MULTI VARIANT REGIONAL FEATURE FOR COLOR IMAGE CLASSIFICATION USING FUZZY RULE SETS

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ABSTRACT

Color image classification has been discussed deeply in the literature and uses various features like color, intensity, shape features to classify the input image. We propose a naval approach for color image classification which uses various features of different regions of the image. The image classification process suffers with the precision of classification due to the varying size of image and different colors of the objects of same with different color. The proposed method uses various sizes of box filters to generate many number of sub sampling images and extracts the features of the image. The sub sampled images are used to generate feature descriptors of those regions of interest. Generated descriptors represent the features of the image and used to generate a feature vector of the selected region. The generated features are used to generate a single value to represent the ROI and based on the ROI using rule set available the image class is identified. The proposed classification approach has produced efficient results.

Keywords : *Image Classification, Fuzzy Rule sets, Classification Accuracy.*

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I. INTRODUCTION

Image classification is the process of obtaining similar or same image from large image data base or classifying a single image towards a group of categorical images. Whatever it is , the image classification process has certain unavoidable steps where the image will be preprocessed to remove the noise present in the image or removing the blur from the image. Then the features of the image will be extracted using which the image is classified. For classification there are many methods available, the simple one is the color based classification, where only the color values are used to classify the image over high dimensional image data set.

There are other measures or features used like shape, volume; density and etc are used for classification. However to compute the different between two pixels of the image, there are many measures used like Hamming distance, Euclidean distance, also few other matrix are used. 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.

Fuzzy rule set are a collection of rule base where each rule specifies set of values for each attribute and using which a single image class can be identified. In our methodology, a single image will be generated with N number of rules according to the size of box filter used and number of rules is based on number of iterations performed. The training set also contains such number of rule sets for a single image.

II. Related Works

Efficient HIK SVM Learning for Image Classification [2], present a new svm training method called intersection coordinate descent which is deterministic and faster than general svm solvers. Also the ICD has been extended in order to increase the efficiency of training. The proposed method has been analyzed theoretically.

Improving Color Constancy Using Indoor–Outdoor Image Classification [3], uses variety of strategies and algorithms for classification. It automatically tunes the parameters of algorithms according to the efficiency of image classification. In this method the author considered the problem of uncertainty of indoor and outdoor problems. The proposed approach derived from popular illumination estimation methods of Gevers.

Iris image classification based on color information [4], 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 [5], which uses binary patterns to represent the feature descriptors. The feature descriptors are three dimensional one. Another local binary pattern using haar wavelet is used to compute the histogram of orientation features. For the classification, they have used enhanced fisher model which classifies the image according to the rule set provided.

Color Local Texture Features for Color Face Recognition [6], 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 both 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.

Vector-valued images such as RGB color images [8], propose a new notion of treating vector-valued images which is based on the angle between the spatial gradients of their channels. Through minimizing a cost functional that penalizes large angles, images with parallel level sets can be obtained. After formally introducing this idea and the corresponding cost functionals, we discuss their Gateaux derivatives that lead to a diffusion-like gradient descent scheme. We illustrate the properties of this cost functional by several examples in denoising and demosaicking of RGB color images. They show that parallel level sets are a suitable concept for color image enhancement. Demosaicking with parallel level sets gives visually perfect results for low noise levels. Furthermore, the proposed functional yields sharper images than the other approaches in comparison.

Image Quality Assessment for Fake Biometric Detection [9], present a novel software-based fake detection method that can be used in multiple biometric systems to detect different types of fraudulent access attempts. The objective of the proposed system is to enhance the security of biometric recognition frameworks, by adding liveness assessment in a fast, user-friendly, and non-intrusive manner, through the use of image quality assessment. The proposed approach presents a very low degree of complexity, which makes it suitable for real-time applications, using 25 general image quality features extracted from one image (i.e., the same acquired for authentication purposes) to distinguish between legitimate and impostor samples.

Coding Visual Features Extracted From Video Sequences [10], propose, for the first time, a coding architecture designed for local features (e.g., SIFT, SURF) extracted from video sequences. To achieve high coding efficiency, we exploit both spatial and temporal redundancy by means of intraframe and interframe coding modes. In addition, we propose a coding mode decision based on rate-distortion optimization. The proposed coding scheme can be conveniently adopted to implement the analyze-then-compress (ATC) paradigm in the context of visual sensor networks. That is, sets of visual features are extracted from video frames, encoded at remote nodes, and finally transmitted to a central controller that performs visual analysis. This is in contrast to the traditional compress-then-analyze (CTA) paradigm, in which video sequences acquired at a node are compressed and then sent to a central unit for further processing. In this paper, we compare these coding paradigms using metrics that are routinely adopted to evaluate the suitability of visual features in the context of content-based retrieval, object recognition, and tracking.

All the approaches we discussed here struggles with the problem of false classification and we propose a new approach for image classification using fuzzy rule sets.

III. Proposed Methos

The proposed method consists of three phases namely preprocessing, Rule Generation and Classification.

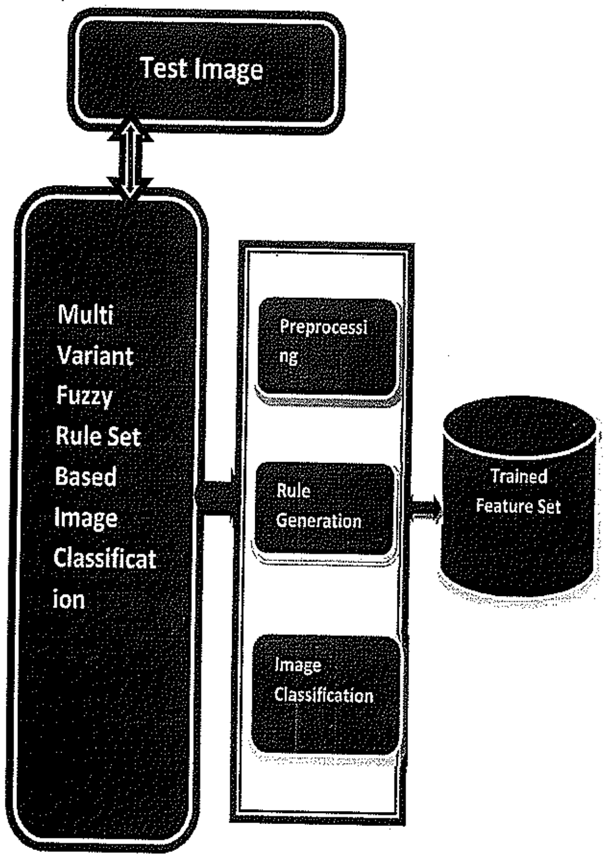


Figure1 : Proposed System Architecture.

3.1 Preprocessing:

At the preprocessing stage, the input image is converted into number of sub sampled image of varying box filters with size S. For each size of the box filter, a number of small images are generated and finally we get many number of sub sampled images. From generated images, we perform intensity approximation technique, which identifies a set of pixel around which has more features around it. Finally from all the sub sampled images a set of pixels are selected and for each of them we generate a feature descriptor which represents the regional feature about the intensity and color values of the sub sampled image. This stage returns as many number of feature descriptors according to number of box filters and number of images.

Algorithm :

Input: input image img.

Output: Feature Descriptor set FDS.

Step1: Initialize size and number of box filters.

Step2: For each filter B of size M

Generate sub sampled images SI =

end.

$$\int_{i=2}^{N}\sum Img(i,j)\times i$$

Step3: for each sub sample image Img_i from SI

perform intensity approximation IA =

Construct Feature Descriptor FD =

$$\int_{M}^{N} Pi \times Max(\sum Imgi(Pj(intensity)))$$

$$\sum Intensity \in (IA > IATH)$$

FD shows the set of intensity values of pixels having intensity greater than threshold.

end.

Step 4 : Add Fd to FDS = $\sum Fd + FDi$

Step 5 : Goto step 2

Step 6 : stop.

3.2 Rule Generation:

The rule generation phase performs estimation of intensities at all the level of box imaging and generates rules. The rule contains different values according to the number of box images generated for each box value there will be a cumulative intensity values. For example, for a box filter of size 2, there will be m number of images and for each an intensity approximate value will be present at the rule set R. The rule r will contain many rules for each box filters of size N and at each rule there will be many values generated according to number of points identified at the stage of preprocessing.

Algorithm:

Input: Feature Descriptor Set FDS.

Output: Rule Set Rs.

Step1: for each feature Descriptor FD_i from FDS

Identify location of Pixel Pi.

Identify other FD_j Covers the P_i

Compute Averaging of FD value.

Cumulative intensity value CIV =

End.

Step2: Generate rule R with $\frac{\sum FD}{N}$ computed CIV

R = { CIV_1 , $CIV_{2,...}$, CIV_{n} }.

Step3: stop.

3.3 Image Classification:

Image classification is performed based on the generated rule set. The rule set are maintained for the trained images as well the input test image given. For each rule generated for the trained image, the input rule is compared by computing similarity weight. The rule and image which has more similarity value will be selected as a result and the image is assigned with the selected class.

Algorithm:

Input: Rule Generated R and Rule Set Rs.

Output: Image Class.

$\int_1^N \sum_1^M (xi - yi)^2$

Step1: for each rule R_i from Rs

Compute similarity Measure SM =

Add Sm to DMS = $\sum DMi + SM$

end

Step2 : Select least similarity measure LSM = Min(DMS).

Step3 : Assign label to the image.

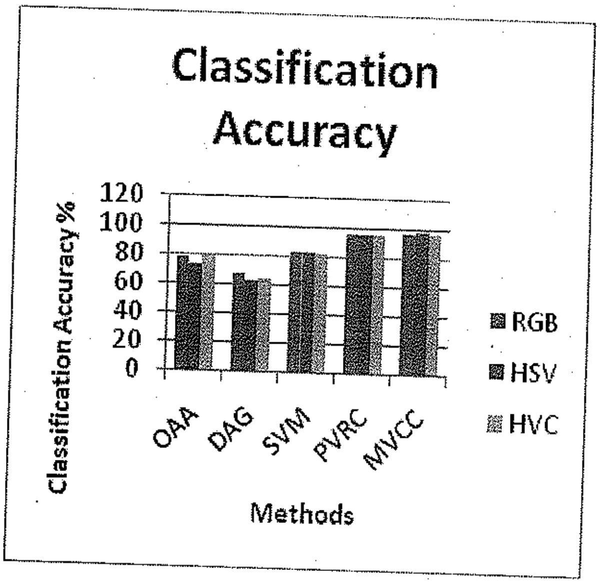
Step4 : stop.

1V. Results and Discussion

The proposed Multi variant feature based color image classifier has produced efficient results than other classifier. We have evaluated the proposed algorithm with different methodologies discussed earlier.

Table1: shows the accuracy of classification with different algorithms.

Color Space	OAA	DAG	SVM	PVRC	MVCC
RGB	79	68	83	96	98.4
HSV	74	63	84	97	99.2
HVC	81	65	82	96.5	98.3



Graph 1: Comparison of classification accuracy.

The graph 1, shows the classification accuracy achieved by different methods. It shows that the proposed MVCC approach has produced efficient classification compared to other methods. Also it produced less false positive results.

V. Conclusion

We proposed a naval multi variant regional feature based image classifier which generate sub sampled image according to number of box filter used. For each sub sampled image an feature descriptor is generated which represent the intensity measures of the region and according to the box size many number of feature descriptors will be generated. Based on generated feature value a cumulative intensity measure will be formed to generate a rule for the region and image. Finally with the rule generated a comparison work is performed to identify the class of the image. We compute a overall similarity measure with the rule set available and identify the class of the image according to the measure. The proposed method has produced better results than other classifier with low time and space complexity.

VI. References

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