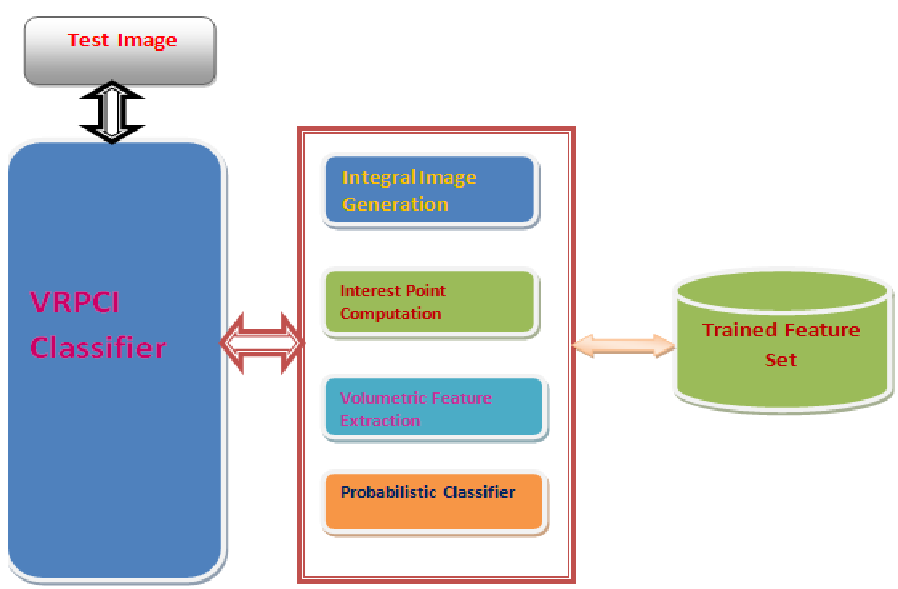

Figure1 : Proposed system architecture.

V. Interest Point Computation

The interest points are computed from generated integral image using pixel adjacency graph. For each pixel from the integral image we generate the pixel adjacency graph with the size from 3×3 to n×n to minimize the number of interest points. The overlapping interest points are dropped from execution and to reduce the execution time of the process. The interest points are computed with 64 features of the region identified. A point from the integral image will be selected based on the feature distribution around the pixel. From the constructed adjacency graph we select the pixel which has more features surrounded and will select the pixel to represent the region. The interest points are used to represent the region of an image even at different scaling and transformation or shifting.

Algorithm:

Step1: Start
Step2 : Read integral image Iimg.
Step3 : For each window w
Identify most dominating pixel $d_{i.}$
$D_{i=}$ Ô(w(Iimg)).
Compute interest point Ip.
Ip= R×(w×(Iimg/w))+ G×(w×(Iimg/w))+ B×(w×(Iimg/w)).
Add to the list IpList = ΣIp.
End
Step4 : Increase window size ws.
Step5 : Compute interest point nIp.
Step6 : If nIp£Ip
Remove Ip from list IpList.
Step7 : Stop.

VI. Volumetric Estimation

The volumetric measure of the image is computed based on the feature density measures i.e. how much the feature at a particular point is dense to represent the image region. For each integral image and interest points identified the selected pixel position is identified and we identify other pixel positions which are having similar values in that region and finds out the edges. Using the edge details we compute the volume using the width and height values.

VII. Probabilistic Classifier

With the computed set of interest points IpList, we compute the probability value for each class trained. The classifier is trained with different class of images with interest points and volume features. The computed interest point is classified with the classes available based on the probability value computed.

Algorithm:

Step1 : Start
Step2 : Read interest points IpList.
Step3 : Initialize probability set Ps.
Step4 : For each class available
For each interest points set Ips for each image Img_i
For each interest point $Ip_{i\ from}$ Ips
Compute total matches Ipm = $\Sigma Ip_i \times Ip_t$
End
End
Compute probability Pb_i = size of Ipm/size of Ip_i(Ips).
End.
Step5 : Select the class with more probability.
Step6 : Assign label with the class.
Step7 : Stop.

VIII. Results and Discussion

The proposed probabilistic volumetric robust feature based classifier has produced efficient results than other classifier. We have evaluated the proposed algorithm with different methodologies discussed earlier.

Color Space	OAA	DAG	SVM	PVRC
RGB	79	68	83	96
HSV	74	63	84	97
HVC	81	65	82	96.5

Table1 : shows the accuracy of classification with different algorithms.

IX. Conclusion

We proposed a new probabilistic model to classify the color images using volumetric robust features, which uses intensity and color values to generate the interest points using which the probability value is computed. The computed probability value is used to classify the images. The proposed method has produced better results than other classifier with low time and space complexity.

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